Lesson A–1

DEFINING AGRICULTURE

Indiana Agricultural Literacy Lesson Plan Library

Unit A. General Agricultural Science

Lesson 1. Defining Agriculture

Indiana's Academic Standard. **Science:** 4.1.7 — Discuss and give examples of how technology, such as computers and medicines have improved the lives of many people, although the benefits are not equally available to all.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe how agriculture supports daily life.
2. Explain that agriculture is a science.
3. Discuss the uses of plants.
4. Discuss the uses of animals.
5. Describe how agricultural products are traded around the globe.

Recommended Resources: One of the following resources should be selected to accompany the lesson:

American Farm Bureau. *Farm Facts*. Call (847) 685-8600 or contact your County Farm Bureau office.

Gibbons, Gail. *Farming*. Holiday House, 1988.

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Siebert, Diane. *Heartland*. Harper Trophey, 1989.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Indiana Farm Bureau Soybean Kit
- ✓ Different colored pens or pencils (four different colors)
- ✓ Internet access or ingredient lists on various products

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Agriculture
- ➤ Biology
- ➤ Commodity
- ➤ Export
- ➤ Import
- ➤ Science

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask students to define agriculture. Ask them what the agriculture industry produces. If they have difficulty, ask them to explain the job of farmers. Let this discussion lead into the content of the lesson.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe how agriculture supports daily life.

Anticipated Problem: Why is agriculture important to everyday life?

I. ***Agriculture*** is the growing and harvesting of plants and animals for use by people. It is made up of lots of different businesses. All of these businesses together make up the agricultural industry.

A. Due to the strength of our agriculture system, the American people have cheaper and safer food than any other people around the globe.

1. Americans spend only 7.1 percent of their yearly income for food.
2. In other countries, people can spend up to 50 percent of their annual income on food alone.

B. The American agriculture industry thrives because of our ideal climate, rich soils, and continuing advancement in technology and innovation. The success and wealth of the United States can be tied to the strength of our agriculture industry.

C. One American farmer produces enough food to feed 129 people.

1. Since American farmers can efficiently feed so many people, other citizens are able to work in many different jobs.
2. If farmers were not able to produce large amounts of food, everyone would be responsible for growing or gathering their own food.

D. Agriculture is not only the farmers in the field. A number of other businesses and services support the farmer and process his or her products into market-ready products.

1. The agriculture industry in the United States employs more people than any other industry, over 20 percent of the civilian workforce.
2. Though the plants and animals grown on farms are used mostly for food and clothes, they can also be used in thousands of other by-products. For example, corn and soybeans are being used to make fuel for automobiles and the acid from the bodies of cattle is used in tire production.

Use TM: A–1A to discuss the content of the objective. Use WS: A–1A to gain an understanding of the percentage of income spent by Americans on their food. Compare these figures with the percentages of income spent by citizens of other countries. Use the results of this worksheet to discuss why Americans spend less of their income on food products.

Objective 2: Explain that agriculture is a science.

Anticipated Problem: Why is agriculture considered a science?

II. ***Science*** is defined as the study of natural occurrences. Agriculture is the management of those natural occurrences that produce food, fiber, and natural resources.

A. Farmers manage natural occurrences such as plant and animal life cycles to increase the production of food and by-products.

B. ***Biology*** is the study of living organisms or their life cycles, growth, and reproduction. Through scientific research the agriculture industry continues to improve efficiency and production.

Invite a local FFA member to visit class. Have the guest provide a presentation on the various science concepts that are included in the production of plants and animals.

Objective 3: Discuss the uses of plants.

Anticipated Problem: How are the plants produced by the agriculture industry used?

III. Plants are the foundation of agriculture and have multiple uses.

A. Food

1. Plants provide us with fruits, vegetables, seeds, and processed ingredients such as flours, oils, sugars, and starches that are our main sources of food.
2. Plants also provide the food for animals that we use for meat.

B. Clothing

1. Plants provide us with fibers used to make clothing.
2. Cotton has been grown in this country for hundreds of years and is made into t-shirts, pants, and other clothing items.

C. Shelter and other wood products

1. Trees are used to build houses, buildings, and furniture. Most of the trees harvested for wood have been planted and maintained by tree farmers.
2. Trees are also used to make paper products. Paper is used for books, writing, wrapping, and packing materials. The large use of paper results in a strong forestry industry.

D. Medicine

1. A number of plants are grown and harvested for use in the manufacturing of medicines.
2. Foxglove is one of the many plants that can be used in the manufacturing of medicines. It is used to make the heart medication *Digitalis*.

E. Decoration

1. One of the fastest growing aspects of the agriculture industry is the use of plants in ornamental horticulture.
2. More people are purchasing plants, such as bushes, trees, turf grass, potted plants, and flowers, for the decoration of their homes and businesses.

Use TM: A–1B to discuss the content of the objective. Choose one of the activities out of the Indiana Soybean Board Soybean Kit to demonstrate how plants are processed and made into other useful products. Suggested products: crayons, lip-gloss, or candles. The Soybean Kit can be checked out from your County Farm Bureau office. Also, after covering the content of Objective 4, have students complete WS: A–1B and WS: A–1C.

Objective 4: Discuss the uses of animals.

Anticipated Problem: How are the animals produced by the agriculture industry used?

IV. Animals provide us with everyday products.

A. Food

1. Most of the animals produced in the United States are raised for food.
2. Beef cattle provide us with steaks, hamburger, roasts, and other meat products.
3. Dairy cattle produce milk that is used for drinking and to make products such as cheese, butter, yogurt, ice cream, and other dairy products.
4. The pork industry supplies us with meat such as ham, sausage, bacon, ribs, and pork chops.
5. The poultry industry provides us with meat and eggs from chickens, turkeys, ducks, and other poultry animals.
6. Sheep and goats provide us with meat and milk. The meat from sheep is called lamb or mutton.
7. Fish, shellfish, and other aquatic animals are also grown on farms to meet the demand of consumers. This is called aquaculture.

B. Clothing

1. The hides of cattle and hogs are used to make leather products like coats, belts, and shoes.
2. Wool from sheep is spun into yarn to make sweaters, coats, socks, and other warm clothing.

C. Household items

1. Many household items are made from by-products of livestock.
2. Some of these include pet foods, detergents, candles, plastics, footballs, and baseballs.

D. Medicine
   1. Animal by-products have been instrumented in the development of new treatments for diabetes.
   2. Research is also being performed on organ transplants from pigs to humans.

E. Service
   1. Animals are still used to complete work in many parts of the agriculture industry.
   2. Horses are still used to herd cattle grazing on large areas of land.
   3. Dogs are used on many farms to herd cattle and sheep.

Use TM: A–1C to discuss the content of the objective. Have students complete WS: A–1B to reinforce the by-products derived from various plants and animals. Follow this up by having students conduct Internet research in completing WS: A–1C.

Objective 5: Describe how agricultural products are traded around the globe.

Anticipated Problem: How and why are agricultural products traded with other countries?

V. Agricultural products are commonly called commodities. Commodities are imported and exported around the world daily.

A. A ***commodity*** is any useful thing that can be grown, produced, sold, or bought.

B. An ***export*** is a commodity that is grown in the United States and shipped to a foreign country.

C. An ***import*** is a commodity that is purchased from another country and shipped to the United States.

D. The reason we trade commodities with other countries is because we cannot produce all the products we need in this country because of our climate. For example, cocoa beans, which are used to make chocolate, are grown in tropical areas such as rainforests.

E. Agricultural commodities are shipped around the world by trucks, trains, boats, and planes. The Mississippi River is an excellent example of how grains are moved on barges from the Midwest to the South to then be shipped all over the world from the shipping ports in the Gulf of Mexico.

Provide students with a list of commodities. Through class discussion, have them identify the commodities as either exports or imports. To aid in understanding, use common fruits and vegetables. Have your students start by discussing whether they think these items are grown locally. If not, where do they think they come from? How do they get here?

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete the included worksheets.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1 = c, 2 = a, 3 = b, 4 = d, 5 = e, 6 = f

Short Answer

Answers will vary. See Objectives 3 and 4.

Test A–1

Name_____

DEFINING AGRICULTURE

▶ Matching

Instructions. **Match the word with the correct definition.**

a. agriculture	d. commodity
b. export	e. import
c. science	f. biology

_____1. The study of natural occurrences.

_____2. The growing and harvesting of plants and animals.

_____3. Products sold and shipped to other countries.

_____4. A useful product that can be grown, produced, sold, or bought.

_____5. Products that are bought from a different country.

_____6. The study of living organisms and their life cycles, growth, and reproduction.

▶ Short Answer

Instructions. **Answer the following questions.**

1. What are two by-products of corn?

2. What are two by-products of cattle?

3. What are two by-products of soybeans?

4. What are two by-products of hogs?

AMERICAN AGRICULTURE

- Agriculture is the growing and harvesting of plants and animals for use by people.
- American people have cheaper and safer food than any other people around the globe.
- Americans pay only 7.1 percent of their yearly income on food.

- The American agriculture industry thrives because of our ideal climate, rich soils, and continuing advancement in technology and innovation.
- One American farmer produces enough food to feed 129 people.
- A number of other businesses and services support the farmer and process his or her products into market-ready products.

USES OF PLANTS

♦ Food

♦ Clothing

♦ Medicine

♦ Decoration

♦ Shelter and other wood products

USES OF ANIMALS

(Courtesy, Mitch Hrdlicka / Getty Images

♦ Food

♦ Clothing

♦ Medicine

(Courtesy, Luck-E-G Nubians, Idaho)

♦ Service

♦ Household items (pet foods, candles, detergents, plastics, etc.)

Name _____

INCOME SPENT ON FOOD

Directions

In the United States, we spend 7.1 percent of our annual income on food products. In other countries, citizens spend 30, 40, and even 50 percent of their income on food products. Using the figures below, calculate the amount of money spent on food products by citizens of different countries. After you have made the calculations, use an atlas to locate the other countries.

1. Suppose that your family has an income of $50,000 a year and that you spend 8 percent of your income on food products. What is the annual amount you spend on food?

2. Suppose you live in the United Kingdom and your income is equal to $30,000. If you spend 11 percent of your yearly income on food, how much would you pay for a year's supply of food?

3. Suppose that you live in Japan and your income is equal to $65,000. If you spend 16 percent of your income on food, how much would you pay for a year's supply of food?

4. Suppose that you live in India and you earn $45,000. If you spend 50 percent of your income on food, how much would you pay for a year's supply of food?

WS KEY: A–1A

INCOME SPENT ON FOOD KEY

1. $4,000
2. $3,300
3. $10,400
4. $22,500

Name _____

SOURCES OF BY-PRODUCTS

Directions

Draw a line from the commodity to its matching by-product. Use a different color pen or pencil for each commodity.

Cow

Pig

Soybeans

Corn

Auto fuels

Football

Hamburger

Chips

Bacon

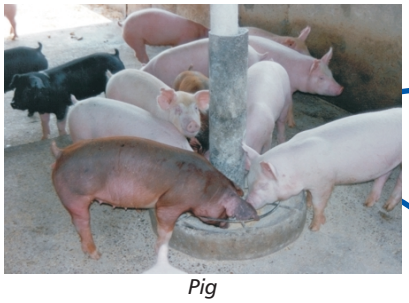
Chocolate

Crayons

Medicine

SOURCES OF BY-PRODUCTS KEY


Cow


Pig


Soybeans


Corn


Auto fuels


Football


Hamburger


Chips


Bacon


Chocolate


Crayons


Medicine

Name _____

BY-PRODUCT SEARCH

Directions

List five by-products for each of the following agricultural commodities. Search the internet or look at the ingredient lists on products you have at home or school.

Cattle

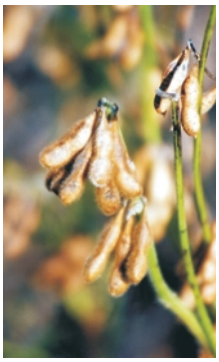
_____

_____

_____

_____

_____



Soybeans

_____

_____

_____

_____

_____

Hogs

_____

_____

_____

_____

_____

Corn

_____

_____

_____

_____

_____

Lesson A–2

HISTORY OF PRODUCTION AGRICULTURE

Indiana Agricultural Literacy Lesson Plan Library

Unit A. General Agricultural Science

Lesson 2. History of Production Agriculture

Indiana's Academic Standard. **Science:** 4.5.5 — Give examples of the impacts of science and technology on the migration and settlement patterns of various groups.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe agriculture's role in developing civilizations.
2. Identify some of the inventions that changed the agriculture industry.
3. Identify some of the equipment currently used in production agriculture.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

American Farm Bureau. *Farm Facts*. Call (847) 685-8600 or contact your County Farm Bureau office.

Bial, Raymond. *Corn Belt Harvest*. Houghton Mifflin, 1991.

History of American Agriculture, 1607–2000, Poster; USDA Economic Research Service; www.ers.usda.gov

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Peterson, Chris. *Century Farm*. Boyds Mill Press, 1999.

www.CAT-ag.com

www.ytmag.com/games.htm

www.ytmag.com/kids.htm

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Baler
- Civilization
- Combine
- Drill
- Geographic Information System (GIS)
- Global Position System (GPS)
- Grain truck
- Horsepower
- Hunters and gatherers
- Internal combustion engine
- Loader
- Planter
- Reaper
- Steel plow
- Stewardship
- Thresher

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Have students make a list of machines farmers use in production agriculture. Write this list on the chalkboard or overhead. Ask the students to describe the job of each machine.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe agriculture's role in developing civilizations.

Anticipated Problem: How does agriculture develop civilizations?

I. A ***civilization*** is a group of people who settle in one place. In order for a civilization to survive in that place they must have food.

   A. One way to obtain food is by hunting and gathering. If a civilization depends on this method of obtaining food, it must designate members of the group to be ***hunters and gatherers***, people who go out and find food for everyone. Eventually, the group will use up all local sources of food or the population will outgrow the supply.

   B. Another way to obtain food is to plant, care for, and harvest crops.

      1. Early civilizations found that for them to establish a community and remain in the same place, it was necessary to plant food and to tame animals. This was the beginning of agriculture science.
      2. As people began planting food and raising animals, they immediately began looking for better ways to care for plants and animals. Through scientific experimentation they began improving the science of agriculture.
      3. As people became more dependent on land and animals, they began to practice stewardship. ***Stewardship*** is the practice of taking care of land and animal resources so they can benefit future generations.

> *Lead a class discussion and ask students to identify past or present civilizations or countries that used hunting and gathering as their main source of food. Ask students to describe the differences between these civilizations and today's United States.*

Objective 2: Identify some of the inventions that changed the agriculture industry.

Anticipated Problem: What are some of the major inventions that changed the agriculture industry?

II. In early agricultural practices, seeds were planted and harvested by hand. Over time a number of inventions and innovations have advanced farming practices to their current state.

A. In 1831, Cyrus McCormick invented a mechanical reaper that made harvesting crops more efficient. The ***reaper*** was a machine pulled by horses that was used to cut wheat at the base of the stem. Prior to the invention, plants had to be cut by hand and bundled into shocks and stacked.

B. In 1837, John Deere began manufacturing a plow with a steel cutting edge, called a ***steel plow***. This steel plow was light enough that horses could pull it through the ground, while at the same time it was strong enough to break up heavy prairie soil.

C. Soon after McCormick's reaper was invented, a thresher was invented. A ***thresher*** separates the grain from the stem of the plant. Farmers would pick up the stalks cut by the reaper and then hand-feed them through the thresher. After the invention of the internal combustion engine, these two machines were combined to make a combine.

D. An ***internal combustion engine*** is a device that uses fuel to create energy which is then used to do work. The invention of this engine lead to the invention of tractors and combines. Work that once took days to do by hand could now be done in minutes.

Use TM: A–2A to provide a more complete overview of important dates in the history of American agriculture. As a cross-curricular activity, have students identify other important historical events that took place at the same time as these agricultural events.

Objective 3: Identify some of the equipment currently used in production agriculture.

Anticipated Problem: What is some of the equipment that is used currently in production agriculture?

III. Powerful, complex equipment is used in today's agricultural industry to increase productivity.

A. Tractor

1. A tractor can be used for a number of different jobs around the farm.
2. Because of their powerful engines and large tires, tractors are able to pull other pieces of machinery through fields.
3. Before tractors were invented farmers used horses to pull heavy equipment.
4. ***Horsepower*** is a measurement for the power of an engine. This word originally meant the number of horses it took to pull machinery.

B. Combine
   1. A ***combine*** is a machine used to harvest crops from the field.
   2. A combine is the combination of a reaper and a thresher. The head of the combine runs through the rows and cuts the stalk of the plant. The plant is then pulled through the machine and the grain is separated from the plant material.

C. Planter or drill
   1. A ***planter*** or ***drill*** is an implement used to drop seeds into the ground.
   2. Typically, a planter is used to plant corn or soybeans, and a drill is used to plant soybeans or small grains like wheat or oats.
   3. Seed counters drop the right amount of seed into rows created by the planter.
   4. Before this machine was invented, farmers dug rows and planted the seeds by hand.

D. Loader
   1. A ***loader*** is a large scoop or bucket that is placed on the front of a tractor.
   2. This bucket can be used to move large amounts of hay, straw, dirt, gravel, or manure around very quickly.
   3. Before tractors and loaders were invented, farmers hand shoveled, carried, or pushed material that needed to be moved.

E. Grain truck or wagon
   1. A ***grain truck*** is a vehicle used to move grain from the field to storage bins or grain elevators.
   2. A combine has a bin behind the cab that stores grain as it moves through the field. When this bin is full, it is unloaded into a grain truck or into a wagon to be taken out of the field.

F. Baler
   1. A ***baler*** is a machine used to wrap straw or hay into tight bundles called bales.
   2. The baler is pulled behind a tractor and picks up the hay or straw off the ground. Inside the baler the hay or straw is tightly packed or wound into round or rectangular bales. When the bale reaches the proper size the machine wraps the bale with wire or twine to secure it.

G. Global Positioning System (GPS)
   1. A ***Global Positioning System (GPS)*** is a system that uses satellites and computers to tell a farmer his or her exact location in a field.
   2. This technology is so precise it can tell a farmer his or her location within inches.
   3. GPS systems can precisely guide tractors and equipment through a field and program computers to deliver precise amounts of seed, fertilizer, or herbicide to plants in variable amounts.

H. Geographic Information System (GIS)
   1. A ***Geographic Information System (GIS)*** is a system used with GPS to make maps or grids of a field.
   2. These maps give a farmer data about soil conditions, crop yield, and other information so he or she can make decisions needed to improve the crops in the field.

Use TM: A–2B thru TM: A–2H to illustrate the different types of equipment used in agricultural production. Use WS: A–2A to reinforce the identification and purposes of each piece of equipment.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Use WS: A–2A to reinforce the concepts of the lesson. Classroom discussion of the objectives and student questions will also assist in applying the concepts.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1 = e, 2 = b, 3 = a, 4 = c, 5 = d

Fill-in-the-Blank

1. John Deere
2. baler
3. satellites, computers

Short Answer

Answers may vary. Examples include reaper, thresher, steel plow, tractor, or internal combustion engine.

Test A–2

Name_____

HISTORY OF PRODUCTION AGRICULTURE

▶ Matching

Instructions. **Match the word with the correct definition.**

a. combine
b. thresher
c. reaper
d. loader
e. tractor

_____1. Powerful machine used to pull other farm implements.

_____2. A machine that separates grain from the stalk.

_____3. This machine is a combination of a reaper and a thresher.

_____4. A machine invented in 1831 by Cyrus McCormick.

_____5. Large bucket on the front of a tractor.

▶ Fill-in-the-Blank

Instructions. **Complete the following statements.**

1. _____ _____ was the first person to manufacture the steel plow.
2. A _____ packs hay or straw into tight bales.
3. Global Positioning Systems use _____ and _____to pinpoint locations within a field.

▶ Short Answer

Instructions. **Answer the following question.**

What are two major inventions that changed the agriculture industry?

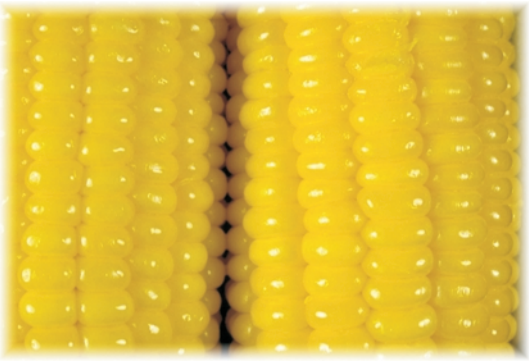
HISTORY OF AMERICAN AGRICULTURE

1493: Christopher Columbus brings calves, goats, sheep, pigs, chickens, melons, and many vegetables to America.

Watermelons

1607: English colonists in Jamestown, Virginia, plant grain, potatoes, pumpkins, melons, cotton, and oranges.

1609: Indians teach the Jamestown settlers how to grow corn.



Corn on the cob

1731: Jethro Tull introduces the horse-drawn cultivator and seed drill into English farming.

1784: James Small invents the iron plow in England.

1793: Eli Whitney invents the cotton gin.

1797: First cast-iron plow is patented.

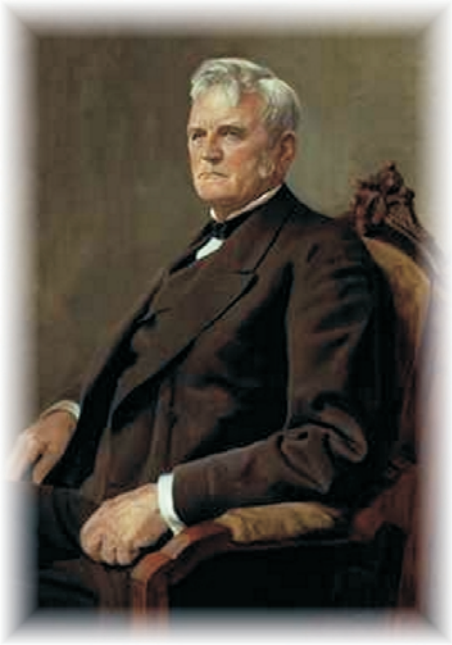
1798: John Chapman (Johnny Appleseed) plants his first apple nursery in western Pennsylvania.

Apples

1831: Cyrus McCormick invents the reaper.

1834: Plows with steel saw blades begin to be manufactured.

1837: John Deere begins manufacturing plows.



John Deere, 1869–86 (Courtesy, Deere & Company)

1841: Practical grain drill is patented.

1842: The first grain elevator is used in Buffalo, New York.

1847: Irrigation methods begin.

1850: S.S. Rembert and J. Prescott develop a mechanical cotton picking machine.

1854: The self-governing windmill is perfected.

1855: Michigan and Pennsylvania establish the first state agriculture colleges.

1855: The two-horse straddle-row cultivator is patented.

1856: A patent for condensing milk is issued to Gail Borden.

1858: Mason jars, used for home canning, are invented.

Mason jars

1862: President Abraham Lincoln signs legislation creating the first Department of Agriculture. The same year he also signs the Morrill Land Grant College Act.

1867: Barbed wire is invented.


Barbed wire

1868: Steam tractors are tested.

1869: Transcontinental railroad is completed.

1875: The first silos are built for grain storage.

1881: Hybrid corn is produced, greatly increasing corn production.

Hybrid corn

1884: Horse-drawn combines are used.

1887: The Hatch Experiment Station Act is passed, providing federal grants to states for agriculture experimentation.

1888: The first long-haul shipment of a refrigerated freight (train) car is made from California to New York.

1890: Cream separators are widely used.

1892: John Froelich builds the first gasoline tractor.


Modern tractor (Courtesy, Case Corporation)

1914: The Federal-State Extension Service is organized (later became the Cooperative Extension Service).

1921: KDKA radio in Pittsburgh, Pennsylvania, broadcasts the first farm market news report.

1926: A practical light tractor is developed.

1927: All-purpose, rubber-tired tractor with complimentary machinery is used.

1933: The Farm Credit Administration is established.

1940: The School Milk Program is initiated by the U.S. Department of Agriculture.

Milk

1942: The spindle cotton picker is sold commercially.

1949: The Agricultural Act of 1949 is passed, giving surplus food to the needy.

1959: The mechanical tomato harvester is developed.

1964: The National Food Stamp Act is passed.

1970s: Minimum tillage agriculture is popularized.

Tomatoes

1980s: More farmers begin to use no-till or low-till to curb erosion.

1988: U.S./Canada Free Trade Accord is ratified.

1993: The North American Free Trade Agreement (NAFTA) is passed.

1994: Farmers begin using Global Positioning Systems (GPS) to track and plan their farming practices.

1996: Net farm income exceeds $51 billion, a new record.

2000: Ethanol production exceeds 1.63 billion gallons.

Modern GPS unit (Courtesy, Deere and Company)

TRACTOR

Tractors do many jobs on a farm. Because of their powerful engines, they are mostly used to pull heavy machines like plows and planters. Their large tires provide traction.

(Courtesy, Deere and Company)

COMBINE

A combine is a machine that picks crops from the field and separates the grain from the stems, cobs, or pods. The grain is then stored in a large bin behind the cab. When the bin is full, the auger, or arm, on the side of the combine moves the grain from the combine into a grain truck or wagon.

(Courtesy, Case Corporation)

PLANTER

The planter places seeds into the ground as a tractor pulls it through the field. The seeds are loaded into tanks on the planter. The machine creates a row and drops the seed in the row. The seed is then covered with a layer of soil.

(Courtesy, Case Corporation)

TRACTOR WITH LOADER

The loader is a scoop or bucket located on the front of a tractor that is used like a large shovel. It helps farmers move hay, straw, gravel, dirt, and manure around the farm.

(Courtesy, Deere and Company)

GRAIN TRUCK AND WAGON

Farmers use grain trucks and wagons to move grain from the field to grain bins or the grain elevator.

(Courtesy, U.S. Department of Agriculture)

(Courtesy, Deere and Company)

BALER

A baler is used to wrap hay or straw into round or rectangular bales. The baler packs the hay or straw tightly and ties it together with wire or twine.

(Courtesy, Deere and Company)

GLOBAL POSITIONING SYSTEM AND GEOGRAPHIC INFORMATION SYSTEM

GPS works through satellites and computers in the tractor to pinpoint exact location. GIS is then used to make a grid for each field to tell farmers how to prepare and maintain the soil and crops in that field.

(Courtesy, Deere and Company)

WS: A–2A

Name _____

NAME THE EQUIPMENT

Directions

Write the name of the piece of equipment on the line under its photo.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

NAME THE EQUIPMENT KEY

1. Planter
2. Grain truck
3. Tractors
4. Baler
5. Combine
6. Tractor with loader

Lesson A–3

CAREERS IN AGRICULTURE

Indiana Agricultural Literacy Lesson Plan Library

Unit A. General Agricultural Science

Lesson 3. Careers in Agriculture

Indiana's Academic Standard. **Social Studies:** 4.4.10 — Explain how money helps people to save and develop a savings plan in order to make a future purchase.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the major career areas in the agriculture industry.
2. Identify what it takes to be successful in an agricultural career.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

http://www.ca.uky.edu/agripedia/agmania/career/

http://www.fb.com/today/class/careers.htm

http://www.fl-ag.com/PlanetAg/careers.htm

Contact these offices for more information:

College of Agriculture at the University of your choice

County Extension Office

County Farm Bureau

High School Guidance Counselor or Ag Teacher

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Internet access
- ✓ Chips, squares of colored paper, or corn kernels to use as markers for the Career Bingo Worksheet
- ✓ Scissors
- ✓ Glue

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Communicators
- ➤ Educators
- ➤ Producers
- ➤ Researchers
- ➤ Scientists
- ➤ Service jobs

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Play Career Bingo to make students familiar with different job titles. Give each student a copy of WS: A–3A and WS: A–3B. Have students cut out the squares on WS: A–3B and paste them on WS: A–3A in a random order. This gives each student a different playing card. Use playing chips, squares of colored paper, or corn kernels to mark each square as it is called. Cut out the squares on a copy of WS: A–3B and select randomly from the squares to call out the careers.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain the major career areas in the agriculture industry.

Anticipated Problem: What are some careers within the agriculture industry?

I. There are over 300 career areas available within the agriculture industry. Many of these jobs are available for people who do not come from a farm. Nationally, one out of five jobs are related to agriculture. All of these jobs are important as the agriculture industry feeds and clothes the world.

A. Science and Research—***Scientists*** and ***researchers*** are people who are responsible for making advances in the agriculture industry. They research crops and new ways to grow them. They work to make new medicines and develop new production practices for livestock. They work in labs, test fields, large corporations, and universities.

B. Production—***Producers*** are people with jobs in production who are responsible for planting, growing, and harvesting food and other agriculture products. These are the farmers, ranchers, and growers of the industry.

C. Communication and Education—***Communicators*** and ***educators*** are teachers, advertising specialists, salespeople, and journalists responsible for informing others about all aspects of agriculture. People with these jobs deal with the public all the time.

D. Business and Industry—People with jobs in business and industry may provide the inputs to producers or be the buyers of meat and grain. They provide the products and services producers need to raise their crops and livestock. They may be the bankers that make sure farmers have the money they need to produce a crop. They are also responsible for purchasing, processing, and marketing the final product and for selling that product around the world.

E. Services—Jobs in services assist farmers and businesses as they produce food and other products. ***Service jobs*** are jobs necessary for keeping the business of agriculture moving. These jobs include mechanics, electricians, inspectors, lawyers, and transporters.

Use TM: A–3A thru TM: A–3E to provide students with examples of specific agricultural careers within the major career areas. Follow this up by having students complete WS: A–3C. This will help them gain a further understanding of specific agricultural careers.

Objective 2: Identify what it takes to be successful in an agricultural career.

Anticipated Problem: What does it take to be successful in an agricultural career?

II. Everyone wants to be successful. In order to succeed in a career, you can develop skills that will help you to be more successful. Being successful means that you have attained your goals. An example of a method you can use to help you choose a career you will be successful in is as follows:

A. Make a list of what interests you. People do a better job and are more successful if they are interested in their work. Your list of interests may not come all at once. It may also change as you get older and have more experiences in life.

B. Identify your strengths and weaknesses. Write down a list of what you like and dislike. Be realistic and adjust your strengths and weaknesses to the list of interests you developed in the first step.

C. Once you have listed what your interests are and your likes and dislikes, find out more about particular jobs in the agricultural industry. Talking with people currently working in the agricultural industry provides real life information about careers.

Use WS: A–3D to help students create a list of their interests. The answers students provide to the questions will help them to narrow their career interests. After they have completed the exercise, use WS: A–3E as a guide in Internet research on particular careers that students find of interest. Have students visit the sites listed in the resources section for the lesson.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Have students decide which of the careers they have studied that they would be most interested in pursuing. Have them write a brief summary of the reasons they would choose that career and why they think they would like it. Also, have them describe the type of education they will need to obtain a job in that field.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1= b, 2 = d, 3 = c, 4 = a

Fill-in-the-Blank

1. five
2. 300
3. products and services

Short Answer

1. Answers will vary.
2. Answers will vary.

Test A–3

Name_____

CAREERS IN AGRICULTURE

▶ Matching

Instructions. **Match the word with the correct definition.**

a. producer
b. educator
c. researcher
d. service job

_____1. Responsible for informing others about all aspects of agriculture.

_____2. Necessary for keeping the business of agriculture moving.

_____3. Responsible for making advances in the agriculture industry.

_____4. Responsible for planting, growing, and harvesting food and other agriculture products.

▶ Fill-in-the-Blank

Instructions**. Complete the following statements.**

1. In the United States, one out of every _____ people work in an agriculture-related job.
2. There are over _____career fields in the agriculture industry.
3. People with jobs in business and industry provide the _____ and _____ producers need to raise crops and livestock.

▶ Short Answer

Instructions**. Answer the following questions.**

1. Which agricultural career do you find most interesting? Why?

2. What type of education would you need to have a job in your field of interest?

SCIENCE AND RESEARCH CAREERS

- Biochemist
- Lab Technician
- Food Scientist
- Animal Nutritionist
- Agronomist
- Agricultural Engineer
- Hydrologist
- Conservationist
- Entomologist
- Horticulturalist
- Remote Sensing Specialist
- Landscape Architect
- Nutritionist/Dietician
- Climatologist
- Molecular Biologist
- Ecologist
- Botanist
- Plant Physiologist
- Turf Scientist

(Courtesy, Agricultural Research Service, USDA)

PRODUCTION CAREERS

- Rancher
- Beef Producer
- Viticulturist (Grapes)
- Turf Producer
- Farm Manager
- Fruit and Vegetable Grower
- Wildlife Manager
- Specialty Animal Producer
- Dairy Farmer
- Corn Grower
- Lamb and Wool Producer
- Soybean Grower
- Wheat Grower
- Pork Producer
- Poultry/Egg Producer

(Courtesy, U.S. Department of Agriculture)

COMMUNICATION AND EDUCATION CAREERS

- Advertising Executive/Writer
- Farm Broadcaster
- Agriculture Journalist
- College Professor
- High School Ag Teacher
- Extension Educator
- Agricultural Literacy Coordinator
- Health Teacher
- Government Worker
- Illustrator
- Computer Software Designer
- Public Relations Representative
- Youth Program Director

(Courtesy, Agricultural Research Service, USDA)

BUSINESS AND INDUSTRY CAREERS

- Grain Elevator Manager
- Grain Broker
- Wholesale Food Salesman
- Seed Salesman
- Loan Officer
- Seed Plant Supervisor
- Pharmaceutical Representative
- Implement Dealer
- Export Sales Manager
- Market Analyst
- Economist
- Association Manager
- Fertilizer Salesman
- Feed Mill Operator
- Farm Supplier
- Credit Analyst
- Meat Cutter
- Estate Manager

(Courtesy, Case Corporation)

SERVICE CAREERS

- Veterinarian
- Mechanic
- Welder
- Truck Driver
- Surveyor
- Inspector
- Agriculture Pilot

WS: A–3A

Name _____

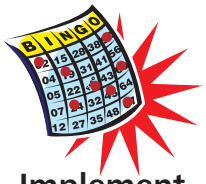
CAREER BINGO CARD

		FREE SPACE		

WS: A–3B

Name _____

CAREER BINGO SQUARES

 Beef Producer	 Veterinarian	 Food Inspector	 Biochemist	 Mechanic
 Implement Dealer	 Farm Journalist	 Loan Officer	 Conservationist	 Fertilizer Dealer
 Agriculture Teacher	 Accountant	 Farm Broadcaster	 Grain Farmer	 Animal Nutritionist
 Elevator Manager	 Meat Cutter	 Grain Broker	 Extension Educator	 Seed Salesman
 Plant Scientist	 Landscape Contractor	 Dietitian	 Agricultural Engineer	

Name_____

CAREER MATCH

Directions

Match the following jobs with their job description.

1. _____ Veterinarian
2. _____ Horticulturalist
3. _____ Agriculture economist
4. _____ Implement dealer
5. _____ Grain broker
6. _____ Mechanic
7. _____ Farm journalist
8. _____ Food scientist
9. _____ Loan officer
10. _____ Meat cutter
11. _____ Truck driver
12. _____ Agronomist
13. _____ Biochemist
14. _____ Biologist
15. _____ Producer

a. Writes for farm newspapers and magazines
b. Transports agriculture products
c. Lends money to farmers for equipment or land
d. Grows or raises an agriculture commodity
e. Studies the chemistry of living things
f. Fixes the machines farmers use
g. Cares for the health of animals
h. Studies the science of crops and soils
I. Studies the prices and costs of agriculture
j. Studies living things
k. Studies plants and how to grow them
l. Studies how food is processed and kept safe
m. Buys and sells grain from farmers
n. Cuts meat to be sold in stores
o. Sells the machines farmers need

CAREER MATCH KEY

Answers

1. g
2. k
3. l
4. o
5. m
6. f
7. a
8. l
9. c
10. n
11. b
12. h
13. e
14. j
15. d

Name _____

WHAT ARE YOUR INTERESTS?

Directions

Below are some questions to help you assess your interests. Read each question, and answer "Yes" or "No." If you feel you don't know enough about the question, answer "More." This means you should investigate the area to find out more about it. You may have interests in the area but don't realize it. Use all your answers to seek knowledge and experience. You may wish to talk with your teacher or a counselor to get more details.

1. Do you like animals?	Yes	No	More
2. Do you like plants?	Yes	No	More
3. Do you like to be outside?	Yes	No	More
4. Do you like wildlife?	Yes	No	More
5. Do you like to use hand tools?	Yes	No	More
6. Do you like to meet people?	Yes	No	More
7. Do you like to share ideas with others?	Yes	No	More
8. Do you like to use computers?	Yes	No	More
9. Do you like science?	Yes	No	More
10. Do you like to prepare food?	Yes	No	More

Name _____

CAREER RESEARCH

Directions

Use the Internet to research information on careers you find interesting. Use the questions below as a guide for your research.

1. What agricultural career are you researching?

2. What are the main job responsibilities for this career?

3. Where does this job take place (lab, farm, office, school, etc.)?

4. What would a person with this job wear to work each day?

5. How much education does it take to get a job in this field?

6. What educational subjects should a person interested in this field focus on?

7. How much money does a person in this job make?

Lesson A–4

SCIENTIFIC METHOD

Indiana Agricultural Literacy Lesson Plan Library

Unit A. General Agricultural Science

Lesson 4. Scientific Method

Indiana's Academic Standard. **Science:** 4.1.7 — Discuss and give examples of how technology, such as computers and medicines, have improved the lives of many people, although the benefits are not equally available to all.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the scientific method and the steps involved.
2. Describe how the scientific method is used in agriculture.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Indiana Soybean Board, www.indianasoybeanboard.com

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

National Corn Growers Association, www.ncga.com

USDA, *Science in Your Shopping Cart*, www.ars.usda.gov/is/np/shopcartintro.html or contact your County Farm Bureau Office.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Markers
- ✓ Paper towel
- ✓ Pencils
- ✓ Ruler
- ✓ Soil
- ✓ Soybeans
- ✓ Two plastic cups per student
- ✓ Tray to hold plastic cups
- ✓ Various liquids (soda, milk, juice, etc.)
- ✓ Water

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Biotechnology
- ➤ Conclusion
- ➤ Data
- ➤ Hypothesis
- ➤ Ration
- ➤ Renewable resource
- ➤ Scientific method

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Present a scientific problem to the class. For example, "Would a flower grow faster with too much water, or not enough water?" Ask them how they would go about solving the problem. Ask them to be specific as to the exact steps they would take. Introduce the scientific method to the class.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain the scientific method and the steps involved.

Anticipated Problem: What is the scientific method, and what steps does it involve?

I. The ***scientific method*** is the process for solving scientific experiments. It is made up of steps that must be followed. The number and order of the steps may vary, but the outcomes they cover are always the same. There are five important steps in the scientific method.

A. State the problem.
   1. A problem cannot be solved without first defining the exact problem.
   2. What do you need to find out? Why will you be performing the experiment?

B. Research the problem.
   1. What will it take to solve the problem?
   2. What do I know? What do I need to know?

C. Form a hypothesis.
   1. A ***hypothesis*** is an educated guess or predicted outcome of an experiment.
   2. What do you think the solution will be?
   3. Remember to keep it simple. The best solution is usually the simplest.

D. Test the hypothesis.
   1. Once a hypothesis is formed, it must be tested.
   2. Perform the test/experiment to see if your hypothesis is correct.

E. Collect data and draw conclusions.
   1. ***Data*** are the results of your experiments.
   2. The ***conclusion*** is the final outcome of an experiment.

3. There are two possible conclusions that may be drawn from your experiments.
   a. The hypothesis is correct. You solved the problem.
   b. The hypothesis is wrong.
      (1) Research what was wrong with your original hypothesis.
      (2) Did you make a poor selection?
      (3) Was the experiment flawed?
      (4) Form another hypothesis and test again.

Use TM: A–4A to illustrate the steps in the scientific method to students. Use class discussion to reinforce each of the steps. Follow the discussion up by having students complete WS: A–4A. The worksheet will give them a good opportunity to apply this objective's concepts.

Objective 2: Describe how the scientific method is used in agriculture.

Anticipated Problem: How is the scientific method used in agriculture?

II. Since agriculture is a science, the scientific method is used on a daily basis as the industry strives to make new discoveries and breakthroughs. Some of the following topics are currently undergoing intense study.

A. Biotechnology
   1. As the world continues to grow in population, the need for better, more efficient crops also grows.
   2. ***Biotechnology*** is a science that uses biology, or cellular make-up, to make new products.

B. Animal nutrition
   1. Scientists are always looking for better ways to feed livestock.
   2. By studying different parts of an animal's diet, or ***ration*** (type of feed the animal receives), researchers can improve the growth and health of animals. In the end, this improved diet provides a better product for consumers.

C. Renewable resources
   1. A ***renewable resource*** is a resource that can be recreated or grown again. An example of a renewable resource would be corn. If our supply of corn runs low, all we have to do is plant more. Corn can be renewed. An example of a non-renewable resource would be oil. When the world's supply of oil is used up, or depleted, there will be no way to make more.
   2. Agriculture research has found many ways to use corn and soybeans to make earth-friendly products that cut down on the use of non-renewable resources. For example, the gasoline we put in our cars is made out of crude oil found in the Middle East. Agricultural researchers have found ways to make fuels out of corn and soybeans. These fuels not only reduce our dependency on crude oil, but they also burn cleaner and emit

fewer pollutants into our air. Researchers continue to look for new uses of corn, soybeans, and other agricultural products because they are renewable.

Use TM: A–4B to discuss some areas of scientific research that are currently undergoing intense study. Have students research the many new products being made out of corn, soybeans, and other agricultural products. Use the web sites listed in the resources section. Ask students to bring examples of the new products to class for discussion. Which of the products did students previously know about? Which new products are they just discovering?

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Application can be used in all experiments and problem-solving activities.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Numbering

2, 5, 1, 3, 4

Matching

1 = c, 2 = d, 3 = a, 4 = b, 5 = e

Test A–4

Name_____

SCIENTIFIC METHOD

▶ Numbering

***Instructions*. Number the steps of the scientific method in the correct order.**

_____ Research the problem.

_____ Collect data and draw conclusions.

_____ State the problem.

_____ Form a hypothesis.

_____ Test the hypothesis.

▶ Matching

***Instructions.* Match the word with the correct definition.**

a. hypothesis
b. data
c. scientific method
d. research
e. conclusion

_____1. The steps taken to solve a problem.

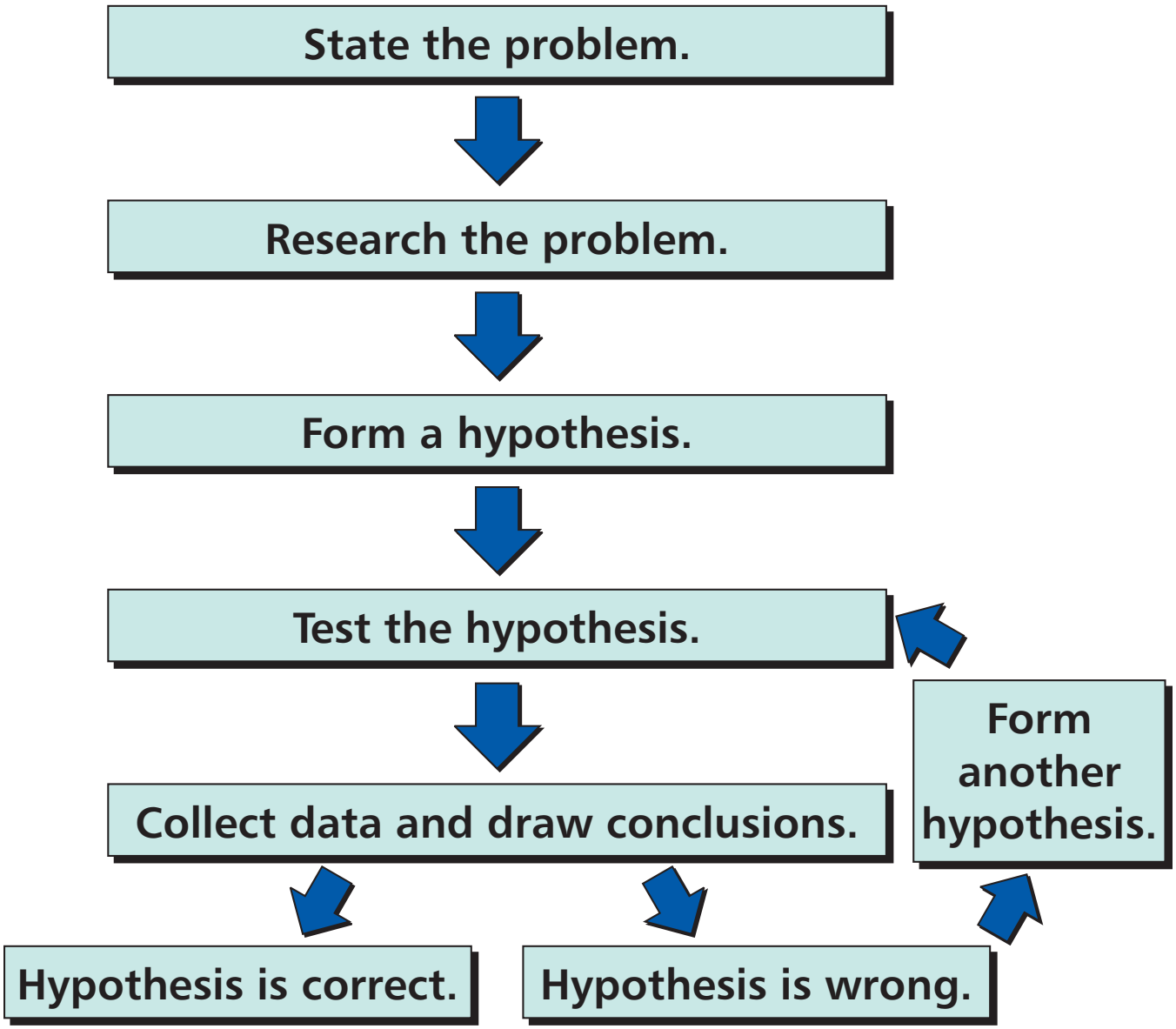
_____2. The gathering of information.

_____3. An educated guess or outcome.

_____4. The information gained from an experiment.

_____5. The final outcome of an experiment.

THE SCIENTIFIC METHOD



AREAS OF SCIENTIFIC RESEARCH IN AGRICULTURE

Some of the following topics are currently undergoing intense study:

- Biotechnology
- Animal nutrition
- Renewable resources

(Courtesy, Agricultural Research Service, USDA)

(Courtesy, Agricultural Research Service, USDA)

Name _____

USING THE SCIENTIFIC METHOD

Directions

Use the following information to complete the steps of the scientific method.

State the Problem: Will a liquid other than water support the growth of plants?

Research: What do you know about…

…water—

…plant needs—

…other liquids—

What do you need to know?

State the Hypothesis: Plants require water for growth; water is a liquid; therefore, the liquid (choose one of the liquids supplied by your teacher and write it here) _____ will also support plant growth.

Test the Hypothesis:

1. Germinate two soybeans by placing them between two pieces of damp paper towel and setting them in a warm spot until the seeds sprout.
2. Take two plastic cups; mark them 1 and 2. Also write your name on each cup.

3. Using a pencil, poke a small hole in the bottom of each cup. Then fill both cups with soil.

4. Carefully remove your sprouted seeds, and plant one in each cup. Make sure the sprout is facing up and that it remains above the soil.

5. Cup 1 will be your control group, and cup 2 will be your experimental group.

6. Take both cups and place them in a tray to catch the drainage from the bottom of the cups.

7. Cup 1 will be watered each day with 1 tablespoon of water. Cup 2 will be watered each day with 1 tablespoon of the liquid you picked in your hypothesis.

Collect Data and Draw Conclusions:

1. Three days after planting your soybean sprouts, begin measuring the height of each plant. Measure the plants every other day, and record your data in the data table.

2. After collecting your data, answer the following questions:

   What does your data tell you?

   Did the liquid in your hypothesis support your plant?

DATA TABLE

	Height of Plant on Day 3 (cm)	Height of Plant on Day 5 (cm)	Height of Plant on Day 7 (cm)	Height of Plant on Day 9 (cm)	Height of Plant on Day 11 (cm)	Height of Plant on Day 13 (cm)
Control Group—Cup 1						
Experiment Group—Cup 2						

Lesson A–5

AGRICULTURAL APPLICATIONS OF BIOTECHNOLOGY

Indiana Agricultural Literacy Lesson Plan Library

Unit A. General Agricultural Science

Lesson 5. Agricultural Applications of Biotechnology

Indiana's Academic Standard. **Science:** 4.1.8 — Recognize and explain that any new invention may lead to other inventions.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe how biotechnology directly affects the lives of humans.
2. Explain how DNA influences the ways that people, animals, and plants grow.
3. Explain how biotechnology is applied in agriculture.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Baeuerle, Patrick A. and Landa, Norbert. *How the Y Makes the Guy.* Hauppauge, New York: Barron's Educational Series, Inc., 1997.

Baeuerle, Patrick A. and Landa, Norbert. *Ingenious Genes.* Hauppauge, New York: Barron's Educational Series, Inc., 1997.

Balkwill, Fran. *Amazing Schemes Within Your Genes.* 1993.

Balkwill, Fran. *DNA is Here to Stay.* 1992.

Biotechnology Industry Organization (BIO)—www.bio.org/foodag/

Biotech Know-ology—www.ces.ncsu.edu/resources/crops/ag546-1/ag546-1.html

Biotechnology: Questions and Answers—http://groups.ucanr.org/sbc/Outreach/Biotechnology_Tutorials_Online.htm

Herskowitz, Joel. *Double Talking Helix Blues.* 1993.

Institute of Food Technologists—www.ift.org

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Look Closer at Biotechnology, Activity Book, The Council for Biotechnology Information, www.whybiotech.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Apple
- ✓ Knife
- ✓ Milk
- ✓ Cereal
- ✓ Tofu
- ✓ Various supplies listed in WS: A–5B and WS: A–5C

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Biotechnology
- ➤ Bovine somatotropin (bST)
- ➤ Bt corn
- ➤ DNA
- ➤ Dominant gene

- Double helix
- Gene
- Genetic code
- Recessive gene

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. Two possible approaches are included here.

Approach 1:

> *Discuss the demand on farmers to produce enough food for the billions of people on Earth. Also discuss how the land available to farmers continues to decrease because of new buildings like subdivisions, malls, and the expansion of cities. Use an apple to demonstrate the small amount of land we have available for food production:*

1. *Cut the apple into four equal parts. Three parts of the apple represent the oceans on Earth The remaining part represents all the land on Earth. Set the three parts representing water aside.*
2. *Cut the land portion in half lengthwise. One part represents land where we cannot grow food (deserts, mountains, arctic, and wetlands). The remaining part represents the eighth of the entire Earth where humans can live. Set aside the part representing places we cannot grow food.*
3. *Cut the part representing the areas humans can live into four equal parts. Three of these parts represent areas that have developed property (houses, cities, roads) and/or that are too hot, cold, rocky, or wet for food to grow. Set those three parts aside.*
4. *Take the remaining 1/32 piece and peel off the skin. This sliver of skin represents all of the land that is available on Earth to grow food. Compare this to all of the other parts we set aside. Explain to students that through the use of biotechnology we can make better plants. These plants are able to produce more food per plant, meaning we can produce more food on the land we have available than we could before.*

Approach 2:

> *Have students taste test milk, cereal, and tofu. After they have eaten, explain to them that these food products and many others are involved in biotechnology.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe how biotechnology directly affects the lives of humans.

Anticipated Problem: How does biotechnology directly affect our lives?

I. Biotechnology: 'Bio' meaning biology or living things and 'technology' meaning tools. ***Biotechnology*** is a science that uses living things to make new products.

A. All living things have a blueprint that determines what that organism will look, act, and feel like, or the living thing's traits.

1. This blueprint is a specific ***genetic code.***
2. This genetic code determines what color a flower will be, what an apple will taste like, or what color a child's eyes are.

B. Biotechnology can be used to help humans.

1. Biotechnology improves foods and crops by adding specific characteristics that give the plant new benefits. For example, biotech rice contains more iron than regular rice.
2. A specific gene is taken from one plant and placed into the DNA of a second plant. The second plant will then grow with all its own traits plus the one from the first plant.

Use TM: A–5A to illustrate some of the products that have been influenced by biotechnology. Use classroom discussion to identify other areas where biotechnology is put to use.

Objective 2: Explain how DNA influences the way people, animals, and plants grow.

Anticipated Problem: How does DNA influence the way organisms grow?

II. Since the discovery of DNA, scientists have studied how DNA relates to the growth of organisms.

A. Basic background of genes.

1. A ***gene*** determines what an organism's offspring will look and feel like.
2. All living things have genes. Each organism has between 50,000 and 100,000 genes.
3. Genes are a part of a DNA molecule in a chromosome, which is found in a cell.
4. Human beings have two of every type of gene. One gene is received from the mother and the other from the father.
5. Genes can be dominant or recessive. Two dominant genes will allow the dominant characteristic to appear. Two recessive genes will cause the recessive trait to be dis-

played. If one dominant and one recessive gene are paired, the ***dominant gene*** will overpower the ***recessive gene*** and the characteristic of the dominant gene will appear in the offspring.

6. The probability of a genetic outcome can be determined using a Punnet Square.

B. DNA is made up of genes.

1. ***DNA*** (deoxyribonucleic acid) is the molecule in a chromosome that furnishes the genes with information for their development.
2. There are four different bases on a DNA molecule:
   a. Adenine (A)
   b. Thymine (T)
   c. Guanine (G)
   d. Cytosine (C)
3. These four bases form base pairs.
   a. Adenine joins with Thymine (A–T)
   b. Guanine joins with Cytosine (G–C)
4. A DNA strand is twisted in a double helix. A ***double helix*** is the spiral structure that DNA forms. The average length of a DNA strand is 6 feet long!

Use TM: A–5B thru TM: A–5D to further explain to students how DNA and genetics are the recipes for all living things. Follow this up by having students complete WS: A–5A, WS: A–5B, and WS: A–5C. After students complete the activities, have them write a paragraph answering the question: What does DNA tell about my friends and me?

Objective 3: Explain how biotechnology is applied in agriculture.

Anticipated Problem: How does biotechnology work in agriculture?

III. Biotechnology lets researchers take good traits from one organism and place them into another, creating a better organism. Biotechnology can be used to improve many agriculture products.

A. Milk

1. Through biotechnology, researchers have been able to increase the amount of milk a dairy cow can produce by increasing the amount of the bovine growth hormone, known as ***bovine somatotropin (bST)***, which is the hormone secreted by the pituitary gland that regulates milk secretion by the mammary glands of cows.
2. bST is a protein that increases the amount of energy cows put toward producing milk. In other words, bST redirects the energy cows get from feed from weight gain to milk production.

3. Cows naturally produce bST in their bodies but not in large amounts. Biotechnology has allowed researchers to put the gene that controls bST production into the DNA of a harmless bacteria.
4. This bacteria is then injected into the cow's system, resulting in increased bST production and increased milk production.
5. Through the use of this biotechnology, milk production can be increased by 10 to 25 percent.
6. The milk causes no harmful side effects in humans because bST is a natural hormone that has always been present in milk.
7. There are also no side effects for the cows.

B. Insecticides

1. Farmers use insecticides to fight damage to crops caused by insects. Insecticides are traditionally sprayed on the field to kill the harmful bugs.
2. Spraying can sometimes cause environmental problems, such as drifting and runoff into nearby streams.
3. Biotechnology researchers have taken genes from plants that naturally kill the insects that harm corn and placed these genes into the DNA of the corn. The result is ***Bt corn***, a corn plant that can kill harmful bugs on its own without the use of spray insecticides. This technology has also been used in potatoes, cotton, and rice.

C. Golden rice

1. Golden rice was a huge breakthrough for the biotechnology industry. This rice contains increased amounts of beta-carotene and iron.
2. The beta-carotene is made into Vitamin A by the human body and prevents infection and blindness. More than 400 million people worldwide suffer from a Vitamin A deficiency.
3. Iron is needed to maintain the human body. People with an iron deficiency suffer from anemia. There are 3.7 billion people worldwide who do not get enough iron.
4. The creation of golden rice was especially important to people in developing countries who depend on rice as a dietary staple but who were not receiving enough nutrients. The introduction of this rice allowed them to grow rice that was full of needed nutrients.
5. The genes to create this rice came from a number of different sources, one of those being daffodils.

Use TM: A–5E to help cover the content of this objective. Have students create a better agricultural product through the use of biotechnology. Have them write about a product they would like to improve, how they would do it, and why.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Have students apply the knowledge they learn from this lesson in the activities, research papers, or a test.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1 = f, 2 = b, 3 = c, 4 = a, 5 = d, 6 = e

Completion

1. recessive
2. Golden rice
3. double helix

Short Answer

Answers will vary. Some suggestions include:

Less pollution—Farmers are spraying fewer pesticides because of plants that can resist pests on their own.

More food—Biotech organisms can produce more than other crops.

More nutritious food—Genetic engineering is producing food with more nutrients than before.

Test A–5

Name_____

AGRICULTURAL APPLICATIONS OF BIOTECHNOLOGY

▶ Matching

Instructions. **Match the word with the correct definition.**

a. biotechnology
b. Bt corn
c. adenine and thymine
d. genetic code
e. dominant gene
f. bST

_____1. A bovine growth hormone that increases milk production.
_____2. A genetically engineered plant that resists harmful insects.
_____3. One of the two base pairs in a DNA strand.
_____4. A science that uses living things to make new products.
_____5. The recipe for life.
_____6. A gene that overpowers another.

▶ Fill-in-the-Blank

Instructions**. Complete the following statements.**

1. The trait of a _____ gene does not appear in offspring unless both parents carry it.
2. _____ _____ contains more beta-carotene and iron than the original.
3. DNA is found in the shape of a _____ _____.

▶ Short Answer

Instructions**. Answer the following question.**

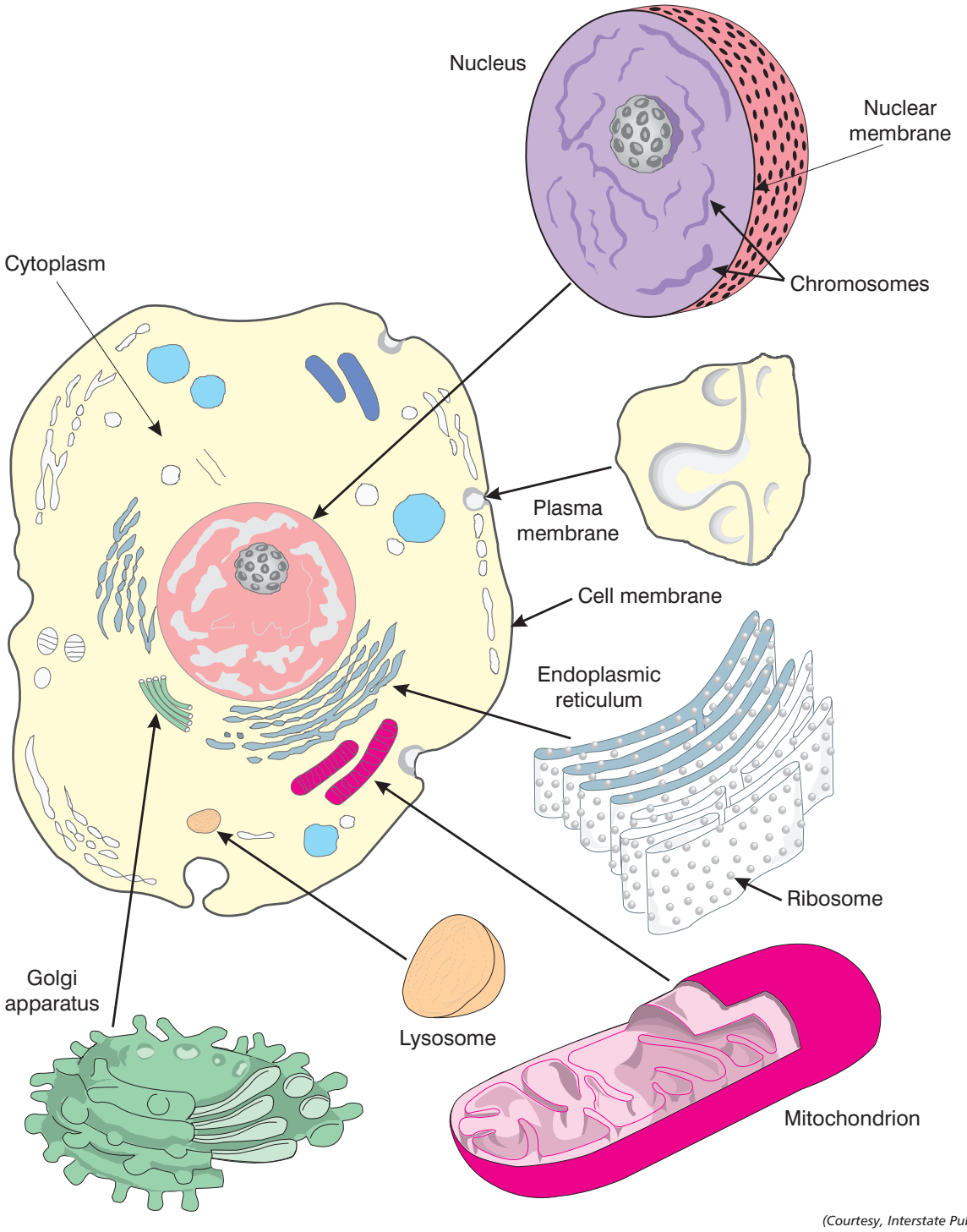
Describe three ways biotechnology can help people live better lives in a healthier world.

PRODUCTS INFLUENCED BY BIOTECHNOLOGY

- Corn can be genetically modified to resist damage from insects without the use of insecticides.
- Scientists are developing a new tomato with less water. (Less water makes processing easier.)

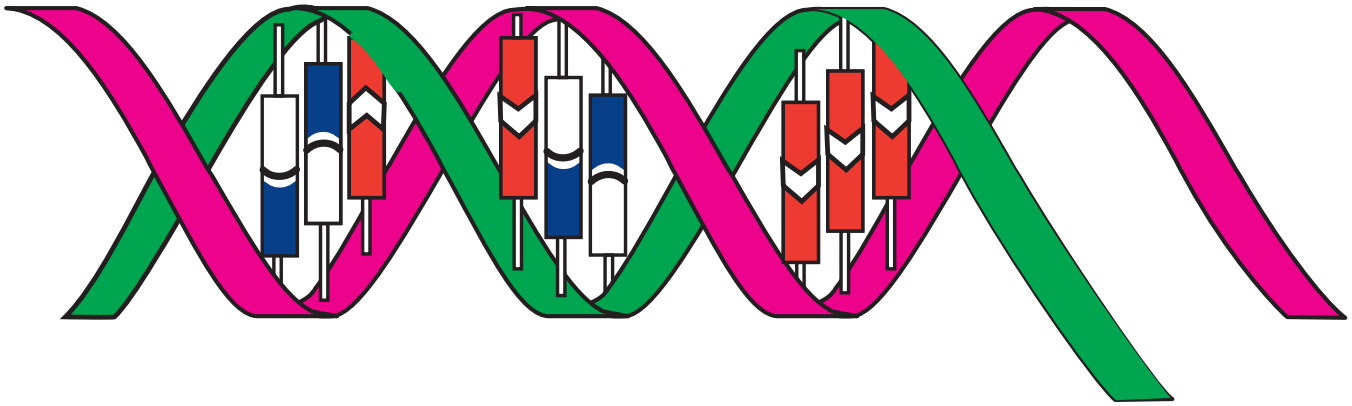
(Courtesy, Agricultural Research Service, USDA)

ANIMAL CELL

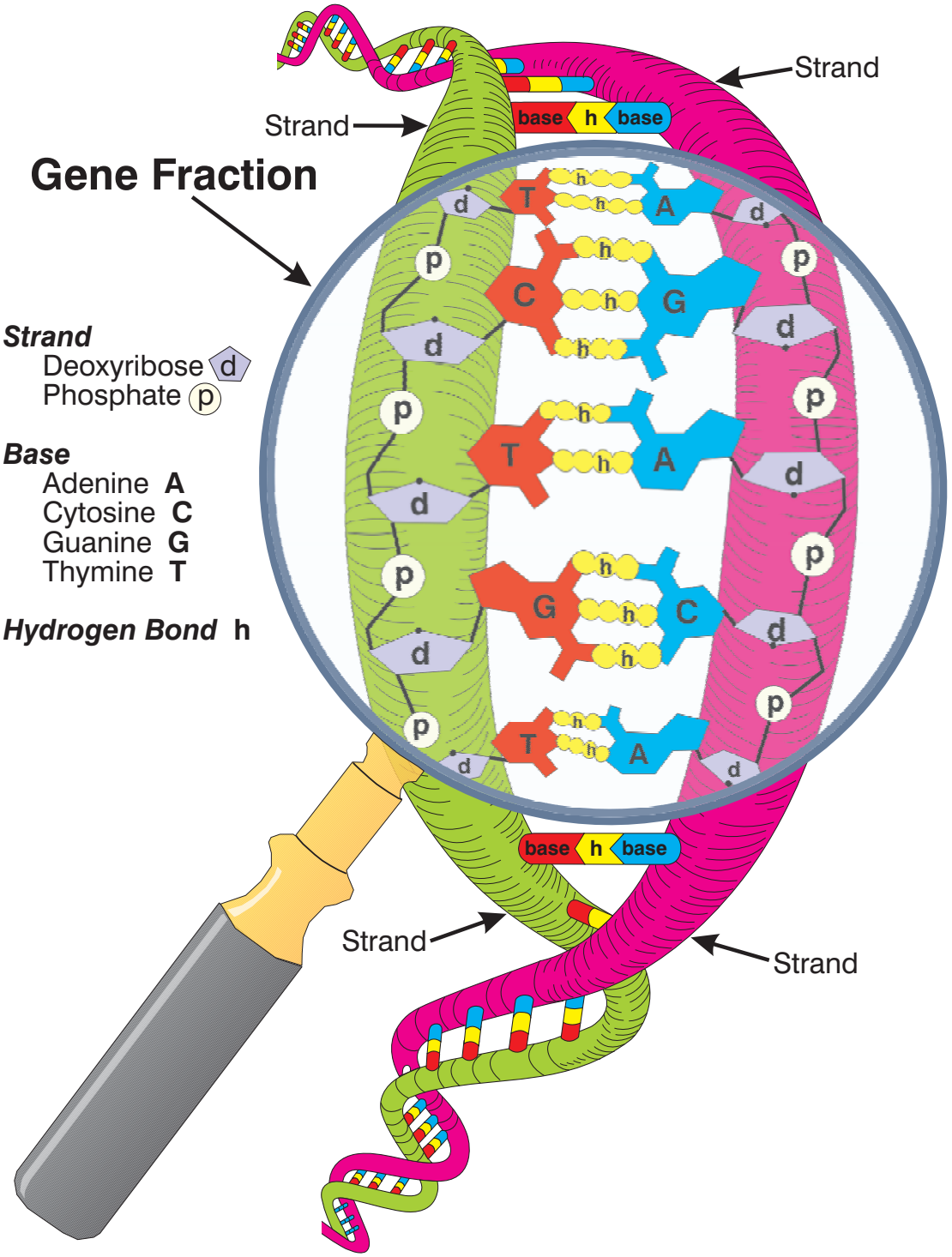


(Courtesy, Interstate Publishers, Inc.)

DOUBLE HELIX



STRUCTURE OF DNA



(Courtesy, Interstate Publishers, Inc.)

EXAMPLES OF AGRICULTURE PRODUCTS THAT HAVE BEEN INFLUENCED BY BIOTECHNOLOGY

- Milk
- Insect-resistant corn
- Golden rice
- Can you name any others?

Name _____

PUNNET SQUARES AND GENETIC PROBABILITY

Information

In agriculture, we breed plants with the hopes that the offspring, or baby plants, will take the best traits of the parent plants. It is important to know the genetic codes of the parent plants before we breed them together. A simple way to find the probability, or chance, of the offspring to have good traits is to use a Punnet Square.

For example, one of the common traits we look for in a corn plant is height. When dealing with height, the tall gene is the dominant gene and the short gene is the recessive gene. Dominant genes are shown with a capital letter (T) and recessive genes are shown with a small letter (t). Remember, genes come in pairs! There are three possible gene combinations that the plants may have:

TT	two dominant genes
tt	two recessive genes
Tt	one dominant gene and one recessive gene

A plant with the TT genetic code will be tall because both genes are dominant. A plant with the tt genetic code will be short because both genes are recessive. A plant with the Tt genetic code will be tall because the dominant (tall) gene will overpower the recessive (short) gene. When breeding the plants, the offspring will receive one gene from each of the parents. If we know the genetic code of the parent plants, we can predict the trait of the offspring and produce plants that are the height we want.

Tall Corn Plant

= TT or Tt

To be tall, at least one of the genes must be the dominant (T) gene for height.

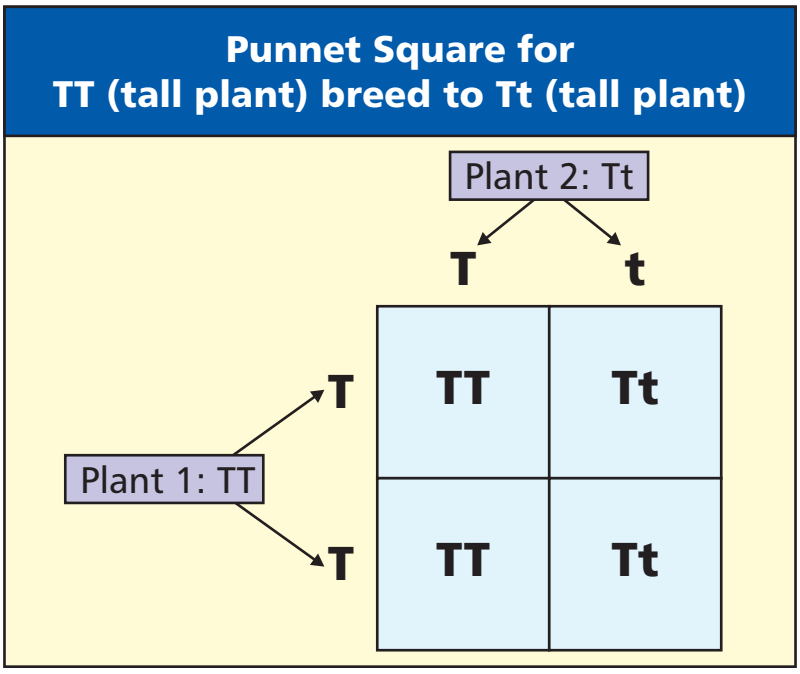
Short Corn Plant

= tt

To be short, both of the genes must be the recessive (t) genes for height.

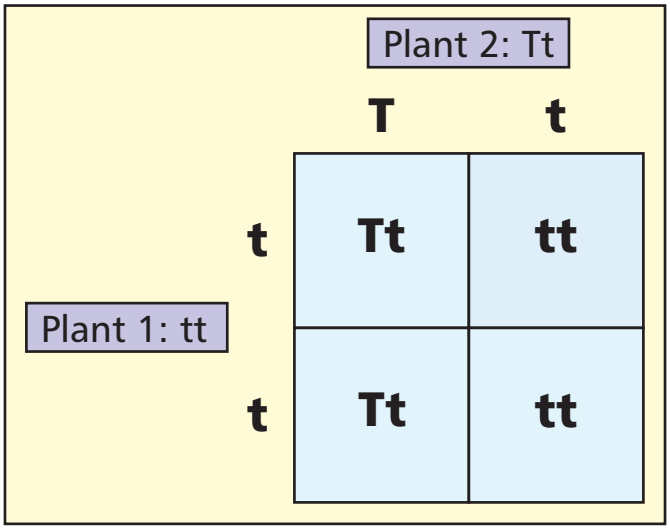
Punnet Square

Here is a simple example of predicting the traits of offspring using a Punnet Square:



This shows us that in each possible gene match up there will always be a dominant (T) tall gene. Let's try another!

We will continue to use Plant 2, but this time we are going to breed it to a plant with two recessive height genes. What will the genetic code for this new plant be? _____

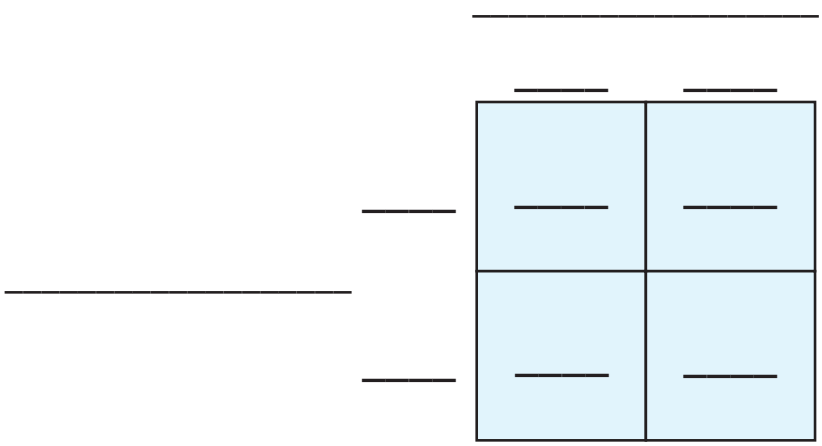


As you can see, only two out of four (or half) of the plants that result from this breeding will have a dominant (T) gene. We would say that the offspring of this plant would have a 50 percent chance of being tall and a 50 percent chance of being short.

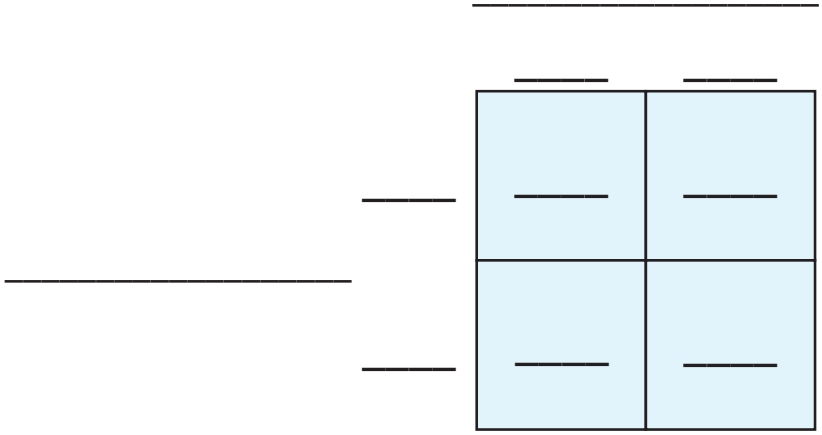
▶ Your Turn...

Can you complete the Punnet Squares for the following breedings?

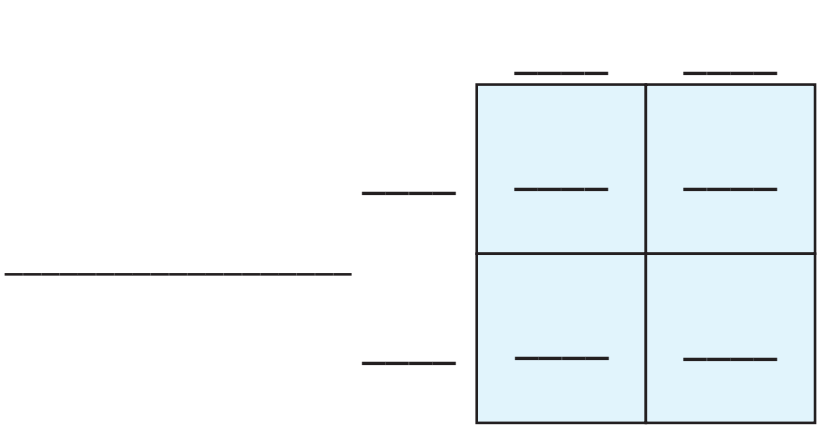
1. Plant 1: Tt, Plant 2: Tt



2. Plant 1: tt, Plant 2: tt

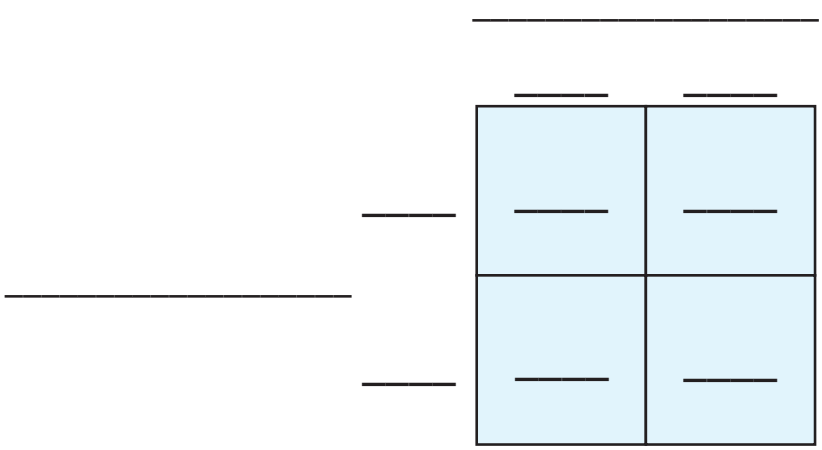


3. Plant 1: TT, Plant 2: TT

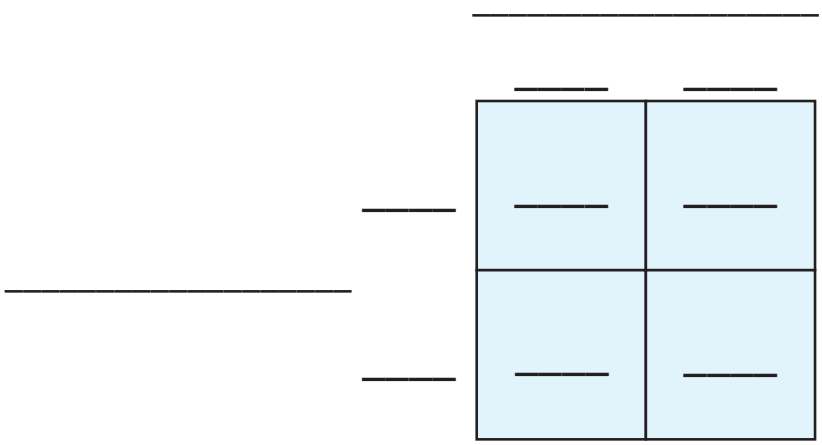


Now let's try a human trait—eye color: In humans, brown eyes are dominant (B), and blue eyes are recessive (b). With this information, complete the following Punnet Squares:

4. Father: BB, Mother: bb



5. Father: Bb, Mother: bb



PUNNET SQUARES AND GENETIC PROBABILITY KEY

1.

Plant 2: Tt

Plant 1: Tt	T	t
T	TT	Tt
t	Tt	tt

2.

Plant 2: tt

Plant 1: tt	t	t
t	tt	tt
t	tt	tt

3.

Plant 2: TT

Plant 1: TT	T	T
T	TT	TT
T	TT	TT

4.

Mother: bb

Father: BB		b	b
	B	Bb	Bb
	B	Bb	Bb

5.

Mother: bb

Father: Bb		b	b
	B	Bb	Bb
	b	bb	bb

Name _____

MAKING A DNA MODEL

Materials

- ✓ 2 white, 12-inch pipe cleaners
- ✓ 2 colored, 12-inch pipe cleaners
- ✓ 12 blue, 6-mm pony beads (A)
- ✓ 12 purple, 6-mm pony beads (G)
- ✓ 6 red, 6-mm pony beads (T)
- ✓ 6 yellow, 6-mm pony beads (C)
- ✓ Scissors
- ✓ Ruler
- ✓ Large marker

Directions

1. Cut each white pipe cleaner into six 2-inch long pieces.
2. The colored beads will represent the four different bases:

   Blue—Adenine (A)

   Red—Thymine (T)

   Purple—Guanine (G)

   Yellow—Cytosine (C)
3. Remember that Adenine (A) pairs only with Thymine (T), and that Guanine (G) pairs only with Cytosine (C).
4. Because the A and G bases have two rings, you will use two beads for each of these bases. Use one bead for the T and C bases because they only have one ring.
5. Take a 2-inch piece of white pipe cleaner and string on beads to show an Adenine and Thymine pair. (Remember to use two blue beads for A and one red bead for T.)
6. Now, build a Guanine and Cytosine pair on another piece of white pipe cleaner. (Remember to use two purple beads to represent G and one yellow bead to represent C.)
7. Repeat steps 4 and 5 until you have made six base pairs of A and T and six base pairs of G and C.
8. After you have strung all your base pairs, wrap one end of the white pipe cleaner around one of the colored pipe cleaners, about 2 cm from the top.
9. Take the other end of the white pipe cleaner and wrap it around the other colored pipe cleaner, about 2 cm from the top.
10. Keep attaching your base pairs onto the colored pipe cleaners. You can put them in any order you want. When you get done, your DNA should look like a ladder.
11. Now twist your DNA into a spiral, or double helix. It might help if you wrap it around a marker to get the right shape.

CONGRATULATIONS! You have made a DNA molecule. Compare your molecule with other students. How are they the same? How are they different?

Name _____

FIND YOUR DNA!

Purpose

In this activity you will take cells from the inside of your cheek and break away the membranes covering them to expose your DNA.

Materials

- ✓ 0.9 percent saltwater (½ teaspoon of salt to 8 ounces of water)
- ✓ small, disposable, paper or plastic cup
- ✓ 30–50 ml test tube or other clear container
- ✓ 25 percent soap solution (1 teaspoon dish soap or shampoo to 3 teaspoons water)
- ✓ ice-cold alcohol (95 percent ethanol/ethyl alcohol is best; 91 percent rubbing alcohol will also work)—keep in freezer or on ice until use
- ✓ teaspoon for measuring

Directions

1. Pour 1 teaspoon of the soap solution into a test tube (or other clear container). Set the test tube aside.
2. Measure 2 teaspoons of saltwater into the small cup.
3. Swish the saltwater from the small cup in your mouth vigorously for 30 seconds. This will knock off some of the cheek cells from inside your mouth.
4. Carefully spit the saltwater with the cheek cells back into the cup.
5. Pour this solution into the test tube containing the soap solution.
6. Gently mix this solution for two to three minutes. Try not to make too many bubbles. The soap will break down the membranes of the cheek cells because they are made of fat.
7. Pour 2 to 3 teaspoons (10 to 15 ml) of ice-cold alcohol down the side of the test tube so that it forms a layer on top of the soapy solution. **Do not mix!**
8. Let the test tube stand for one to two minutes.
9. The white clumps that form in the test tube are your DNA! Laboratories use a similar process to study DNA from different organisms.

(Courtesy, UIUC-Hughes Biotechnology Education and Outreach Program [BEOP])

Lesson B–1

CLASSIFYING ANIMALS

Indiana Agricultural Literacy Lesson Plan Library

Unit B. Animal Science

Lesson 1. Classifying Animals

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand how agricultural animals are utilized.
2. Explain the terms used to identify different animals within livestock species.
3. Explain the differences between digestive systems.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Cow and a Worm Poster, National Cattleman's Beef Association, 2002. Web site: www.teachfree.com

The American Angus Association — www.angus.org

The American Shorthorn Association — www.shorthorn.org

The American Simmental Association — www.simmental.org

The American Hereford Association — www.hereford.org

The American Maine-Anjou Association — www.maine-anjou.org

The Holstein Association — www.holsteinusa.com

The American Jersey Cattle Association — www.usjersey.com

The Brown Swiss Association — www.brownswissusa.com

The American Guernsey Association — www.usguernsey.com

The United Suffolk Sheep Association — www.u-s-s-a.org

The American Southdown Breeders Association — www.southdownsheep.org

www.nationalswine.com/breeds/breeds.htm

www.cpsswine.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheet
- ✓ Internet access

Terms. The following terms are presented in this lesson (shown in bold italics):

- ► Abomasum
- ► Barrow
- ► Boar
- ► Breed
- ► Bull
- ► Calf
- ► Chick
- ► Cockerel

- Cow
- Crossbreed
- Cud
- Ewe
- Ewe lamb
- Farrowing
- Gilt
- Heifer
- Hen
- Lamb
- Omasum
- Piglet
- Polled
- Pullet
- Ram
- Reticulum
- Roan
- Rooster
- Rumen
- Sow
- Steer
- Wether

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Write several of the terms for this lesson on the chalkboard or overhead before students enter the classroom. Have students write down the meanings of as many of the terms as they can on a sheet of paper. After a few minutes, have the students share and discuss their answers. After the discussion, continue with the lesson about the classification of animals.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand how agricultural animals are utilized.

Anticipated Problem: What are some of the factors and terms used to classify animals in the agricultural industry?

I. Animals can be classified based on use, breed, or age and gender.

A. Animals can be classified based on whether they are used for work, food, clothing, technology, or recreation.

1. Many times, animals in the agricultural industry are used to perform tasks.
    a. Before the invention of machines, like tractors and combines, horses were used to pull plows and harvesting equipment.
    b. Some animals, such as dogs, may be used to help herd sheep, cattle, or other animals.
    c. Animals may be used to protect other animals from predators, like coyotes.
2. Many of the animals in the agricultural industry produce food for human consumption.
    a. Dairy cows provide milk and dairy products like ice cream, butter, and yogurt.
    b. Beef cattle are used for meat products, such as hamburgers, roasts, and steaks.
    c. Swine, or hogs, give us meats like bacon, ham, sausage, pork chops, and ribs.
    d. Chickens and other poultry produce both meat and eggs.
    e. Sheep provide meat called lamb or mutton.
3. Some animals in the agricultural industry are raised to provide materials needed to make clothing.
    a. The hair on a sheep is called wool and is used to make warm clothing like sweaters, coats, socks, and gloves to protect humans from cold weather.
    b. Shoes, jackets, and other leather items are made from the hide of a cow.
4. Some animals can be used to make advancements in technology.
    a. Many of the medicines and other products we use today were developed with the help of animals.
    b. Many common medicines are by-products of animals. For example, chicken eggs are used to make a flu vaccine, and the heart valves of pigs are being used to replace diseased heart valves of humans.
    c. Some animals are used to test medicines to make sure they are safe for human use.

5. Some animals are enjoyed by humans for recreation.
    a. Horses are widely used as a recreation animal in the United States. Many people ride horses to relax. Some people enjoy entering their horses in racing or jumping events.
    b. Many companion animals—dogs, cats, and other small animals that live in the home—play an important role in the daily lives of humans as companions.

B. Animals in the agricultural industry can be classified by breed.
    1. A ***breed*** is defined by common characteristics of animals, such as color, size, maternal instinct, muscle quality, disposition, and structure.
    2. Many times producers will cross two different breeds of animals in order to gain good characteristics from each breed. The offspring of this mating is called a ***crossbreed***.
    3. Some popular breeds of beef cattle in the United States are Angus, Shorthorn, Simmental, and Hereford.
        a. Angus cattle originated in Northern Scotland and are one of the most popular breeds in the U.S. They are black, medium-sized, trim, and well-muscled. They are also known to give birth to smaller calves, which reduces the amount of difficulties during birth. Angus cattle are also ***polled,*** which means they naturally do not have horns.
        b. Shorthorn cattle are large, rectangular, and well-muscled. The Shorthorn breed was the first breed established in the United States and originated in northeastern England. They range in color from red to white and can be spotted or roan. ***Roan*** means light speckles in a dark coat. Roan Shorthorns have a dense mixture of red and white hairs.
        c. Simmental cattle originated in Switzerland and may be black, red, or cream colored with white faces, underlines, shoulders, or legs. They are a large breed known for muscling, calm dispositions, and good milk production. This makes them a popular breed to use in crossbreeding.
        d. Hereford cattle are known for their red body color and white faces. They are natives of England and can be found with horns or polled, without horns. A Hereford without horns is called a Polled Hereford. Herefords are muscular, trim, and smooth and have good dispositions and maternal traits. They are known for their ability to adapt to and graze in many climates.
    4. Popular dairy cattle breeds in the United States include Holstein, Jersey, Brown Swiss, and Guernsey.
        a. Holstein cattle are what most people think of when they think about dairy cows. They are black and white spotted and make up more than 80 percent of all registered dairy cattle. On average, they give 20,000 pounds of milk in a 305 day period with a milk fat rating of 4.7 percent.
        b. Jersey cattle are originally from Jersey Island and make up 13 percent of all registered dairy cattle. The average weight of a cow is 1,000 pounds. Jersey cows give approximately 15,000 pounds of milk in a 305 day period. They are light brown in color with black noses and eyes. Their milk is desirable because its high fat content is needed to make ice cream and butter.

c. Brown Swiss cattle originated in Switzerland and range from dark brown to light brown. They resemble dark Jerseys in color but are larger and more sturdily built. The average Brown Swiss cow weighs 1,400 pounds and gives 16,000 pounds of milk in a 305 day period with a milk fat rating of 4.7 percent.
d. Guernsey cattle are golden brown to light yellow in color and have white spots or bands. The average Guernsey cow produces 13,000 pounds of milk in a 305 day period. Guernseys originated from Guernsey Island.

5. Yorkshire, Duroc, Hampshire, and Chester White are a few of the popular breeds of swine in the United States.
   a. Yorkshire hogs originated in England and are known to be large hogs that make good mothers but are slow growers. They are white and have very short, pugged noses and erect ears.
   b. The Duroc breed of hogs originated in the United States. Durocs are very versatile and have a high rate of gain, which means they easily convert their food into weight or muscle. They are deep red in color and have drooping ears.
   c. Hampshire hogs are very lean and produce a high quality carcass for meat. They are one of the oldest breeds in the United States and are black with a white band around their shoulders. Hamshires have erect ears.
   d. Chester White hogs originated in Chester County, Pennsylvania, and are known for their white skin, large litter size, soundness, and excellent mothering ability. Chester Whites have drooping ears.
6. Some popular sheep breeds in the United States include Suffolk, Dorset, and Southdown.
   a. The Suffolk breed is the most popular breed of sheep in the country. Suffolks are identified by white bodies and black heads and legs. Their wool is short and coarse. They have fast growth rates and produce high quality meat.
   b. The Dorset breed is the second most popular breed in the United States and produces a clean white fleece, or wool. The wool is very strong and usually weighs 5 to 9 pounds when sheared off. Dorsets are known for having two or three lambs at a time and quality meat.
   c. The Southdown breed originated in Sussex England and is light gray in color. Southdowns are medium to small in body size and are known for their lambing ability and milk production. A Southdown ewe usually weighs 130 to 180 pounds, while the ram weighs 190 to 230 pounds.

Have students research the breeds of cattle, sheep, or swine further. Many of the breed associations have a web site with complete histories of each breed. Have the students give reports on a particular breed or mark a world map with the origins of each breed and how it made its way to the United States. Use TM: B–1A through TM: B–1D to discuss the characteristics of each breed.

Objective 2. Explain the terms used to identify different animals within livestock species.

Anticipated Problem: What terms are used to identify animals within livestock species?

II. There are proper terms used to distinguish between animals of different ages and gender.

A. In beef and dairy cattle, a baby when first born is called a ***calf***. The female calf is called a ***heifer***, and the male calf is called a ***bull***. Once the heifer matures and has her own calf, she is then called a ***cow***. A bull calf can grow to be used for breeding or be castrated at an early age to produce better quality meat. The castrated male calf is called a ***steer***.

B. A female hog that has produced babies or offspring is called a ***sow***. Sows have litters of baby pigs. A baby pig is called a ***piglet***. The act of giving birth is called ***farrowing***. A young female that has not farrowed is called a ***gilt***. The male hog is called a ***boar*** while the castrated male is called a ***barrow***.

C. A male sheep is called a ***ram*** while a castrated sheep is called a ***wether***. A baby sheep is called a ***lamb***. A female sheep that has not given birth is called a ***ewe lamb***. A female sheep that has given birth is called a ***ewe***.

D. A baby chicken after it hatches from the egg is called a ***chick***. The female is called a ***pullet*** before she begins to lay eggs and is called a ***hen*** afterwards. A young male is called a ***cockerel*** and grows into a ***rooster***.

Use TM: B–1E to further the discussion on the classification of animals based on age and gender.

Objective 3: Explain the differences between digestive systems.

Anticipated Problem: What are the two types of digestive systems in animals?

III. Animals have either a ruminant digestive system or a monogastric digestive system. The digestive system an animal has determines the type of foods the animal eats.

A. The ruminant digestive system allows ruminant animals to break down heavy grasses or hay and use them as an energy source. This is an important process because ruminants are able to take large quantities of materials that cannot be used directly as food for humans and convert them into human food in the form of meat and milk.

1. Examples of ruminant animals in the agricultural industry are cattle, sheep, and goats.
2. The ruminant stomach has four compartments, or sections: the rumen, the reticulum, the omasum, and the abomasum.
   a. The ***rumen*** is the largest of the four sections and is the first place food travels after it is swallowed. Ruminants eat very quickly and do not chew their food completely before swallowing it. The half-chewed food enters the rumen and is mixed with bacteria to begin breaking it down. When the rumen becomes full, the animal lays

down and begins forcing small amounts of the food in the rumen back up the throat to be chewed again. This is called chewing the ***cud***. Cattle chew their cud about six to eight times per day, and a total of five to seven hours each day is spent in rumination.

b. Once the cud has been chewed, it is swallowed again and enters the ***reticulum*** where bacteria and muscles continue the breakdown of the food. From this section the food moves into the omasum.

c. The ***omasum*** is the third section of the stomach and has the strongest muscles. It continues to squeeze the food to break it down and remove water.

d. The ***abomasum*** is the true stomach. In this section, the feed is mixed with gastric juices and digestion takes place just like it would in a nonruminant animal.

B. A monogastric system has a simple stomach. The stomach is a muscular organ that stores ingested food and moves it to the small intestine. Dogs, cats, chickens, and swine have monogastric stomachs. These animals eat feeds that are high in nutrients and digestibility, but low in roughage and fiber.

Use TM: B–1F and TM: B–1G to show students the parts of the ruminant and monogastric digestive systems. Make a copy of TM: B–1F for each student. As you review the steps of ruminant digestion, have the students follow the path of food through the system.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Use WS: B–1A to reinforce the concepts of the lesson. Classroom discussion of the objectives and student questions will also assist in applying the concepts.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. d
3. c
4. f
5. e

6. a

Fill-in-the-Blank

1. cud
2. ram, wether
3. farrowing, piglets

Short Answer

1. The four sections of the ruminant stomach are the rumen, the reticulum, the omasum, and the abomasum.
2. Answers will vary depending on the breed chosen.

Test B–1

Name_____

CLASSIFYING ANIMALS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. heifer	d. polled
b. rumen	e. abomasum
c. gilt	f. crossbreed

_____1. The largest compartment in the ruminant stomach. This is the first place food goes after it is eaten.

_____2. Cattle that do not have horns.

_____3. The name for a female pig before she gives birth to piglets.

_____4. The offspring of a cross between two different breeds of animals.

_____5. The true stomach of the ruminant system where digestion takes place.

_____6. The name for a female beef or dairy calf before she gives birth to a calf of her own.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. The _____ is food that has already been eaten by ruminant animals and is brought back up to be chewed again.
2. A male sheep is called a _____ while a castrated sheep is called a _____.
3. A female pig is called a sow after she gives birth. The act of giving birth is called _____ and the babies are called _____.

Short Answer

***Instructions*. Answer the following questions.**

1. Name the four sections of the ruminant stomach.

2. Pick a breed you learned about in this lesson and write about the characteristics that set it apart from other breeds.

BREEDS OF BEEF CATTLE

♦ Angus bull

(Courtesy, American Angus Association)

♦ Shorthorn bull

(Courtesy, Shorthorn Country)

♦ Simmental cow with her calf

(Courtesy, American Simmental Association)

♦ Polled Hereford cow

BREEDS OF DAIRY CATTLE

♦ Holstein cow

(Courtesy, Pete's Photo, Wykoff, Minnesota)

♦ Jersey cow

(Courtesy, Pete's Photo, Wykoff, Minnesota)

♦ Brown Swiss cow

(Courtesy, Pete's Photo, Wykoff, Minnesota)

♦ Guernsey cow

(Courtesy, Pete's Photo, Wykoff, Minnesota)

BREEDS OF SWINE

♦ Yorkshire sow with litter

(Courtesy, American Yorkshire Club, Inc.)

♦ Duroc barrow

(Courtesy, National Duroc Swine Registry)

♦ Hampshire gilt

(Courtesy, Hampshire Swine Registry)

BREEDS OF SHEEP

♦ Suffolk ewe

♦ Southdown ewe

♦ Dorset ewe

CLASSIFICATION OF ANIMALS BASED ON AGE AND GENDER

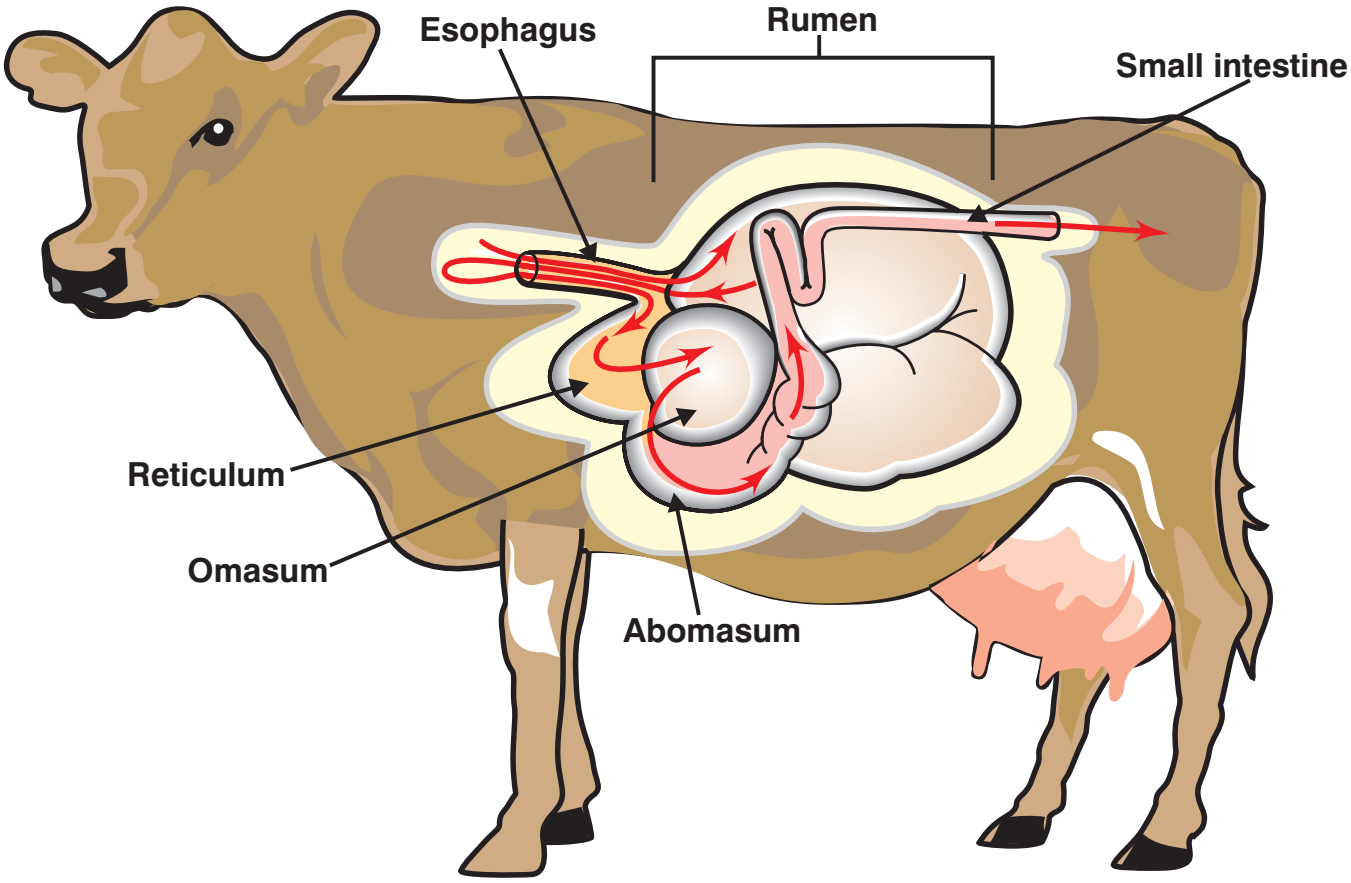
Category	Cattle	Goat	Sheep	Hog	Chicken	Turkey
Name	Bovine	Caprine	Ovine	Porcine	Galine	Meleagris
Mature Male	Bull	Buck	Ram	Boar	Rooster	Tom
Mature Female	Cow	Doe	Ewe	Sow	Hen	Hen
Young Male	Bull	Buck Kid	Ram Lamb	Shoat	Cockerel	Tom Poult
Young Female	Heifer	Doeling	Ewe Lamb	Gilt	Pullet	Hen Poult
Altered Male	Steer	Wether	Wether	Barrow	Capon	—
Newborn	Calf	Kid	Lamb	Pig	Chick	Poult
Group	Herd	Herd	Flock	Herd	Flock	Flock

Category	Dog	Cat	Horse	Guinea Pig	Rabbit
Name	Canine	Feline	Equine	Cavy	Lagomorph
Mature Male	Stud	Tom	Stallion	Male Cavy	Buck
Mature Female	Bitch	Queen	Mare	Female Cavy	Doe
Young Male	Intact	—	Colt	—	—
Young Female	Bitch	—	Filly	—	—
Altered Male	Neuter	Gib	Gelding	—	—
Newborn	Puppy	Kitten	Foal	Kit	Kit
Group	Pack	Bevy	Herd	Group	Group

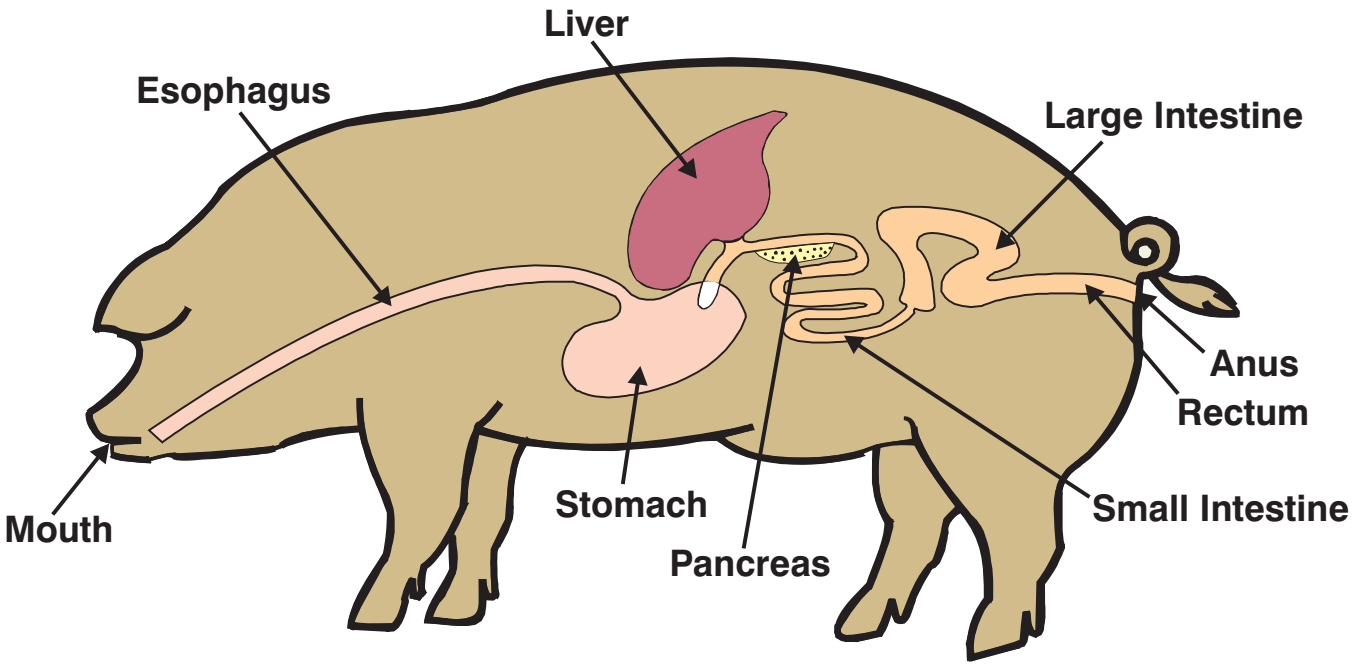
THE RUMINANT DIGESTIVE SYSTEM

The path of food through the ruminant stomach:

- Mouth to rumen
- Rumen to mouth
- Mouth to reticulum
- Reticulum to omasum
- Omasum to abomasum



THE MONOGASTRIC DIGESTIVE SYSTEM



WS: B–1A

Name _____

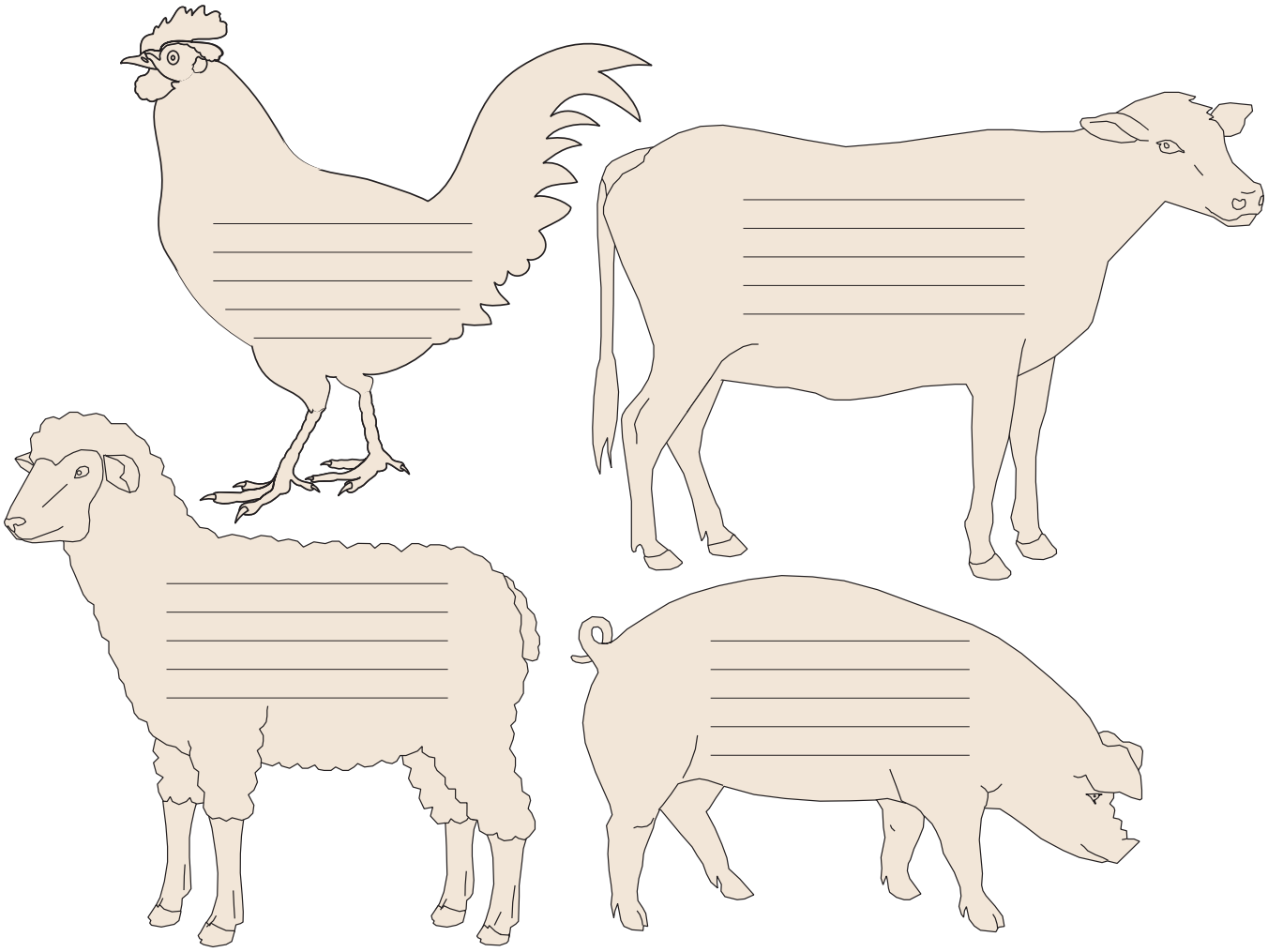
AN ANIMAL BY ANY OTHER NAME

▶ Directions

Place each word from the Word Bank in the animal shape that it relates to.

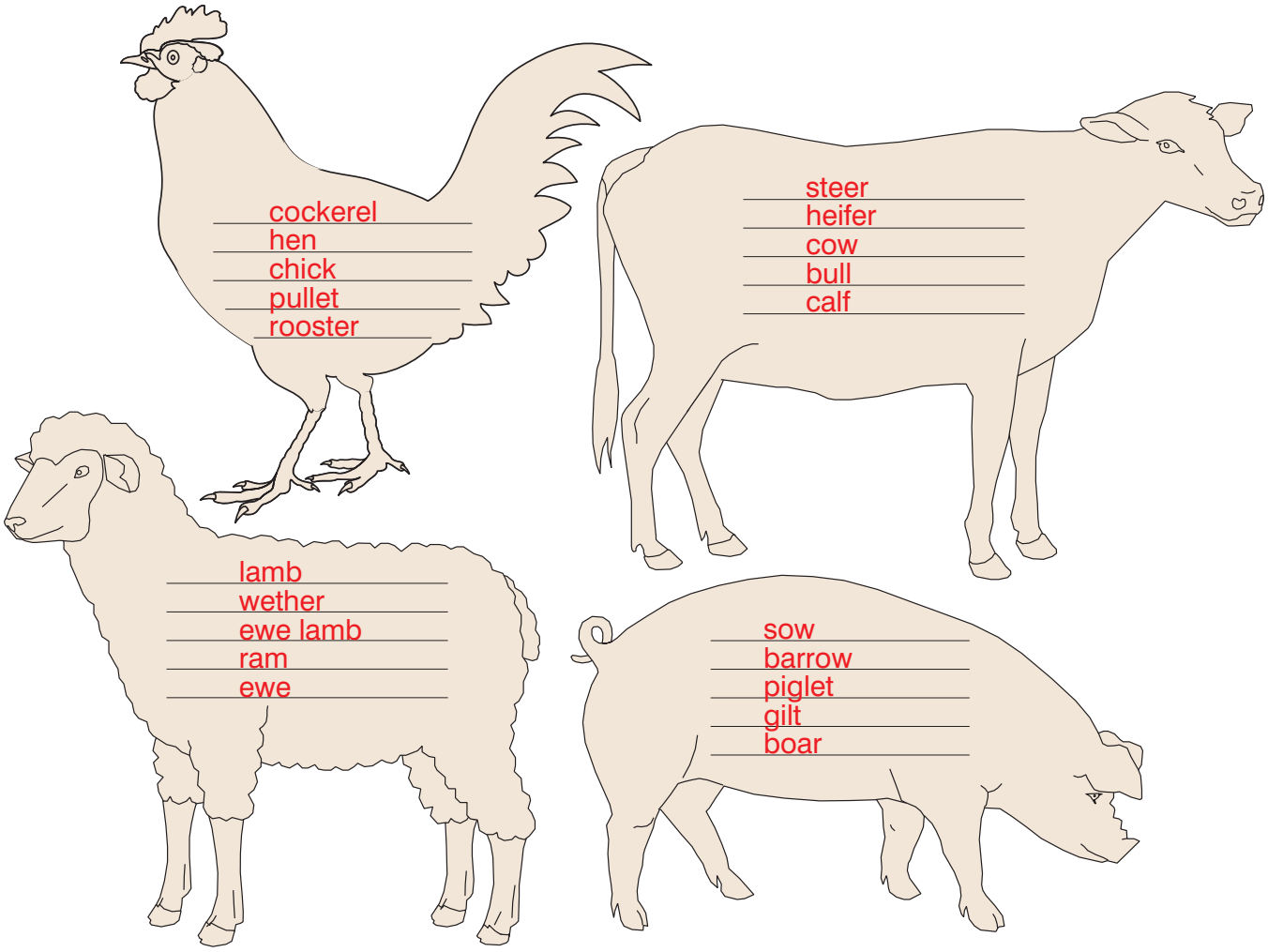
▶ Word Bank

sow	heifer	bull	hen	ram
steer	wether	cockerel	chick	boar
barrow	cow	ewe lamb	pullet	ewe
lamb	piglet	gilt	calf	rooster



WS KEY: B–1A

AN ANIMAL BY ANY OTHER NAME KEY



Lesson B–2

EXPLORING THE LIVESTOCK INDUSTRY

Indiana Agricultural Literacy Lesson Plan Library

Unit B. Animal Science

Lesson 2. Exploring the Livestock Industry

Indiana's Academic Standard. **Social Studies:** 4.4.2 — Define productivity and provide examples of how productivity has changed in Indiana during the past 100 years.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand the beef industry and the numerous products that come from the beef animal.
2. Understand the swine industry and the numerous products that come from swine.
3. Understand the sheep industry and the numerous products that come from sheep.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Spinning Kit. Ag Experience. Phone: (209) 384-9272. ($12.00)

Wool Fiber in the Making Chart. Pendleton Woolen Mills. Phone: (800) 760-4844. (Free)

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Cow-calf operation
- Feeder pig producer
- Feedlot operation
- Iron
- Lamb
- Marbling
- Market hog producer
- Mutton
- Pork
- Protein
- Purebred operation
- Zinc

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask the students to name all of the things they eat or use that come from the beef, swine, or sheep industry. Also ask them to consider how the products that they use get to them in the form that they want. Use this discussion to lead into the lesson.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1:

Understand the beef industry and the numerous products that come from the beef animal.

Anticipated Problem: What is the beef industry and what products do beef animals produce?

I. The beef industry includes the different types of operations used to raise cattle and the different products and by-products made from the cattle.

A. There are three types of beef cattle operations—purebred operations, cow-calf operations, and feedlot operations.

1. A ***purebred operation*** raises cattle of a single, pure breed. This type of operation produces purebred bulls to be used in cow-calf operations and animals to be sold to other purebred cattle farms. Breeders of the purebred animals are responsible for many of the genetic improvements in the beef cattle industry.
2. A ***cow-calf operation*** is responsible for producing the calves that will enter the feedlots. These operations are located in areas with plenty of grass to allow cows to graze. Calves are usually born in the spring, stay with their mother through the summer, and are weaned, or taken away from the mother, in the fall.
3. The owner of a ***feedlot operation*** buys calves from the cow-calf operation and feeds them until they put on enough weight to be harvested. Most feedlot operations are located in the Midwest because of the ready supply of grains, like corn, for feed.

B. Beef cattle are raised to produce high quality meat cuts called beef.

1. When a 1,000 pound animal is harvested it will yield on average a 600 pound carcass. This carcass will be cut into approximately 465 pounds of retail cuts, which are cuts of meat that are sold in grocery stores. One quarter of the carcass will be steaks, another quarter will be roasts. A remaining quarter will be ground beef or stew meat. The last quarter will be fat and bones.
2. The fat located in the meat, or muscle, is called ***marbling*** and gives the meat flavor and tenderness. Beef is a good source of the important nutrients zinc, iron, and protein. These nutrients keep the body strong and are important in the growth of young children. ***Protein*** builds, maintains, and repairs body tissues. ***Iron*** helps red blood cells carry oxygen to body cells and tissues. ***Zinc*** is a necessary mineral for growth and reproduction and for maintaining the integrity of the body's immune system.

C. Many other products are by-products of the beef industry. By-products are made from some part of the beef animal.

1. Medicines—The systems of the human body and those of cattle are very similar. That means our bodies are able to use a number of medicines that come from cattle to keep us healthy.
    a. Blood factors are used for treating hemophilia, killing viruses, and making anti-rejection drugs.
    b. Chymotrypsin promotes healing of burns and wounds.
    c. Collagen is used in plastic surgery and to make non-stick bandages.
    d. Cortisol is used as anti-inflammatory.
    e. Glucagon treats hypoglycemia or low blood sugar.
    f. Heparin is used as an anticoagulant to treat blood clots.
    g. Insulin is used for treating diabetes or high blood sugar.
    h. Pancreatin aids in digestion of food.
    i. Thrombin is used as a coagulant to help blood clot.
    j. Vasopressin controls intestinal and renal functions.
    k. Vitamin B-12 prevents B-complex deficiencies.
2. Food—Gelatin comes from the connective tissue of cattle and is used to make many of the foods we often eat.
    a. Candies
    b. Dairy products
    c. Desserts
    d. Diet products
    e. Jellies
3. Household Products—Many of the items in our homes are made from fats and proteins in beef cattle.
    a. Candles
    b. Ceramics
    c. Cosmetics
    d. Crayons
    e. Deodorants
    f. Detergent
    g. Floor wax
    h. Insecticides
    i. Insulation
    j. Linoleum
    k. Mouthwash
    l. Paint
    m. Paper
    n. Perfume
    o. Plastic

p. Soap
q. Shaving cream
r. Textiles
s. Synthetic rubber
t. Toothpaste

4. Textiles and apparel—Cowhide is used to make leather, which gives us many of the items we wear or use.
   a. Clothing
   b. Shoes
   c. Boots
   d. Belts
   e. Purses
   f. Wallets
   g. Gloves
   h. Luggage
   i. Automobile/furniture upholstery
5. Transportation—Traveling would be much more difficult without beef by-products, like fats and proteins.
   a. Antifreeze contains glycerol derived from beef fat.
   b. Asphalt contains a binding agent from beef fat.
   c. Beef fats and proteins are used to make auto and jet lubricant, outboard engine oil, high-performance grease, and brake fluid.
   d. Glue from beef protein is used in automobile bodies.
   e. Tires have stearic acid, which makes rubber hold its shape.

Use TM: B–2A to show the major external parts of a steer. Demonstrate the nutritional importance of beef by displaying TM: B–2B. Explain to students that 12 ounces of tuna, 8 pounds of broccoli, and 12 chicken breasts contain the same amount of zinc, iron, thiamin, riboflavin, and vitamin B-12 as one 3-ounce hamburger! Use TM: B–2C to illustrate the different retail cuts of beef. Use WS: B–2A to have students perform a scavenger hunt for beef products and by-products. Play Beef Bingo to make students familiar with the different by-products that come from beef cattle. Give each student a copy of WS: B–2B and WS: B–2C. Have students cut out the squares on WS: B–2C and paste them on WS: B–2B in a random order. This gives each student a different playing card. Use playing chips or squares of colored paper to mark each square as it is called. Cut out the squares on a copy of WS: B–2C and select randomly from the squares to call out the by-products. The first student to complete a row wins!

Objective 2: Understand the swine industry and the numerous products that come from swine.

Anticipated Problem: What is the swine industry and what types of products do swine produce?

II. The swine industry includes the different types of operations used to raise hogs and the different products and by-products produced from hogs.

A. There are two basic types of swine operations—feeder pig producers and market hog producers.

1. ***Feeder pig producers*** maintain a large number of sows that give birth to two litters of piglets each year. In most cases, a crossbred sow is bred to a purebred boar to produce offspring with good qualities from each parent. The feeder pigs are then sold to the market hog producers when they are about five to eight weeks old.
2. The ***market hog producer*** feeds the young pigs until they reach a market weight of 220 to 240 pounds. This process usually only takes about six months. When the pigs reach their market weight, they are sold to a processing plant to be harvested.

B. The swine industry has made great strides in the past twenty years to produce a very lean and trim hog compared to those in the past. The U.S. swine industry brings in over $10 billion dollars in sales each year. The United States is the third largest swine producer in the world.

C. The meat obtained from a pig is called ***pork***. Examples of pork are ham, sausage, bacon, pork chops, ribs, and tenderloins.

1. When a 215-pound hog is harvested, it will usually result in a 150 pound carcass once all of the unusable portions are removed. The highest priced wholesale cut per pound on a pig is the loin, followed by the ham, then the boston butt, or the shoulder, and finally the picnic, or the area surrounding the front leg.
2. The average American eats 46 pounds of pork each year. This makes pork the second most consumed red meat.

D. There are many by-products that come from hogs.

1. Glass
2. Fertilizer
3. Glue
4. Buttons
5. Paint brushes
6. Gloves
7. Insulation
8. China
9. Pet food
10. Linoleum
11. Chalk

12. Cement
13. Cosmetics
14. Plastic
15. Rubber
16. Crayons
17. Matches
18. Antifreeze
19. Floor wax
20. Herbicide

Use TM: B–2D to show the major external parts of a hog. Use TM: B–2E to illustrate the different retail cuts of pork. To help make students familiar with the different by-products that come from hogs, have them complete a relay race using WS: B–2D.

Objective 3: Understand the sheep industry and the numerous products that come from sheep.

Anticipated Problem: What is the sheep industry and what products does it provide?

III. The sheep industry includes the different types of operations used to raise sheep and the different products and by-products produced from sheep.

A. Sheep are produced and used for many purposes.

1. Sheep have an impressive history. As far back as 10,000 years ago, primitive man in the Mesopotamian Plain used sheep for three basic human needs: food, clothing, and shelter. Thousands of years later, sheep are still providing humans with the "basic three." However, they also make possible dozens of other products.
   a. From hide and wool: lanolin, drum heads, insulation, rug pads, asphalt binder, paint and plaster binder, tennis balls, felt, carpet.
   b. From fats and fatty acids: paints, ceramics, medicines, dish soap, biodegradable detergents, antifreeze, candles, shaving cream, protein hair shampoo and conditioner.
   c. From the bones, horns, and hooves: syringes, bone china, wallpaper and wallpaper paste, photographic film.
   d. From manure: fertilizer.
2. When you add up the value of items such as wool suits in clothing stores, lamb chops in restaurants, lamb roasts in grocery stores, and the many other products produced from sheep, the U.S. sheep industry contributes over $1 billion each year to the American economy.
3. Compared to citizens in other countries, Americans eat more lamb than mutton. ***Lamb*** is the meat from a sheep that is less than one year old. ***Mutton*** is the meat from a sheep that is one year old and older. Because Americans favor lamb over mutton, the

United States typically sends sheep over one year of age to Mexico, which has a strong mutton market.

4. Sheep are earth-friendly animals, no matter where they graze. In many areas of the country, sheep are used to graze leftover stalks and seeds after crops have been harvested. Sheep also help control weeds in ditch banks, roadsides, and pastures. They have even been used to graze heavily weeded areas to reduce the amount of flammable materials that could catch fire! The wool from sheep can be made into mats that are used to soak up oil spills both on land and water.

B. Sheep are raised in every state of the Union, from tiny islands off the coast of Maine to the Alaska Peninsula.
   1. Those who raise sheep are as diverse as the regions they call home.
   2. The term sheep producer is used to define any person raising sheep, regardless of the number of sheep he or she raises. Some producers have farm flocks of 50 to 200 animals. Other producers have large range operations of 1,000 to 5,000 sheep with shepherds who live with the sheep and dogs that guard the sheep from predators and help move them to new grass and water.

C. U.S. sheep producers raise many breeds and crossbreeds of sheep. Almost every breed provides two products—meat and wool. The exception is hair sheep that do not produce wool. Some breeds of sheep are genetically geared toward producing higher quality meat or wool. For instance, meat breeds are geared to producing just that—meat—while wool production is stressed in wool breeds, be they fine-wool breeds or long-wool breeds. There are also sheep that are called "dual purpose breeds" because wool and meat production are equally emphasized.
   1. Fine-wool sheep produce fine-textured wool with an average staple length of 4 inches. (Staple length is the length of a single fiber.)
      a. Fine wools are generally softer and are often used to make expensive garments like suits and evening gowns.
      b. Find-wool breeds raised in the United States are the Merino and Rambouillet.
   2. Medium-wool sheep are often dual-purpose sheep, used for both meat and wool.
      a. Medium wools are typically used in blankets, sweaters, and socks.
      b. Medium-wool breeds include the Columbia, Corriedale, and Dorset. Medium-wool sheep tend to be the white-faced breeds.
   3. Long-wool sheep are usually larger than other breeds and produce long wool with a staple length of 6 to 8 inches.
      a. Long-wool breeds include the Lincoln, Romney, and Cotswold.
      b. The fleece from long-wool sheep is often used in carpets.
   4. Crossbred-wool sheep are crosses between two different breeds and, therefore, have the traits of both breeds.
      a. Fleece from crossbred-wool sheep is typically referred to as commercial wool in the sheep industry.
      b. Most crossbred-wool sheep are dual purpose.
   5. Hair sheep are generally used for their meat.
      a. Hair sheep breeds include the Katahdin, Dorper, St. Croix, and Texels.

b. These sheep are prized for their excellent mothering abilities.
c. The good muscle quality of most hair sheep makes them an outstanding meat breed.

6. Coarse-wool sheep, such as the Suffolk and Hampshire, are often blamed for the scratchy feel of wool.

Use TM: B–2F to show the major external parts of a sheep. Use TM: B–2G to illustrate the major wholesale and retail lamb cuts. Obtain a copy of the Wool Fiber in the Making Chart to further discuss the process of making wool into textiles. Students can spin their own wool by obtaining a Spinning Kit from Ag Experience.

Review/Summary. Allow students to taste beef, pork, and lamb. Have them compare and contrast the differences between the three types of meat. Have them research the nutritional values of each of the types of meats. To review by-products, display samples of by-products from each of the species on a table. Write a number in front of each by-product. Have students identify which species the product came from on a sheet of paper.

Application. Use WS: B–2A through WS: B–2D to reinforce the concepts of the lesson. Classroom discussion of the objectives and student questions will also assist in applying the concepts.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. e
2. d
3. b
4. a
5. c

Fill-in-the-Blank

1. Pork
2. market hog producer
3. Mutton

Short Answer

Answers will vary. Use Objective 3 to score this question.

Test B–2

Name_____

EXPLORING THE LIVESTOCK INDUSTRY

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. cow-calf operation
b. lamb
c. iron
d. zinc
e. marbling

_____1. The fat found inside a cut of meat that gives the meat flavor and tenderness.

_____2. A mineral necessary for maintaining the integrity of the body's immune system.

_____3. The name for meat that comes from sheep less than one year old.

_____4. A beef operation that produces animals that will enter a feedlot.

_____5. A nutrient that helps red blood cells carry oxygen to body cells and tissues.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

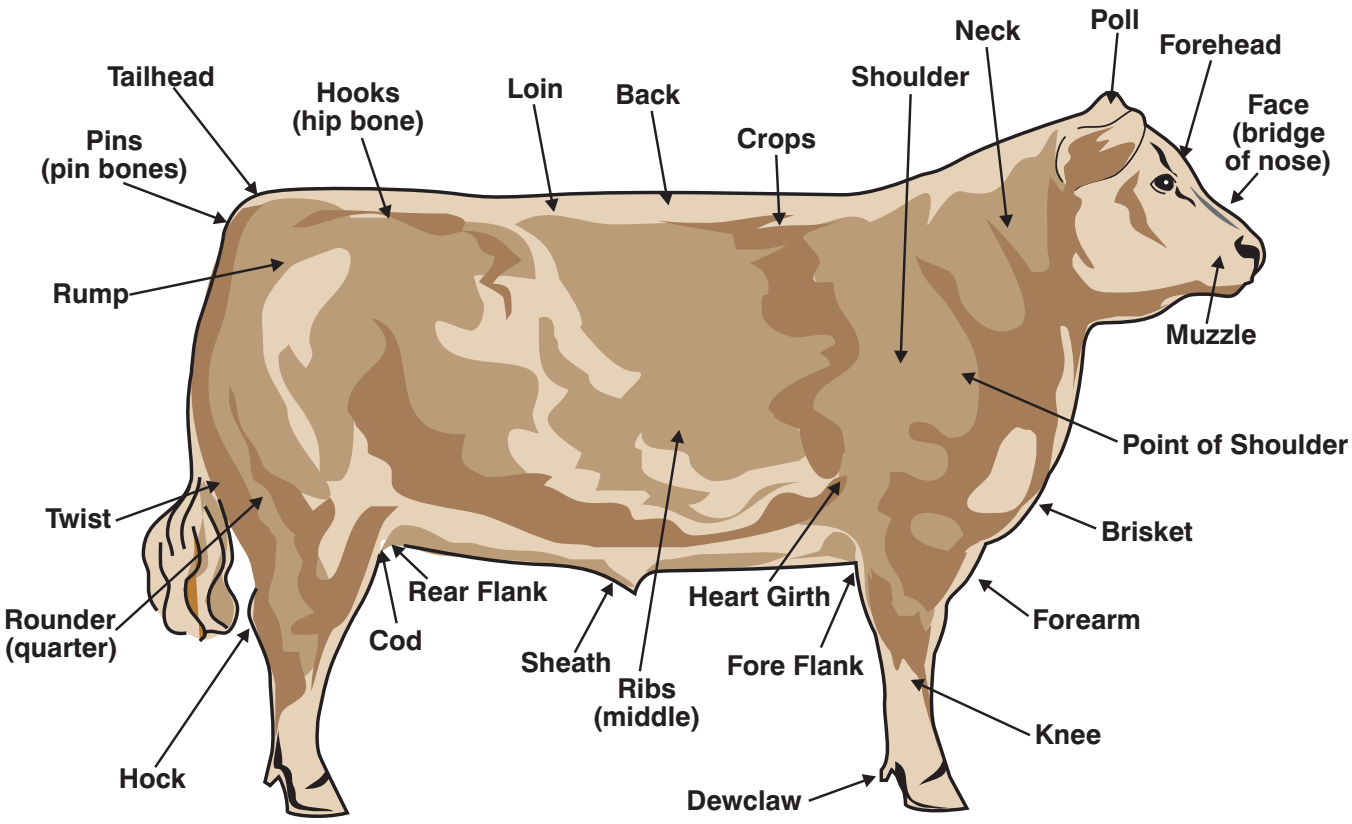
1. _____ is meat that comes from a pig.
2. The _____ _____ _____ feeds the young pigs until they reach a market weight of 220 to 240 pounds.
3. _____ is the meat from a sheep that is one year old and older.

▶ Short Answer

***Instructions*. Answer the following question.**

List five products or by-products produced from sheep.

MAJOR EXTERNAL PARTS OF A STEER



WHICH WOULD YOU RATHER EAT?

12 ounces of tuna, 8 pounds of broccoli, and 12 chicken breasts

OR

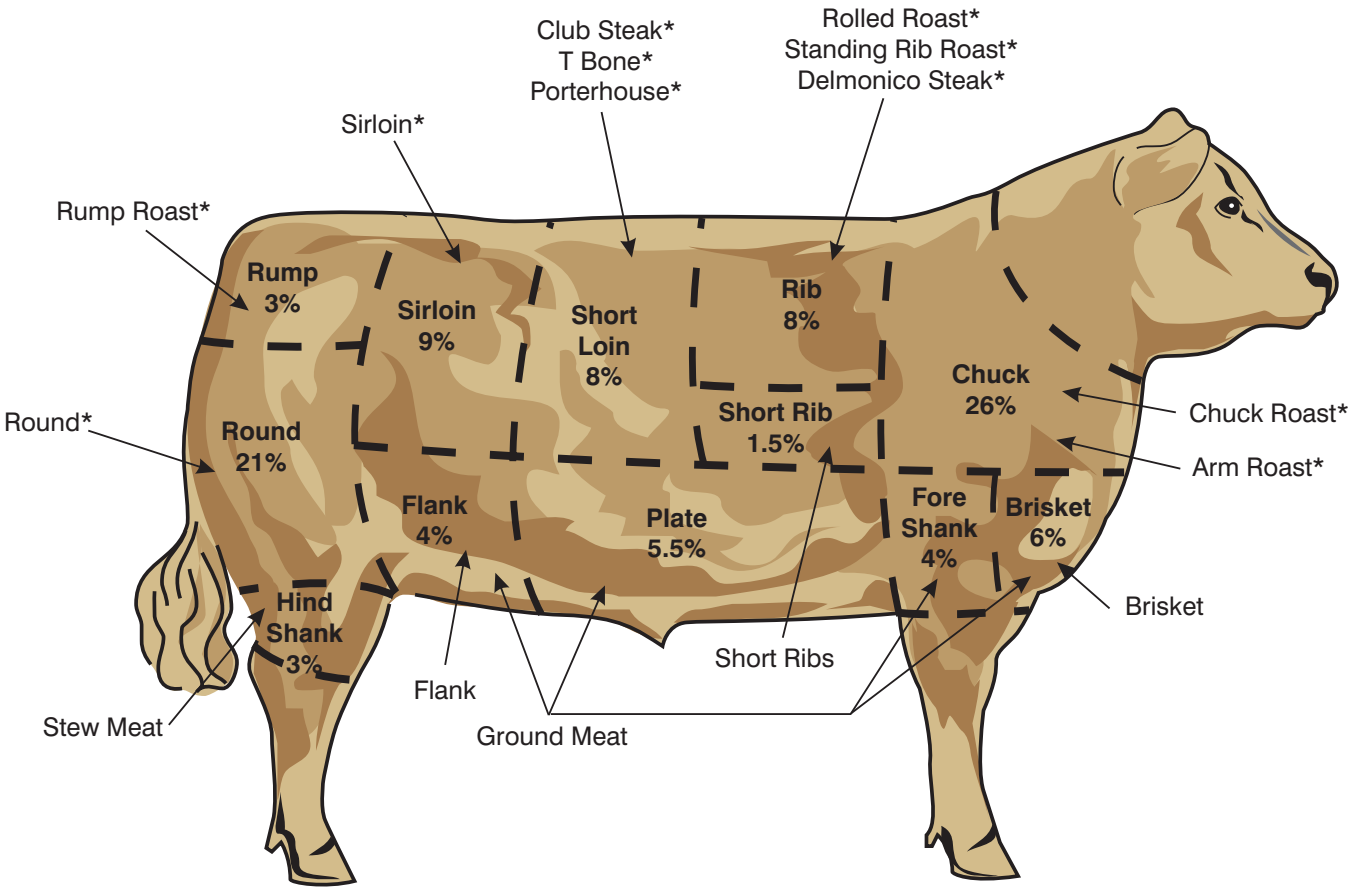
ONE Cooked Hamburger!

(Courtesy, National Cattlemen's Beef Association)

*One 3-ounce hamburger =

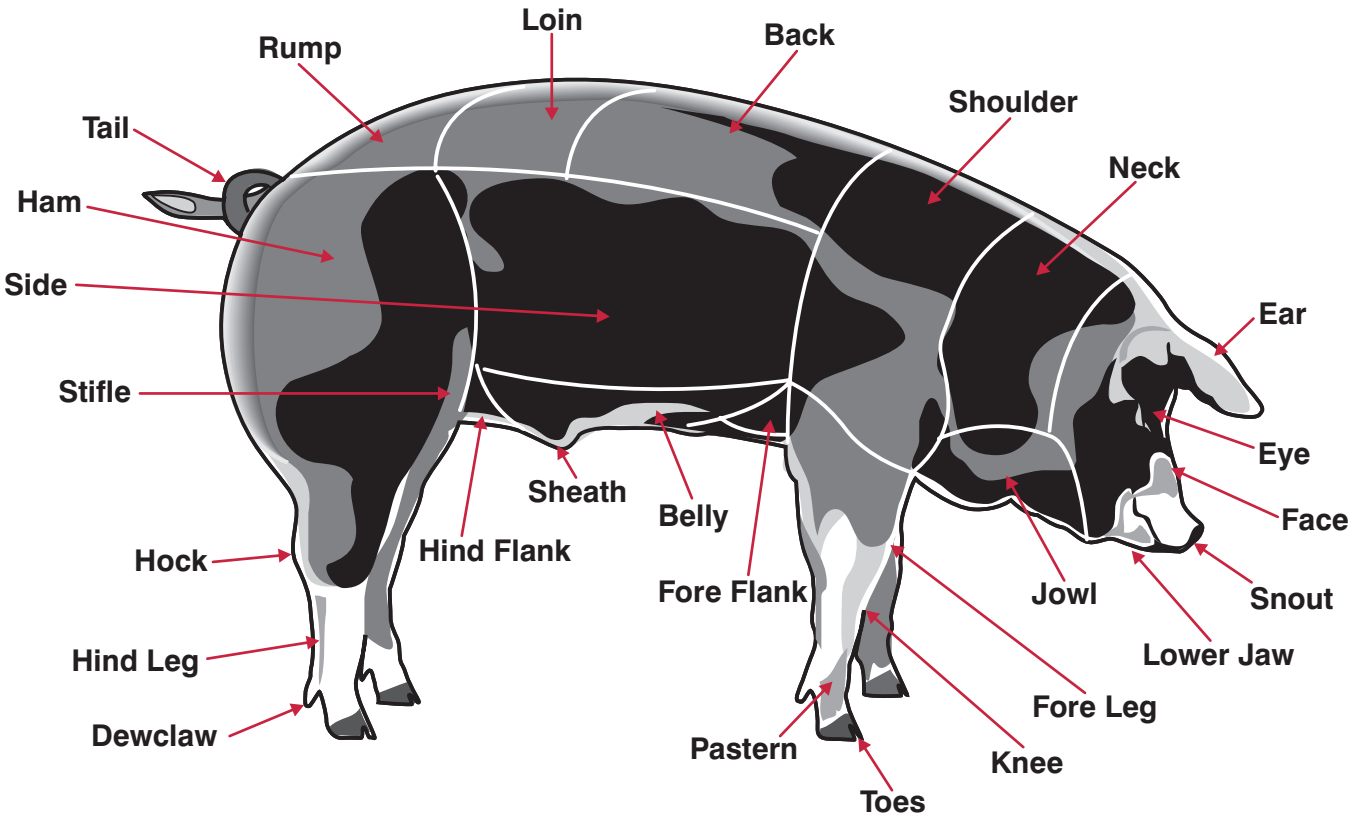
- Zinc = 12 ounce can of tuna
- Iron = 8 pounds of broccoli
- Thiamin = $1\frac{1}{3}$ chicken breasts
- Riboflavin = $2\frac{1}{4}$ chicken breasts
- Vitamin B-12 = $8\frac{1}{2}$ chicken breasts

LOCATION OF BEEF CUTS

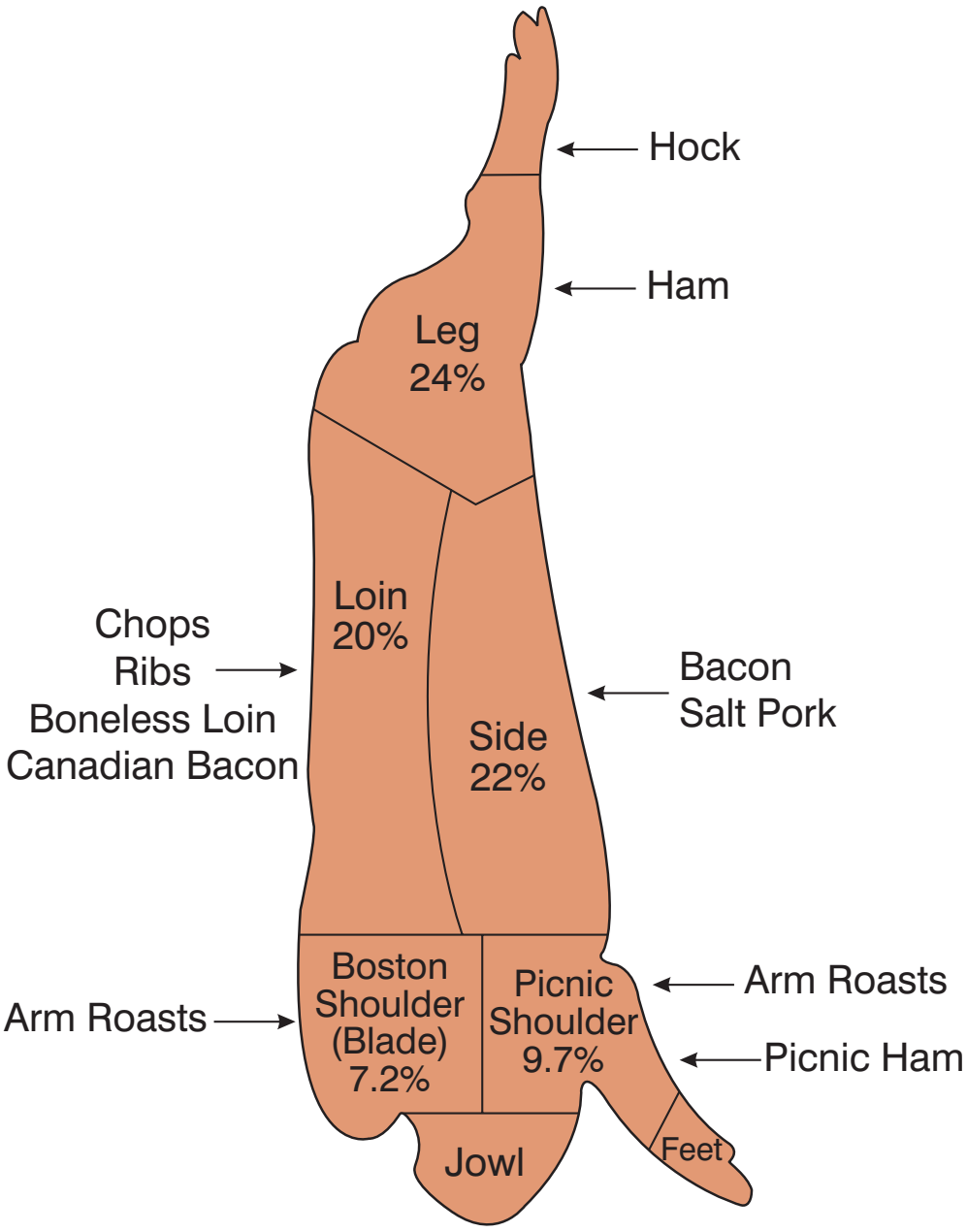


***Indicates the most desirable cuts that sell for a higher price.**

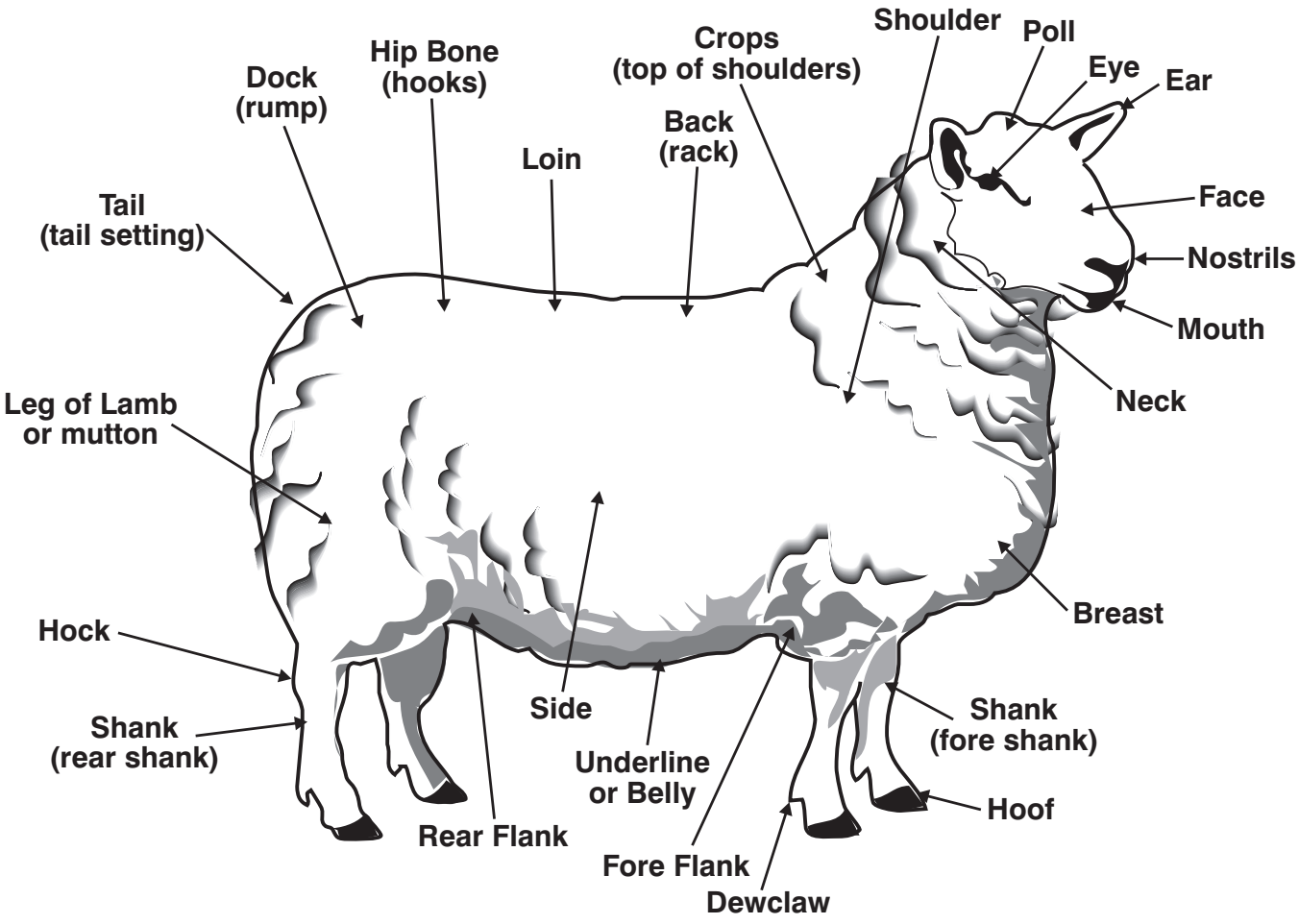
MAJOR EXTERNAL PARTS OF A HOG



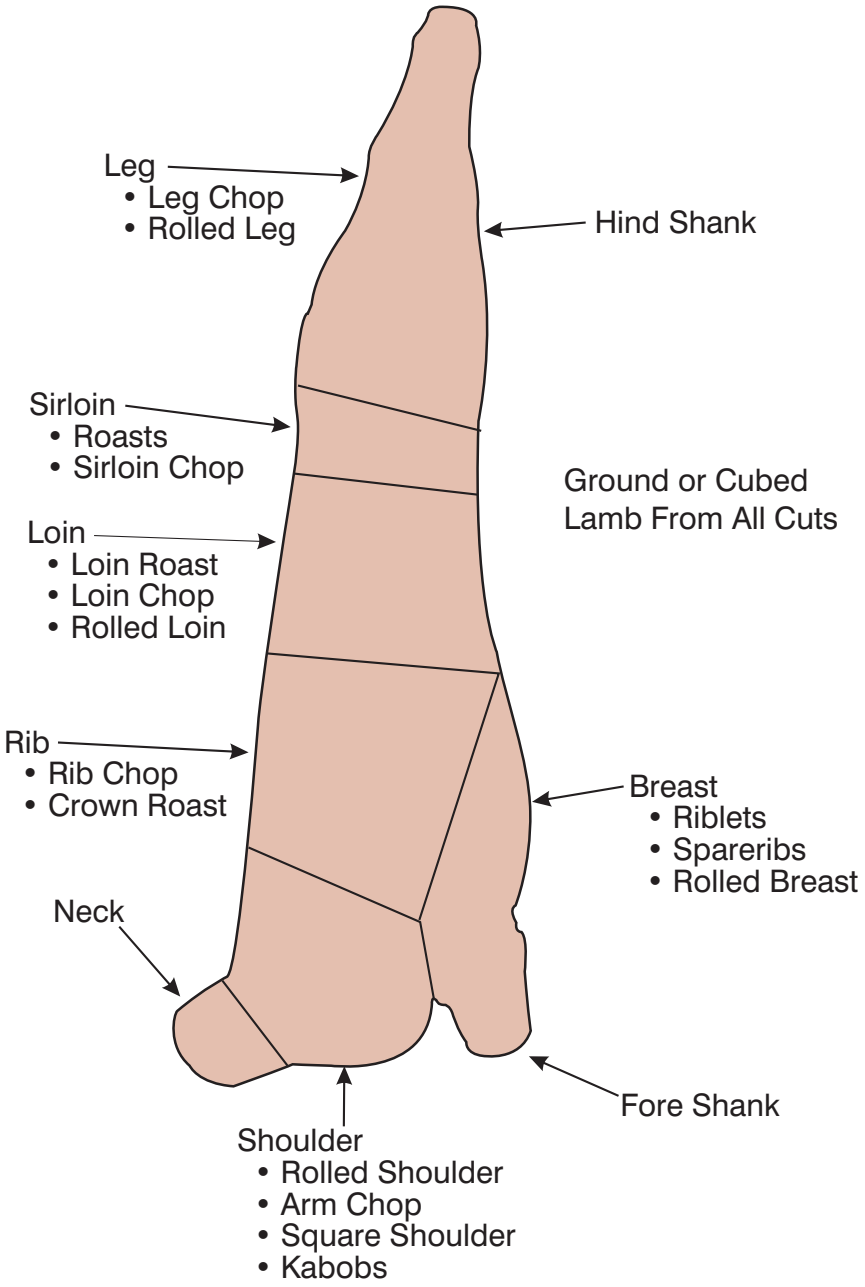
LOCATION OF MAJOR PORK CUTS



MAJOR EXTERNAL PARTS OF A SHEEP



MAJOR WHOLESALE AND RETAIL LAMB CUTS



Name _____

SCAVENGER HUNT

Materials

- ✓ Magazines with meat cuts and beef by-products
- ✓ Scissors
- ✓ Glue
- ✓ Posterboard

Directions

1. After studying the many products and by-products of beef cattle, perform a scavenger hunt around the school or at home in search of items that come from cattle. Search the internet or look at the ingredient lists on products you have at home or school.
2. Make a list of all the items you find that come from cattle.
3. Compare your list with the lists created by other students. Did they find more items than you? Did they find anything that you didn't know came from cattle?
4. After the scavenger hunt, create a collage of beef products and by-products using pictures from magazines.

Name _____

BEEF BINGO CARD

		FREE SPACE		

Name _____

BEEF BINGO SQUARES

Directions

Cut out the by-products listed below and paste them in random order on your Beef Bingo Card. Since you will not need to use all the by-products, pick only the ones you want. As your teacher calls out a by-product, find it on your sheet and place a marker on it. If you complete a row, call out "Bingo," and you win!

Clothing	Shoes	Boots	Belts	Purses
Wallets	Gloves	Luggage	Upholstery	Dairy Products
Candles	Ceramics	Cosmetics	Crayons	Deodorants
Detergents	Floor Wax	Insecticide	Insulation	Linoleum
Mouthwash	Paint	Paper	Perfume	Plastic
Soap	Shaving Cream	Textiles	Synthetic Rubber	Toothpaste
Candies	Desserts	Diet Products	Jellies	Collagen
Cortisol	Glucagon	Insulin	Vitamin B-12	

Name _____

PORK RELAY

Materials

- ✓ Pork and non-pork by-products
- ✓ Four laundry baskets
- ✓ Construction paper
- ✓ Markers

Directions

1. Each student should bring in one item from home that is a by-product of swine and one item that is not.
2. Clear a large area in the classroom or find an area outdoors.
3. Stack all of the items at one end of the area.
4. Use the construction paper to create labels for each of the laundry baskets.
5. Mark two of the baskets "Swine By-Products" and two of them "Other Items."
6. Divide into two teams.
7. Line up near the items.
8. Have a relay race to see how many items each team can get into the correct basket.

Lesson B–3

EXPLORING POULTRY AND POULTRY PRODUCTS

Indiana Agricultural Literacy Lesson Plan Library

Unit B. Animal Science

Lesson 3. Exploring Poultry and Poultry Products

Indiana's Academic Standard. **Social Studies:** 4.4.2 — Define productivity and provide examples of how productivity has changed in Indiana during the past 100 years.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand the types of animals that are considered to be poultry.
2. Discuss the chicken industry.
3. Discuss the turkey industry.
4. Understand the parts of an egg and the development of the embryo.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

The American Egg Board — www.aeb.org

University of Illinois Incubation and Embryology Project — www.urbanext.uiuc.edu/eggs/index.html

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters

Terms. The following terms are presented in this lesson (shown in bold italics):

- Air cell
- Albumen
- Blastoderm
- Blastodisc
- Broilers
- Chalaza
- Gizzard
- Grit
- Layers
- Poultry
- Poults
- Shell
- Shell membrane
- Toms
- Yolk

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask the students to name all of the things they eat that come from poultry. If they are not familiar with the definition of poultry, ask them what things they eat that come from chickens and turkeys. Use this discussion to lead into the lesson.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand the types of animals that are considered to be poultry.

Anticipated Problem: What types of animals are called poultry?

I. ***Poultry*** is fowl, or birds, that have been domesticated or kept by humans.

A. Examples of poultry are chickens, turkeys, ducks, ostriches, emus, quail, pigeons, pheasants, and geese.

B. As a whole, poultry animals produce meat, feathers, and eggs.

C. Chickens and turkeys are the most common poultry in the United States.

D. Indiana is the leading producer of ducks for meat in the country.

Use TM: B–3A to discuss the content of the objective. Have students discuss which of the birds pictured in the transparency are raised locally. What other types of poultry have the students observed? Also, discuss with the students what types of products might come from each of the pictured animals.

Objective 2: Discuss the chicken industry.

Anticipated Problem: What is involved in the chicken industry?

II. The chicken industry primarily produces meat and eggs from chickens.

A. Most birds in the chicken industry are purchased as chicks (baby chickens) and kept in long, low buildings.

B. There are two types of chickens—layers and broilers.

1. ***Layers*** are chickens that are raised to lay eggs.
2. ***Broilers*** are chickens that are fed to produce meat.

C. Chickens must be fed properly to produce.

1. Chickens do not chew their food. They swallow it whole and use a strong, muscular organ, called a ***gizzard,*** to grind the food into smaller pieces.
2. Chicken feed is a mixture of corn, sorghum, wheat, and other grains.
3. Layers need grit in their diets to be able to form the shell of the egg. ***Grit*** is usually small pieces of granite added to the chicken feed.
4. Layers need at least 4 pounds of feed to produce a dozen eggs.
5. Broilers eat 1 pound of feed a week to gain weight.

D. Egg production is an important part of the chicken industry.
   1. The average American family eats about 250 eggs per year.
   2. It takes hens just over one day to produce an egg.
   3. After eggs are laid they are quickly moved to a plant that washes, measures, grades, and packages the eggs for sale.
   4. Most eggs are in the grocery store about 72 hours after they are laid.

Use TM: B–3B to illustrate the digestive system of a chicken. Discuss the products produced by and the methods used in the chicken industry. Invite a local chicken producer to visit class. Have the students prepare a list of questions in advance and ask the guest to provide answers.

Objective 3: Discuss the turkey industry.

Anticipated Problem: What is involved in the turkey industry?

III. The turkey industry produces over 275 million turkeys in this country each year.

A. Turkeys are raised mostly for meat.

B. Producers who raise turkeys to lay eggs sell the ***poults*** (baby turkeys) as soon as they hatch to the producers who will feed them for meat production. Turkey eggs are light brown with dark speckles.

C. While wild turkeys are mostly brown and have colorful feathers, domesticated turkeys, those that are raised by humans, are white with a red head and neck.

D. Turkey feed is a mixture of corn and soybeans with extra vitamins and minerals mixed in.

E. ***Toms*** (male turkeys) will eat about 80 pounds of feed before they reach market weight.

Use TM: B–3C to cover the content of the objective. Invite a local turkey producer to visit class. Have the students prepare a list of questions in advance and ask the guest to provide answers.

Objective 4: Understand the parts of an egg and the development of the embryo.

Anticipated Problem: What are the parts of an egg and how does the embryo develop?

IV. For eggs to hatch they must first be fertilized and incubated. Chickens will lay eggs even if they are not fertilized. The non-fertilized eggs are the ones you can buy at the store.

A. The length of time for an embryo to develop in an egg varies by species.
   1. Chickens need 21 days.
   2. Geese need 29–31 days.

3. Turkeys need 27–28 days.
4. Ducks, depending on their species, need 28–35 days.

B. There are seven major parts of an egg.

1. The ***shell*** is the outer covering of the egg that protects the inside. The shell is made up of mostly calcium carbonate.
2. The ***shell membrane*** is actually two very thin linings that protect harmful contaminants like bacteria from entering the egg.
3. The ***air cell,*** or pocket, forms at the large end of the egg and grows larger as the embryo (developing baby chick) gets larger.
4. The ***yolk*** is the center, yellow part of the egg that provides nourishment for the developing embryo.
5. The ***blastodisc*** is the area where the embryo will begin to grow if the egg is fertilized. When the egg is fertilized, this area is called the ***blastoderm***.
6. The ***albumen*** is the egg white or clear part of the egg. It cushions the embryo as it grows and gives it protein.
7. The ***chalaza*** is the curly cord that holds the yolk in the middle of the egg.

Use TM: B–3D to illustrate the major parts of a chicken egg. Use TM: B–3E to illustrate the development of a chick embryo in an incubating egg. Consider actually hatching some chicken eggs in the classroom using an incubator. Be sure to make arrangements for the hatched chicks ahead of time to guarantee their well-being.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Classroom discussion of the objectives and student questions will assist in applying the concepts.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. e
2. a
3. c
4. b

5. d

Fill-in-the-Blank

1. tom
2. 21
3. gizzard
4. Layers

Short Answer

1. Albumen
2. Yolk
3. Air cell
4. Shell membrane
5. Shell
6. Chalaza

Test B–3

Name_____

EXPLORING POULTRY AND POULTRY PRODUCTS

▶ Matching

Instructions. **Match the word with the correct definition.**

a. chalaza
b. shell
c. blastodisc
d. poultry
e. broilers

_____1. This type of chicken is raised for its meat.

_____2. This twisted cord holds the yolk in the center of the egg.

_____3. The area where the embryo will begin to grow if the egg is fertilized.

_____4. The outer covering of the egg that protects the inside of the egg.

_____5. Fowl, or birds, that have been domesticated or kept by humans.

▶ Fill-in-the-Blank

Instructions**. Complete the following statements.**

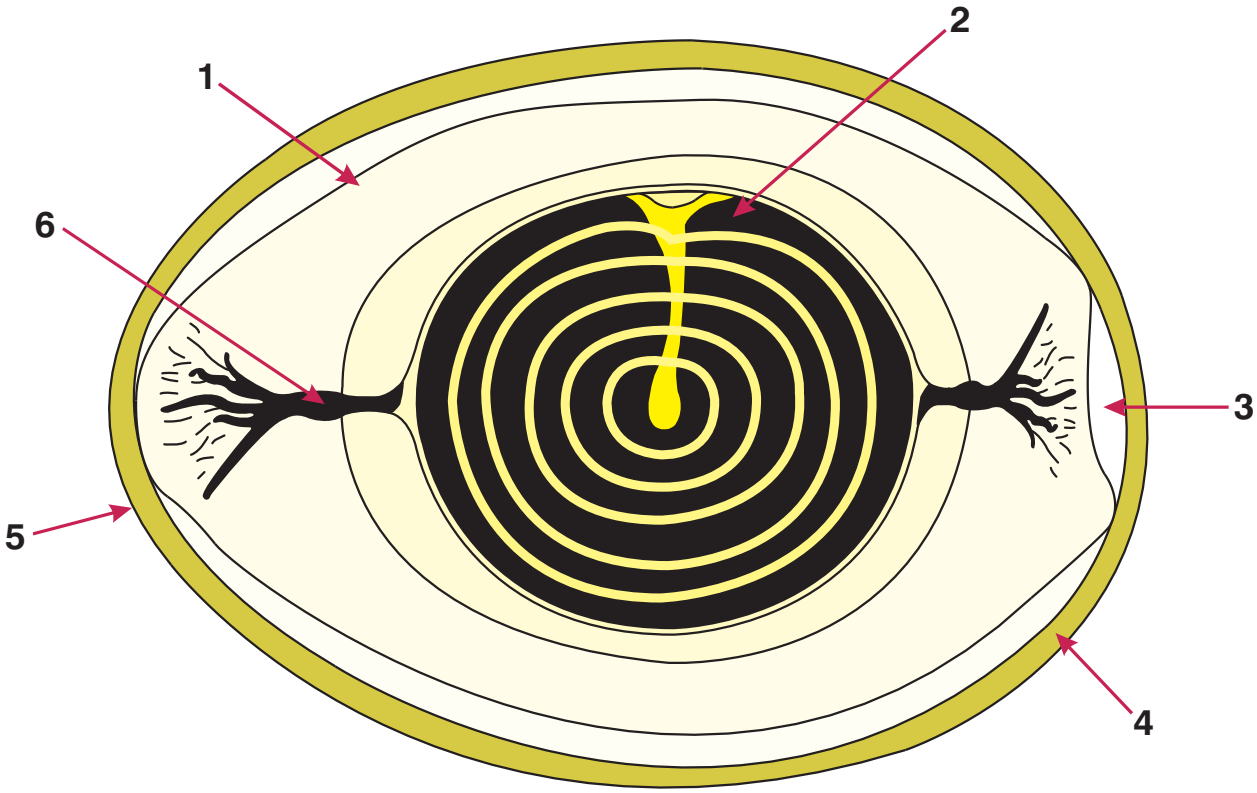
1. A male turkey is called a _____.
2. Chicken eggs require _____ days to hatch.
3. Chickens swallow their food whole and use a strong, muscular organ, called a _____ to grind the food into smaller pieces.
4. _____ are chickens raised to lay eggs.

Short Answer

***Instructions*. Answer the following question.**

Label the parts of an egg.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



TYPES OF POULTRY

White Leghorn Chickens

White Turkeys

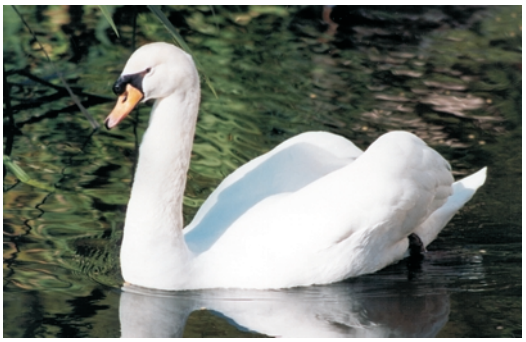
Ostriches

Canada Goose

Pekin Ducks

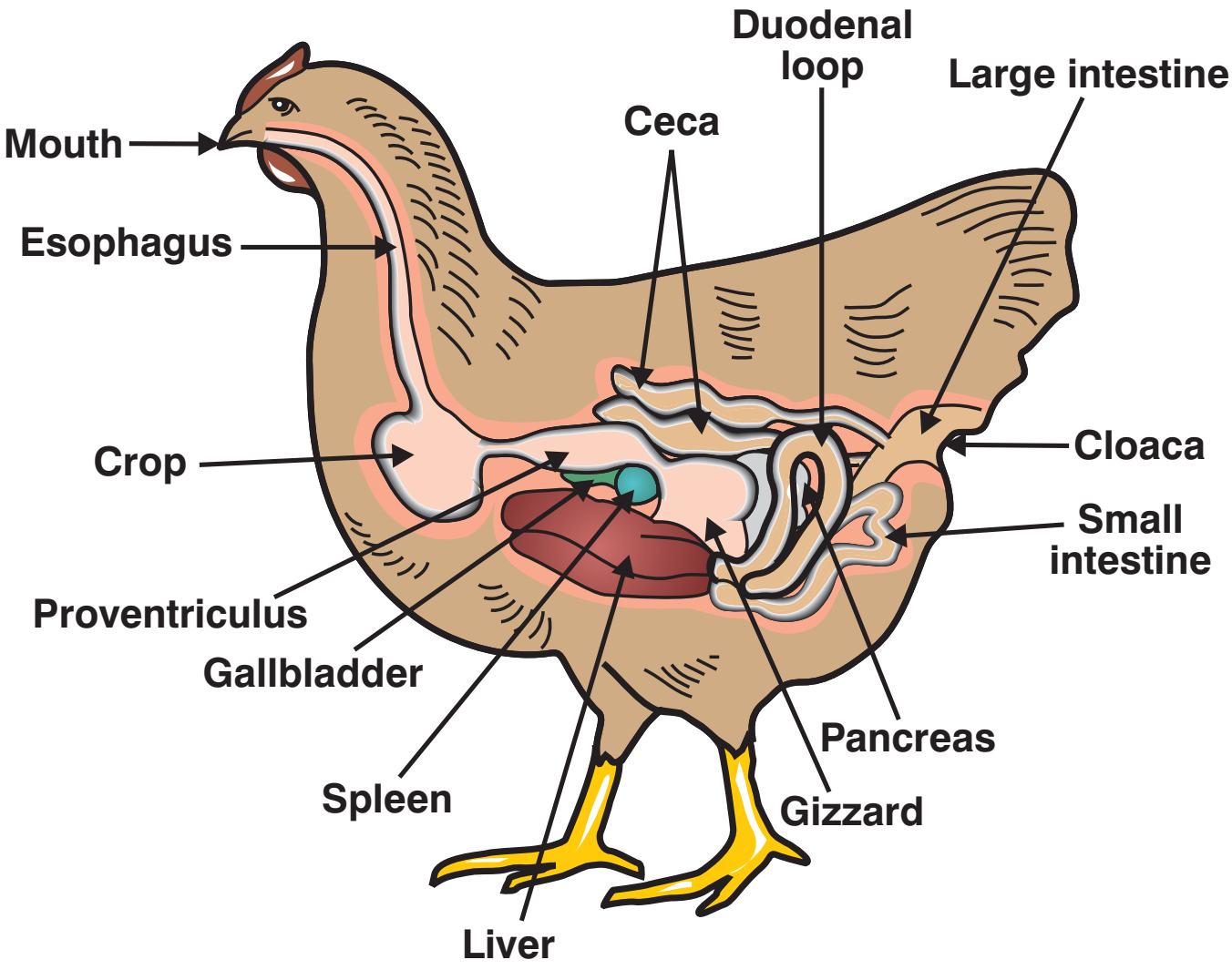
Peacock

Guinea Fowl



White Swan

DIGESTIVE SYSTEM OF A CHICKEN



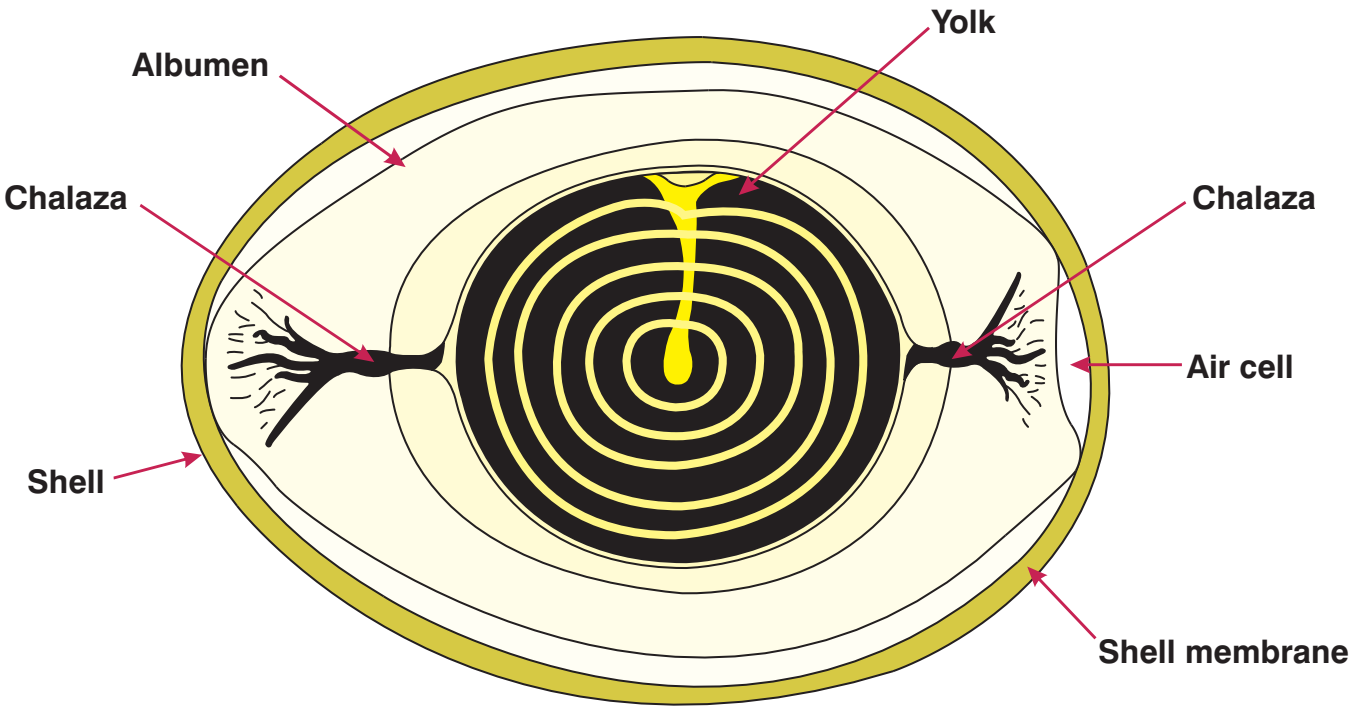
THE TURKEY INDUSTRY

- Over 275 million turkeys are produced in the U.S. each year.
- Turkeys are raised mostly for meat.
- Domesticated turkeys are white with a red head and neck.
- Turkey feed is a mixture of corn and soybeans with extra vitamins and minerals mixed in.
- Toms will eat about 80 pounds of feed before they reach market weight.

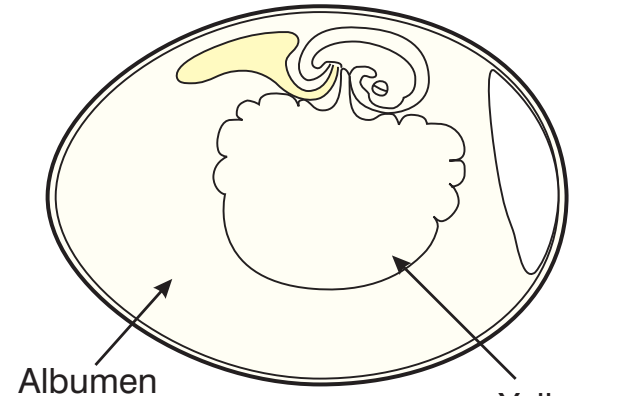
Large white turkey male (tom).
(Courtesy, Agricultural Research Service, USDA)

Large white turkey female (hen).
(Courtesy, Agricultural Research Service, USDA)

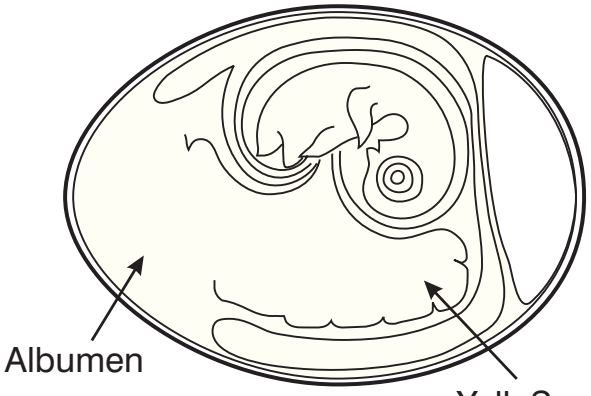
EGG STRUCTURE



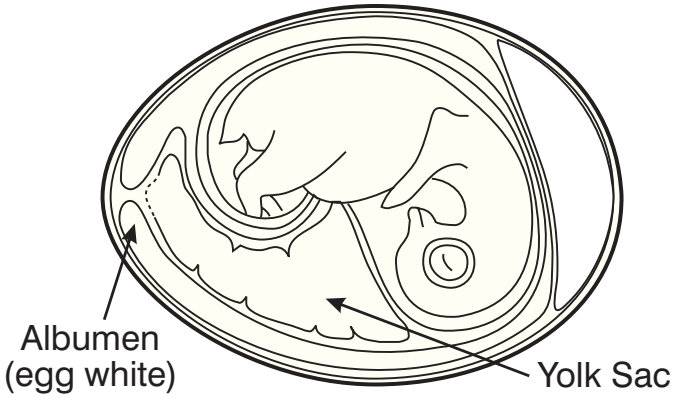
DEVELOPMENT OF A CHICK EMBRYO IN AN INCUBATING EGG



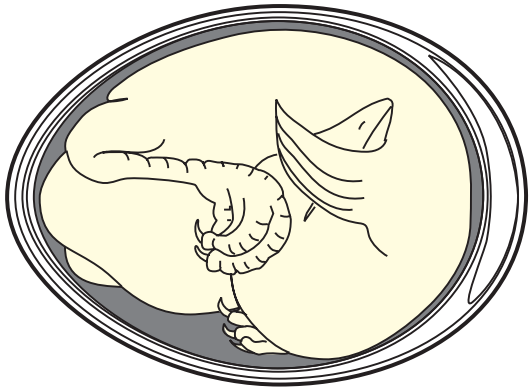
5 Days



10 Days



15 Days



20 Days

Lesson B–4

EXPLORING DAIRY ANIMALS AND DAIRY PRODUCTS

Indiana Agricultural Literacy Lesson Plan Library

Unit B. Animal Science

Lesson 4. Exploring Dairy Animals and Dairy Products

Indiana's Academic Standard. **Science:** 4.4.4 — Observe and describe that some source of energy is needed for all organisms to stay alive and grow.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand the anatomy of dairy cattle and how they produce milk.
2. Explain how milk is processed for human consumption.
3. Describe dairy products and how they are made.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Illinois Farm Bureau Agriculture in the Classroom. *Dairy AgMag*. Phone: (309) 557–3334. Web site: www.agintheclassroom.org

Where Milk Comes From (Video). Dairy and Nutrition Council.

Kalman, Bobbie. *Hooray for Dairy Farming.* Crabtree Publishing Company, 1998. (ISBN 0-86505-664-1)

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

National Dairy Council. *Milk from Cow to You Kit*. 1995. Web site: www.nutritionexplorations.com/catalog/elementary2.asp

www.dairycam.com (watch cows being milked on a webcam)

www.indianadairycouncil.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Curds
- Homogenization
- Lumens
- Pasteurized
- Silage
- Teat
- Udder
- Whey

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask the students to raise their hands if they like ice cream. Ask them to raise their hands if they like pizza. Now ask them if they know where the ice cream and the cheese on their pizza comes from. Ice cream and cheese are made from milk and milk comes from dairy cows, but how do the cows produce the milk and how is the milk

made into other products that we want and that are safe for us to consume? Use this discussion to lead into the lesson.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand the anatomy of dairy cattle and how they produce milk.

Anticipated Problem: How does a dairy cow make milk?

I. Dairy cows take the food and water they consume and turn it into milk to feed their calves. The milk is also used by humans.

A. Dairy cows must be fed properly in order to produce milk.

1. Dairy cows eat a total of 90 pounds of feed a day.
2. They eat about 40 pounds of grain and hay and 50 pounds of silage a day. ***Silage*** is chopped plant material that has been allowed to ferment. Silage may contain leaves, stems, grain heads, and other plant parts. Most silage is made from green, growing crops, such as corn, grass, or sorghum.
3. Cows also drink 25 to 50 gallons of water each day.
4. With this amount of food and water, a dairy cow can produce about 100 glasses of milk a day.

B. Cows make milk in their udder.

1. The ***udder*** is a pouch that hangs underneath the cow that contains the mammary glands.
2. The udder is divided into four sections.
3. Each section of the udder has a small tube called the ***teat*** that lets the milk out.
4. Inside the udder are ***lumens*** that make small drops of milk. Once the lumens make enough milk to fill up the udder, milk comes out of the teat when the cow is milked or when she feeds her calf.
5. A cow's udder can hold 25 to 50 pounds of milk.

Use TM: B–4A to illustrate the major external parts of a dairy cow. TM: B–4B shows the structure of the cow's udder.

Objective 2: Explain how milk is processed for human consumption.

Anticipated Problem: How is milk processed for human consumption?

II. There are many steps involved in getting milk from a dairy cow into the store.

A. Milk must be properly collected from the cow.

1. People have been milking cows for a very long time. For many years farmers milked cows by hand. When milking was done by hand, it took one hour to milk six cows. Today in the United States most of the milking is done by milking machines. With these machines producers can milk 100 cows in one hour.
2. Milking machines are placed on each of the cow's teats and gently suck the milk out of the cow's udder.
3. The milk is then pumped into a large tank at the farm.
4. A truck from the dairy company comes to the farm, tests the milk, and then takes it to the dairy to be processed.

B. Milk must be safe for humans to consume.

1. At the dairy plant, milk is ***pasteurized***, which means it is quickly heated to a high temperature and then quickly cooled.
2. The pasteurization process kills germs and bacteria that are naturally present in the cow's milk. Germs and bacteria can make humans sick and can cause the milk to spoil quickly.
3. ***Homogenization*** breaks the fat globules in the milk into tiny particles. If this step does not take place, the fat or cream would sit on the top of the milk.
4. After processing, the milk is poured into jugs and cartons to be sold in stores. The milk is never touched by human hands when it is in the plant, so it is one of the safest foods you can eat.

Use TM: B–4C to illustrate modern dairy facilities. Tour a dairy farm to show students the steps involved in getting milk from the dairy cow. Invite a dairy manager to visit the class. Have students prepare a list of questions they would like to ask and have the dairy manager answer them.

Objective 3: Describe dairy products and how they are made.

Anticipated Problem: How is milk changed into other dairy products?

III. Through many processes, milk is made into many different dairy products.

A. Ice cream is one of the most popular dairy products. Sugar and flavoring are added to milk and then frozen into ice cream.

B. Cheese is made by allowing milk to sour and separate into whey and curds.

1. ***Curds*** are the chunks that form in soured milk and are the beginnings of cheese.
2. ***Whey*** is the liquid that remains after the curds form.

3. The curds are separated from the whey and aged and flavored to make the cheeses you eat every day.

C. Butter is the cream, or fat, that is present in milk. The fat is removed from the milk and churned or shaken into a solid form called butter.

D. Yogurt is made by adding certain bacteria to concentrated, pasteurized milk. The milk is then heated at 110°F for four or five hours to allow the bacteria to grow. The smooth, custard-like texture that is formed is the result of the growth of the bacteria. Flavoring or fruit can be added to the mixture.

Use TM: B–4D to cover the content of this objective. Have students make ice cream, butter, and curded milk using WS: B–4A, WS: B–4B, and WS: B–4C. Each activity can serve as an exercise in states of matter (liquid, solid, gas). The ice cream activity can also lead to a discussion of freezing points.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Have students complete WS: B–4A, WS: B–4B, and WS: B–4C to gain an understanding of how milk is processed into dairy products. There are a number of resources listed in the beginning of this lesson to visually show students the concepts discussed.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. b
3. a
4. c

Fill-in-the-Blank

1. udder
2. Silage
3. 100

Short Answer

Answers will vary. Use the information in Objective 3 to score this answer.

Test B–4

Name_____

EXPLORING DAIRY ANIMALS AND DAIRY PRODUCTS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. curds
b. pasteurization
c. homogenization
d. lumen

_____1. Located inside the udder and makes small drops of milk.

_____2. The process of heating milk to a high temperature and quickly cooling it to kill natural bacteria.

_____3. The solid chunks that form as milk sours.

_____4. Breaks the fat globules in the milk into tiny particles.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

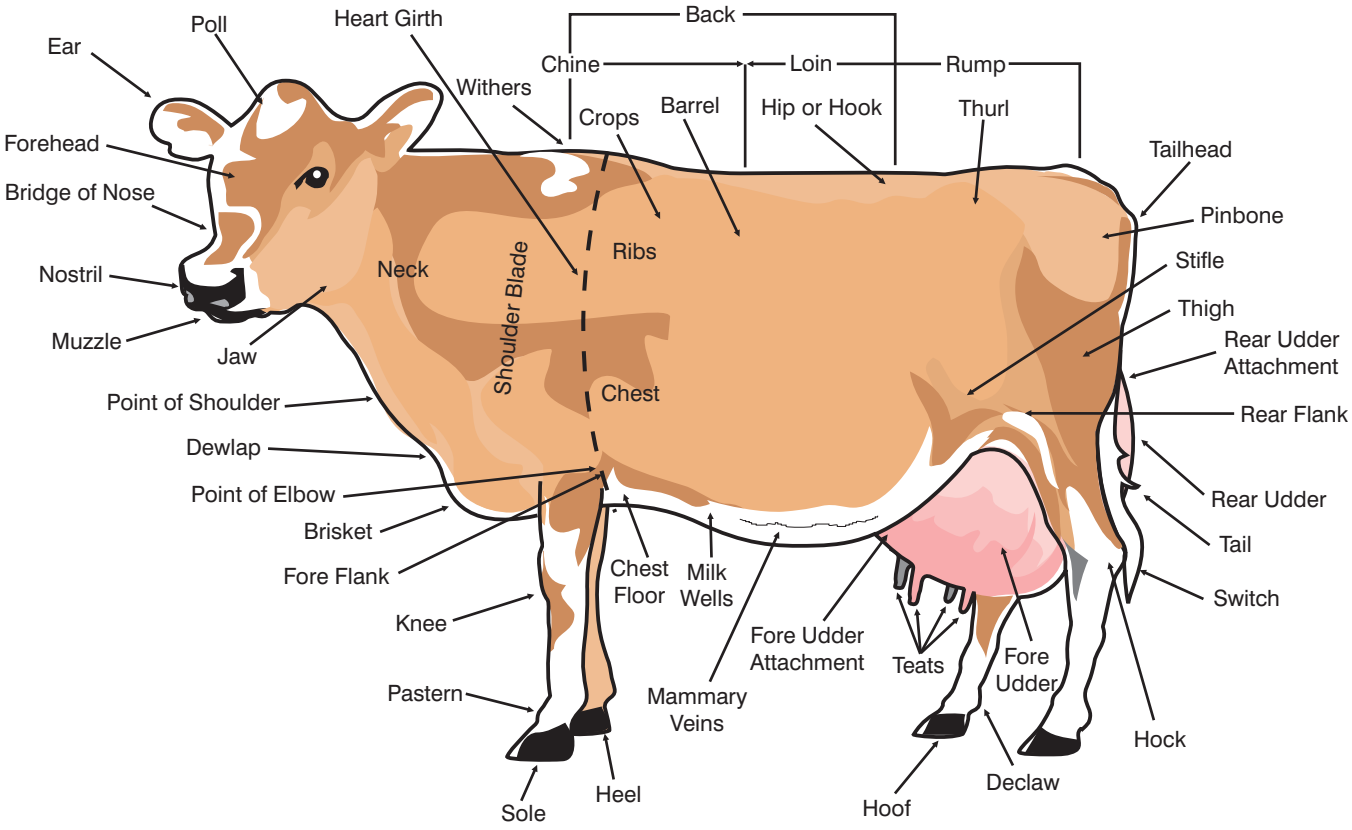
1. The _____ is where the milk is made and is held until the cow is milked.
2. _____ is chopped plant material that has been allowed to ferment.
3. With modern milking machines, _____ cows can be milked in one hour.

▶ Short Answer

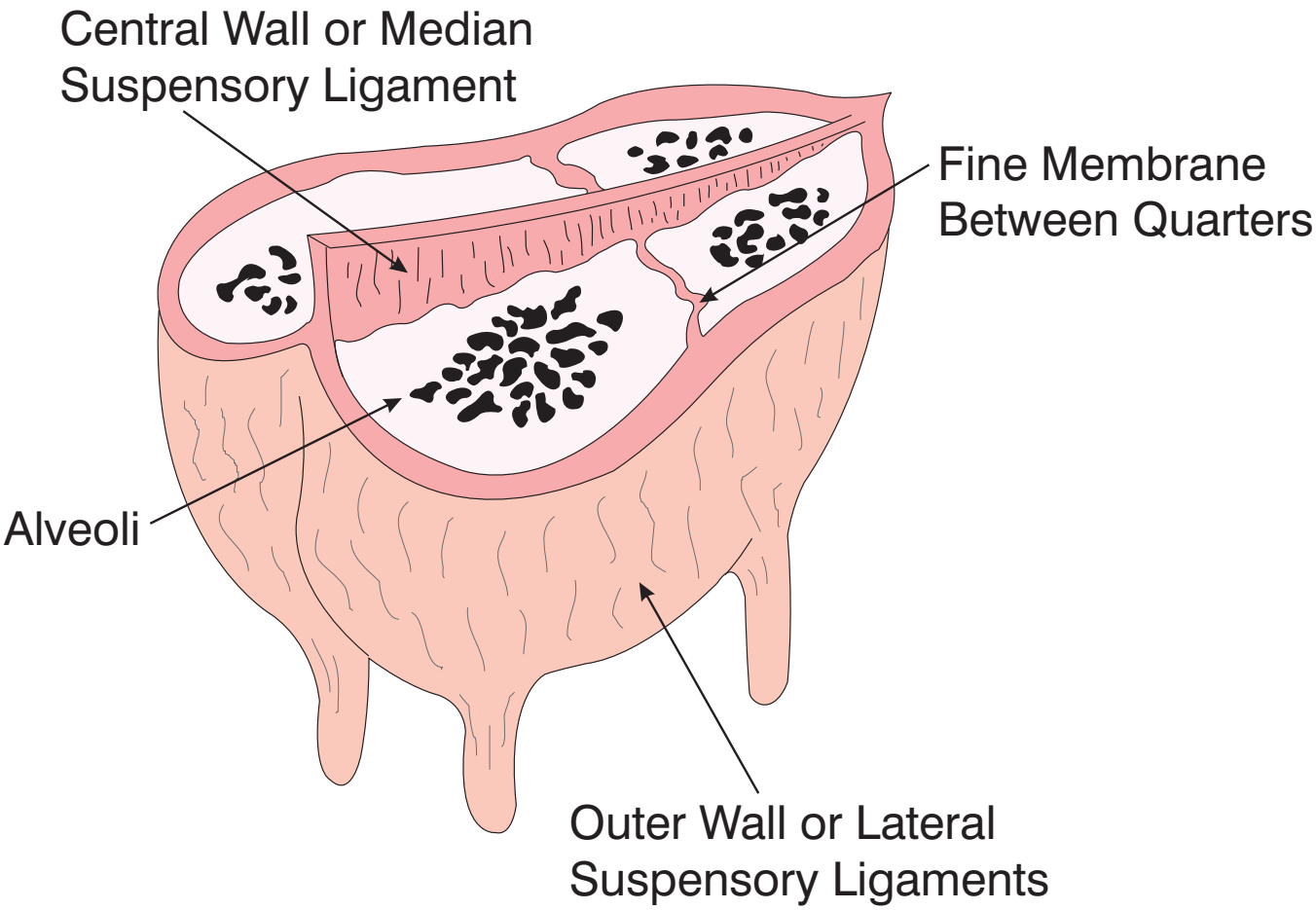
***Instructions*. Answer the following question.**

Name one dairy product and describe how it is made.

MAJOR EXTERNAL PARTS OF A DAIRY COW



STRUCTURE OF A COW'S UDDER



MODERN DAIRY INDUSTRY

EXAMPLES OF DAIRY PRODUCTS

- Milk
- Ice cream
- Cottage Cheese
- Yogurt
- Sour Cream
- Whipped Cream
- Chip/Vegetable Dip
- Cheese
- Butter
- Cream Cheese

(Courtesy, U.S. Department of Agriculture)

(Courtesy, U.S. Department of Agriculture)

Name _____

ICE CREAM IN A BAG

Introduction

Your class will be making ice cream in a bag. You'll be using salt and ice to lower the temperature of the ingredients to their freezing point. Make sure you have all of the materials before you begin this activity.

Materials

- ✓ 1 cup milk
- ✓ 1 cup half and half
- ✓ ¼ cup sugar
- ✓ ½ teaspoon vanilla extract
- ✓ Crushed ice
- ✓ 1 cup of rock salt
- ✓ One 1 quart size resealable plastic freezer bag
- ✓ One 1 gallon size resealable plastic freezer bag
- ✓ Duct tape
- ✓ Bath towel

Directions

1. Put the milk, half and half, sugar, and vanilla in the quart size freezer bag and seal.
2. Tear off a piece of duct tape and fold it over the zipper of the bag so it does not come open.
3. Place the bag with the milk mixture into the gallon size bag.
4. Fill the rest of the gallon size bag with crushed ice and the cup of rock salt. Put in a little ice, then a little rock salt until the bag is full and you have used all the salt.
5. Zip up the gallon size bag and cover the zipper with duct tape to make sure it stays closed.
6. Wrap the bag in the bath towel, and tape the towel around the bag.
7. Shake the bag quickly for 10 minutes.
8. Carefully remove the towel and open the gallon size bag.
9. Remove the quart size bag and dry it off.
10. Cut the top off of the bag and spoon the ice cream into bowls. You should have enough ice cream in your bag for four people.
11. Enjoy!

Name _____

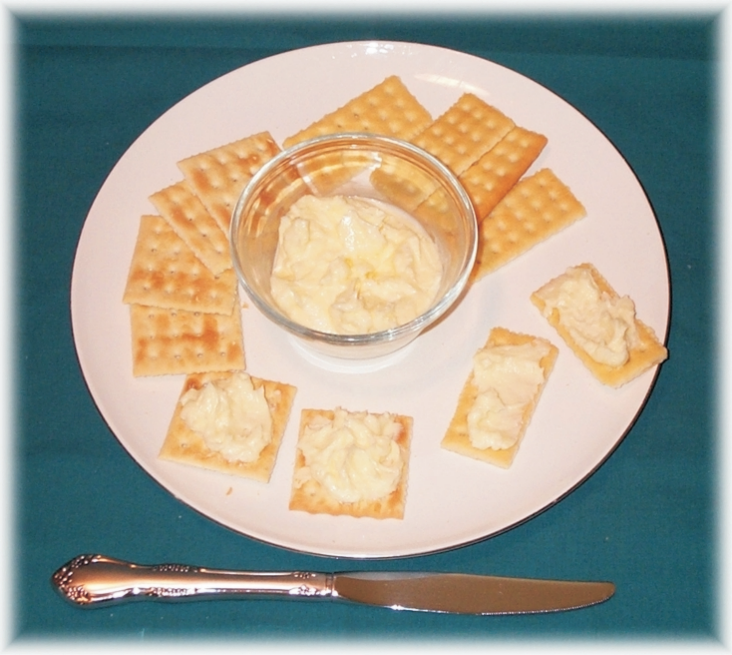
BUTTER IN A JAR

Materials

- ✓ ½ pint heavy whipping cream (room temperature)
- ✓ Glass jar with tight-fitting lid
- ✓ Salt (pinch)
- ✓ Crackers
- ✓ Knife

Directions

1. Pour the heavy whipping cream into the jar and screw the lid on tightly.
2. Quickly shake the jar for 5 to 10 minutes.
3. When you can feel a lump of butter form in the jar, remove the lid and pour out the extra buttermilk.
4. Add a pinch of salt to the jar. Replace the lid and shake again for one minute.
5. Remove the lid and use the knife to spread your butter onto the crackers.



Name _____

CURDS AND WHEY

Information

Milk spoils because of bacteria that is naturally present in the milk. As milk spoils, chunks form. These chunks are called curds. The liquid that remains is called whey. Cottage cheese and cheese are made from curds. In this activity we will watch how curds form in milk.

Materials

- ✓ 1 cup milk
- ✓ 1 tablespoon vinegar
- ✓ Glass bowl

Directions

1. Pour 1 cup of milk into a bowl.
2. Add 1 tablespoon of vinegar to the milk.
3. Over the next hour, check the bowl to see if any curds have formed.

Questions

1. What happened to the milk?

2. Why did this happen?

Lesson B–5

EXPLORING COMPANION ANIMALS

Indiana Agricultural Literacy Lesson Plan Library

Unit B. Animal Science

Lesson 5. Exploring Companion Animals

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Name some types of companion animals and how they benefit humans.
2. List important characteristics of dogs.
3. Define terminology and care of cats.
4. Describe important concepts in keeping rabbits.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Lee, Jasper S., et al. *Introduction to Livestock and Companion Animals*, Third Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2004.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Angora fur
- Bitch
- Buck
- Carnivore
- Companion animal
- Declawed
- Doe
- Hairball
- Herding dog
- Hound
- Kindling
- Kitten
- Litter
- Monogastric
- Non-sporting breed
- Normal fur
- Puppy
- Queen
- Rex fur
- Satin fur
- Sporting dog
- Stud dog
- Terrier
- Tomcat

- Toy breed
- Whelping
- Working dog

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Have an owner bring in his or her well-trained dog. Allow interested students to pet the dog and have the owner demonstrate any tricks the dog knows. Ask the owner to talk about how much time went into training the dog. Have students make a list of questions for the owner about the dog's diet, grooming requirements, breed, and any other information they want to know about.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Name some types of companion animals and how they benefit humans.

Anticipated Problem: What are some companion animals and how do they help humans?

I. Companionship and pleasure are important to people. A ***companion animal*** is an animal that is used to provide humans with fun and friendship through close association.

A. Companion animals are often called pets.

B. Common examples of companion animals are dogs, cats, fish, rabbits, hamsters, gerbils, ferrets, and snakes.

C. Some companion animals also provide service, such as dogs that help people who are visually impaired. Dogs and other animals may also be used to protect property and guard or herd livestock.

D. Companion animals may be used for sporting events. Some people with horses or ponies, for example, may enjoy entering horse racing or rodeoing events.

> *Use TM: B–5A to illustrate a few examples of different companion animals. Ask students to name any pets that they have and discuss what activities they like to do with their pets.*

Objective 2: List important characteristics of dogs.

Anticipated Problem: What are some common characteristics of dogs?

II. Dogs were kept as companion animals over 10,000 years ago. There are many facts that are important to know about dogs.

A. Even though most dogs eat processed dog food, they are carnivores by nature. A ***carnivore*** is a meat- or flesh-eating animal.

B. Dogs are monogastric mammals. ***Monogastric*** describes an animal with only one stomach compartment.

C. The scientific name for dogs is *Canis familiaria*. Since their family name is *Canidae,* they are often called canines.

D. A mature female dog is called a ***bitch***. A mature male dog is called a sire or ***stud dog***. The process of a bitch giving birth is called ***whelping***. An immature dog of either sex is called a ***puppy***. A group of puppies born to the same parents is called a ***litter***.

E. Dogs have skeletal systems with about 320 bones. Large breeds have larger bones and small breeds have smaller bones.

F. Dogs can weigh anywhere from less than 6 to over 200 pounds at maturity depending on the breed.

G. There are approximately 300 dog breeds. In the United States, the American Kennel Club (AKC) does the classification and record keeping on dog breeds. Based on both use and characteristics, seven classes of dogs have been identified.

1. A ***herding dog*** is a dog that is easily trained to help with herding animals like sheep and cattle. It is important to give these dogs a lot of space because they need to run often. Examples: Australian Cattle Dog, Shetland Sheepdog, Collie, German Shepard.
2. A ***sporting dog*** is a dog used for sporting purposes like hunting. Sporting dogs can be used for retrieving, finding, and scaring out game animals. Examples: Spaniels, Retrievers, Setters, Pointers.
3. A ***working dog*** is a dog that is used by people to help get something done like protection of property, sled pulling, or police work. Examples: Alaskan Malamute, Doberman Pinscher, Saint Bernard, Rottweiler.
4. A ***hound*** is a dog used for tracking because it has a good ability to follow scent. Hounds are used by hunters to locate game animals and by law officials to track lost people or people who have escaped from confinement. Examples: Beagle, Greyhound, Basset, Dachshund.
5. A ***terrier*** is a dog that digs into the ground to capture its prey. There are 25 terrier breeds that are recognized by the AKC. Examples: Miniature Schnauzer, Airedale, Scottish Terrier, Bull Terrier.
6. ***Toy breed*** is a name describing a class of dogs that weigh between 4 and 16 pounds. They live longer than larger breeds and are easier to keep in a smaller area because of their size. Examples: Chihuahua, Toy Poodle, Yorkshire Terrier, English Toy Spaniel.

7. The final class is the ***non-sporting breed*** of dogs. This class includes dogs that were developed for purposes other than sport. Examples: Dalmatian, Bulldog, Poodle.

Use TM: B–5B to show the major external parts of a dog. Use TM: B–5C to illustrate some examples of different dog breeds. Ask students what breed of dog they have, if any. Have them describe some characteristics of the dog. Also have them list some of the things they do to help care for the dog.

Objective 3: Define terminology and care of cats.

Anticipated Problem: What are some important facts to know about cats?

III. Cats are very common in the United States. Around 60 million cats are kept as companion animals. There are many facts to learn about cats' biology, anatomy, and terms associated with them.

A. Cats can live up to 30 years, but most only live between 12 and 18 years.

B. A mature male cat is called a ***tomcat***. A mature female cat is called a ***queen***. A baby cat of either sex is called a ***kitten***. A group of kittens born to the same parents is called a litter.

C. Typically, cats weigh between 6 and 15 pounds at maturity. They have approximately 250 bones and 500 muscles. Their life processes are similar to other mammals.

D. Even though most cats are fed cat food designed especially for their needs, by nature they are carnivores that can feed on mice and rats.

E. Cats differ from other animals because they have extra sensitive ears, noses, and paws. They also have extra taste organs and can therefore distinguish between foods. Cats have three-dimensional vision and their whiskers are attached to nerves that help cats to find their way in the dark.

F. Other animals in the cat family include lions and tigers. Cats are similar to these wild animals because their foot structures are closely designed.

G. Since cats are domesticated, their owners often have them declawed so they don't damage carpeting, furniture, and curtains. ***Declawed*** means that the cat's claws are surgically removed by a veterinarian. It is important to keep cats that are declawed inside because they no longer have their most important defense mechanism.

H. The skeletal system of a cat is very complex. This complex system allows cats to be quick and agile in order to survive outside a house.

I. There are many different classes and breeds of cats. The main choices are purebred or the common house cat that is not purebred. There are two classes of purebred cats—short-haired and long-haired. There are 36 breeds found in the U.S.

1. Short-haired breeds are popular because they are less work than long-haired breeds. They require little to no brushing and have less hair to shed. Examples: Rex, Siamese, American Shorthair, Japanese, Burmese, Japanese Bobtail, Manx, Russian Blue, Korat, Egyptian Mau.

2. Long-haired breeds require more work because they need to be brushed frequently. They often get hairballs because they lick themselves. A ***hairball*** is a wad of hair that collects inside the digestive tract and blocks the digestion of food. Examples: Turkish Angora, Himalayan, Persian, Balinese, Maine Coon.

Use TM: B–5D to show the major external parts of a cat. Use TM: B–5E to illustrate some examples of different cat breeds. Ask students who have a cat at home to describe some of the equipment needed to care for the cat. Also have them list some of the things they do to help care for the cat.

Objective 4: Describe important concepts in keeping rabbits.

Anticipated Problem: What are some important concepts in keeping rabbits?

IV. All domestic rabbits are descendants of wild rabbits. They are found throughout the world and can become nuisances because of their eating habits and rapid reproductive ability. There are many facts that are important to know about rabbits.

A. The anatomy of wild and domesticated rabbits is the same.

B. A male rabbit is called a ***buck***. A female rabbit is called a ***doe***. When a female rabbit gives birth, it is called ***kindling***. A group of young rabbits born at one time is called a litter.

C. The American Rabbit Breeders Association (ARBA) recognizes 42 different breeds of rabbits. The breeds are broken down into four different fur types.

1. The first breed type based on fur is called normal. ***Normal fur*** has long guard hairs that protect a dense undercoat.
2. The second type is satin. ***Satin fur*** has luster, is composed of transparent hair, and is finer than normal fur.
3. ***Rex fur*** has a very soft feel because it is very dense and the undercoat and guard hairs are the same length.
4. The final fur type is angora. ***Angora fur*** is used to manufacture clothing because of its long wool-like fiber.

D. Many people raise rabbits for 4-H and FFA projects. These rabbits may be shown at local and state events. Shows are an opportunity to compete and also to learn more about other breeds and management options. It is also interesting to see how your rabbits compare to those raised by other people.

E. It is important to keep pet rabbits tame and clean so they can be handled without injury to the animal or owner.

Use TM: B–5F to show the major external parts of a rabbit. Have an owner bring in his or her rabbit. Allow interested students to pet the rabbit. Ask the owner to talk about how much time is required to care for the rabbit. Have students make a list of questions for the owner about the rabbit's diet, grooming requirements, breed, and any other information they want to know about.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Have students complete WS: B–5A to explore further information about an animal of their choice.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. c
2. d
3. e
4. a
5. b
6. f

Fill-in-the-Blank

1. working dog
2. kindling
3. hairball
4. Monogastric

Short Answer

1. The seven classes of dogs are herding dog, sporting dog, working dog, hound, terrier, toy breed, and non-sporting breed. Examples will vary. See Objective 2 for examples of dogs in each class.

Test B–5

Name_____

EXPLORING COMPANION ANIMALS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. carnivore
b. tomcat
c. companion animal
d. doe
e. puppy
f. whelping

_____1. An animal that is used to provide humans with fun and friendship through close association.
_____2. A female rabbit.
_____3. An immature dog.
_____4. A meat- or flesh-eating animal.
_____5. A mature male cat.
_____6. The process of a dog giving birth.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A _____ _____ is a dog that is used by people to help get something done like protection of property, sled pulling, or police work.
2. When a female rabbit gives birth, it is called _____.
3. A _____ is a wad of hair that collects inside the digestive tract and blocks the digestion of food.
4. _____ describes an animal with only one stomach compartment.

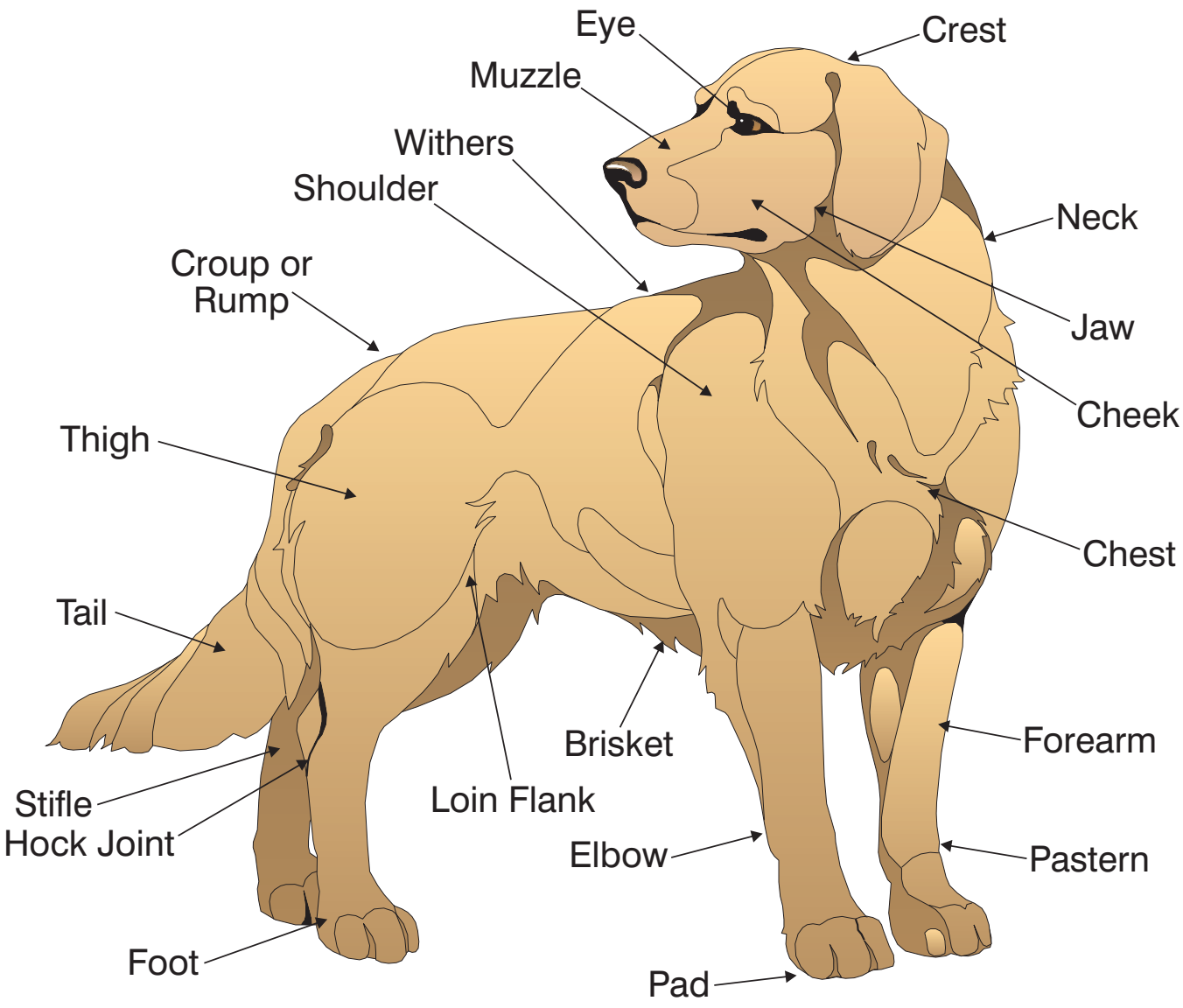
▶ Short Answer

***Instructions*. Answer the following questions.**

Name the seven classes of dogs and give an example of each.

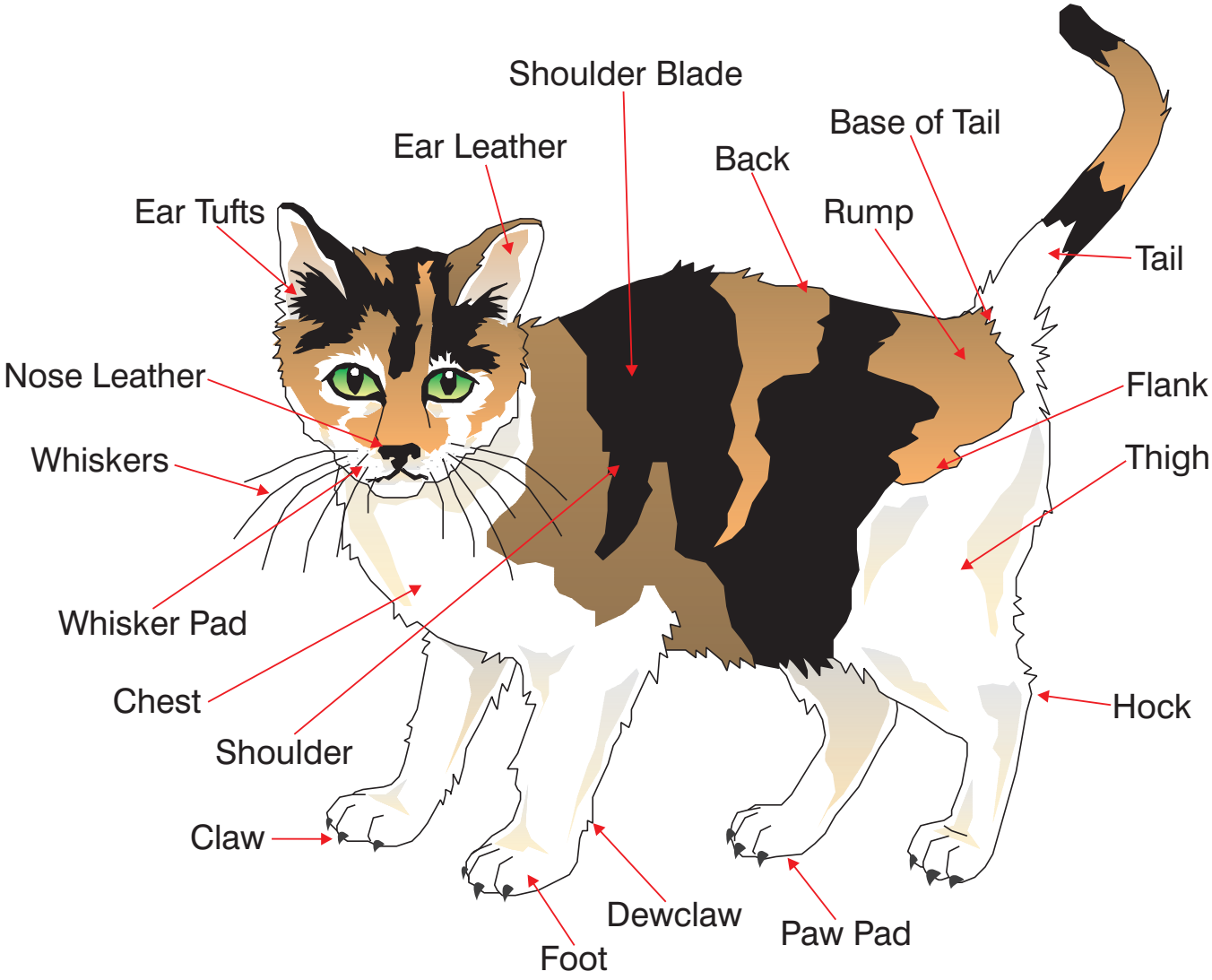
TYPES OF COMPANION ANIMALS

MAJOR EXTERNAL PARTS OF A DOG

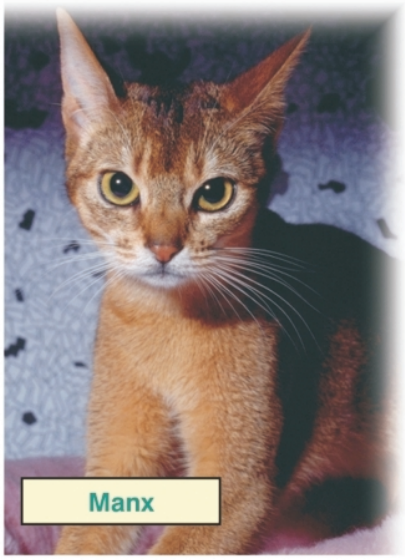


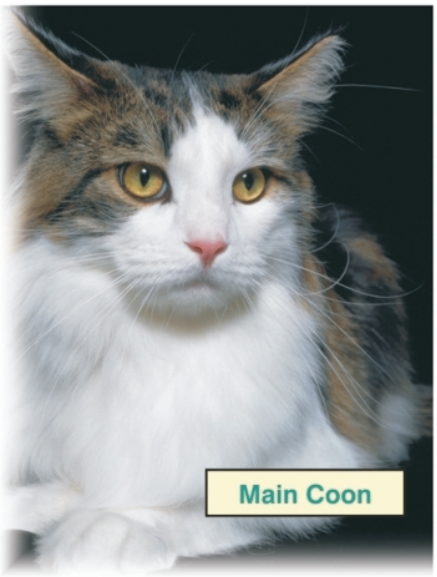
SOME DOG BREEDS

MAJOR EXTERNAL PARTS OF A CAT

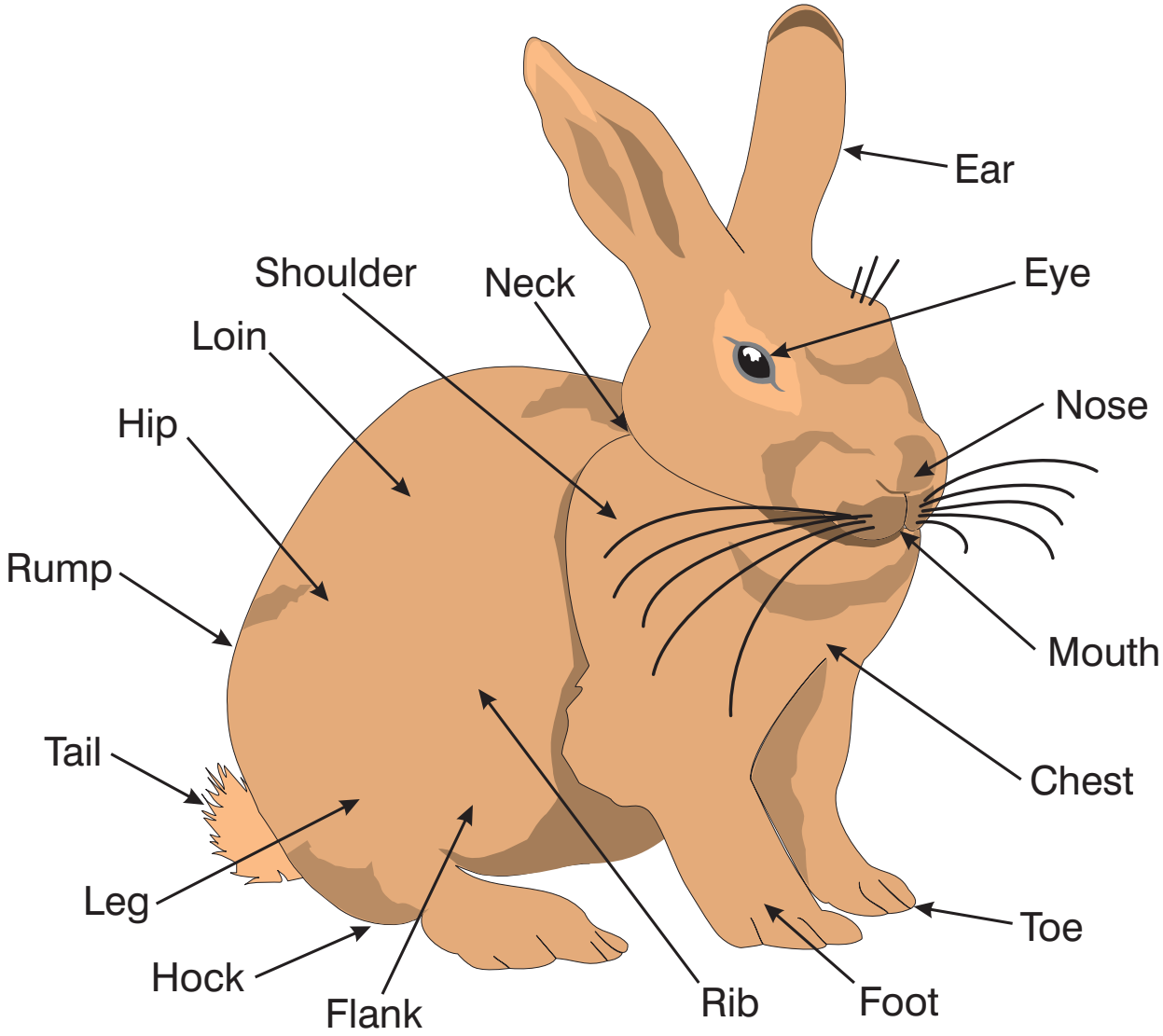


SOME CAT BREEDS





MAJOR EXTERNAL PARTS OF A RABBIT



WS: B–5A

Name _____

PET PROJECT

Directions

1. Choose a companion animal that you are interested in.
2. Research the animal and gather all the information you can find about it.
3. Fill in the information below about the pet.

Information

1. The scientific name of the animal is: _____
2. The common name of the animal is: _____
3. Is there a particular breed of this animal that interests you? If so, write it below.

4. List the supplies and equipment needed to care for and keep this animal.

5. What is the vaccination schedule for this animal?

6. Find a picture of the animal and paste it here.

Lesson C–1

PARTS OF A PLANT

Indiana Agricultural Literacy Lesson Plan Library

Unit C. Plant Science

Lesson 1. Parts of a Plant

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Identify the parts of a plant.
2. Understand the function of each plant part.
3. Identify the plant parts that are used for human consumption.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

www.urbanext.uiuc.edu/gpe/index.html

Contact these offices for more information:
College of Agriculture at the University of your choice
County Extension Office
County Farm Bureau

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Flower
- Fruit
- Leaf
- Root
- Seed
- Stem

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Briefly talk with students about how humans use plants to protect the soil, provide fresh air, and create visual interest. Ask the students if they have thought about plant parts that they eat. As a class, brainstorm edible plant parts. List them either on the chalkboard or on an overhead transparency. After the students have either exhausted their ideas or you think the list is long enough, give each student a copy of WS: C–1A. Have them work in pairs or small groups to identify which category (flowers, fruits, leaves, roots, seeds, or stems) they think each of the foods belong.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Identify the parts of a plant.

Anticipated Problem: What are the main parts of a plant?

I. There are six main parts of a plant. Each part is important to the plant's survival.

A. Flower
B. Fruit
C. Leaf
D. Root
E. Seed
F. Stem

Use TM: C–1A to illustrate some of the parts of a plant. The next objective will concentrate on the functions and use of the different parts. Use WS: C–1B to help students identify the parts of a plant.

Objective 2: Understand the function of each plant part.

Anticipated Problem: What is the function of each part of a plant?

II. Each part of the plant has a specific job to do. Without even one of these parts, the plant, as a whole, would not be able to survive.

A. Flower—The ***flower*** is the reproductive organ of the plant that produces seeds. The flower may also attract insects for pollination, if necessary.
B. Fruit—The ***fruit*** is the part of the flowering plant that contains the seeds.
C. Leaf—The ***leaf*** is the food factory of the plant. The leaves use chlorophyll, water, sunlight, and carbon dioxide to make food.
D. Root—The ***root*** is the anchor of the plant. The roots also absorb and carry water and nutrients from the soil.
E. Seed—The ***seed*** contains an embryo that provides food and water until the plant is able to make food for itself.
F. Stem—The ***stem*** holds the leaves and flowers of the plant. Tubes in the stem transport food and water from the roots.

Use TM: C–1B through TM: C–1F to illustrate all of the plant parts. Discuss the functions each part serves in helping the plant to thrive.

Objective 3: Identify the plant parts that are used for human consumption.

Anticipated Problem: What plant parts do humans eat?

III. The fruits, vegetables, and spices that we eat are parts of plants. Many times people incorrectly identify the part of the plant they are eating.

A. Some examples of flowers that humans eat are broccoli, cauliflower, artichokes, and whole cloves.

B. Some examples of fruits that humans eat are apples, grapes, avocados, pumpkins, cucumbers, tomatoes, and eggplants.

C. Some examples of leaves that humans eat are cabbage, lettuce, Brussels sprouts, spinach, oregano, and basil.

D. Some examples of roots that humans eat are beets, carrots, radishes, turnips, and rutabagas.

E. Some examples of seeds that humans eat are peas, beans, corn, sunflower seeds, nuts, rice, peanuts, and popcorn.

F. Some examples of stems that humans eat are celery, mushrooms, onions, potatoes, asparagus, cinnamon, and yams.

Use TM: C–1H through TM: C–1M to illustrate and discuss the different plant parts that humans eat. Use WS: C–1C to help students understand some of the uses for the different plant parts.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: C–1A, WS: C–1B, and WS: C–1C. Students could be asked to research their favorite plant part and write or give an oral report on the steps it takes to get that food from the farm to their fork.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. a
3. e
4. f
5. b
6. c

Short Answer

1. Answers will vary. Use Objective 3 to score this question.
2. Answers will vary. Use Objective 3 to score this question.
3. Answers will vary. Use Objective 3 to score this question.
4. Answers will vary. Use Objective 3 to score this question.
5. Answers will vary. Use Objective 3 to score this question.
6. Answers will vary. Use Objective 3 to score this question.

Test C–1

Name_____

PARTS OF A PLANT

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. flower
b. fruit
c. leaf
d. root
e. seed
f. stem

_____1. The anchor of the plant. Also absorbs and carries water and nutrients from the soil.
_____2. The reproductive organ of the plant.
_____3. Contains an embryo that provides food and water until the plant is able to make food for itself.
_____4. Holds the leaves and the flowers of the plant.
_____5. The part of the flowering plant that contains the seeds.
_____6. The food factory of the plant.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name two flowers that humans eat.

2. Name two fruits that humans eat.

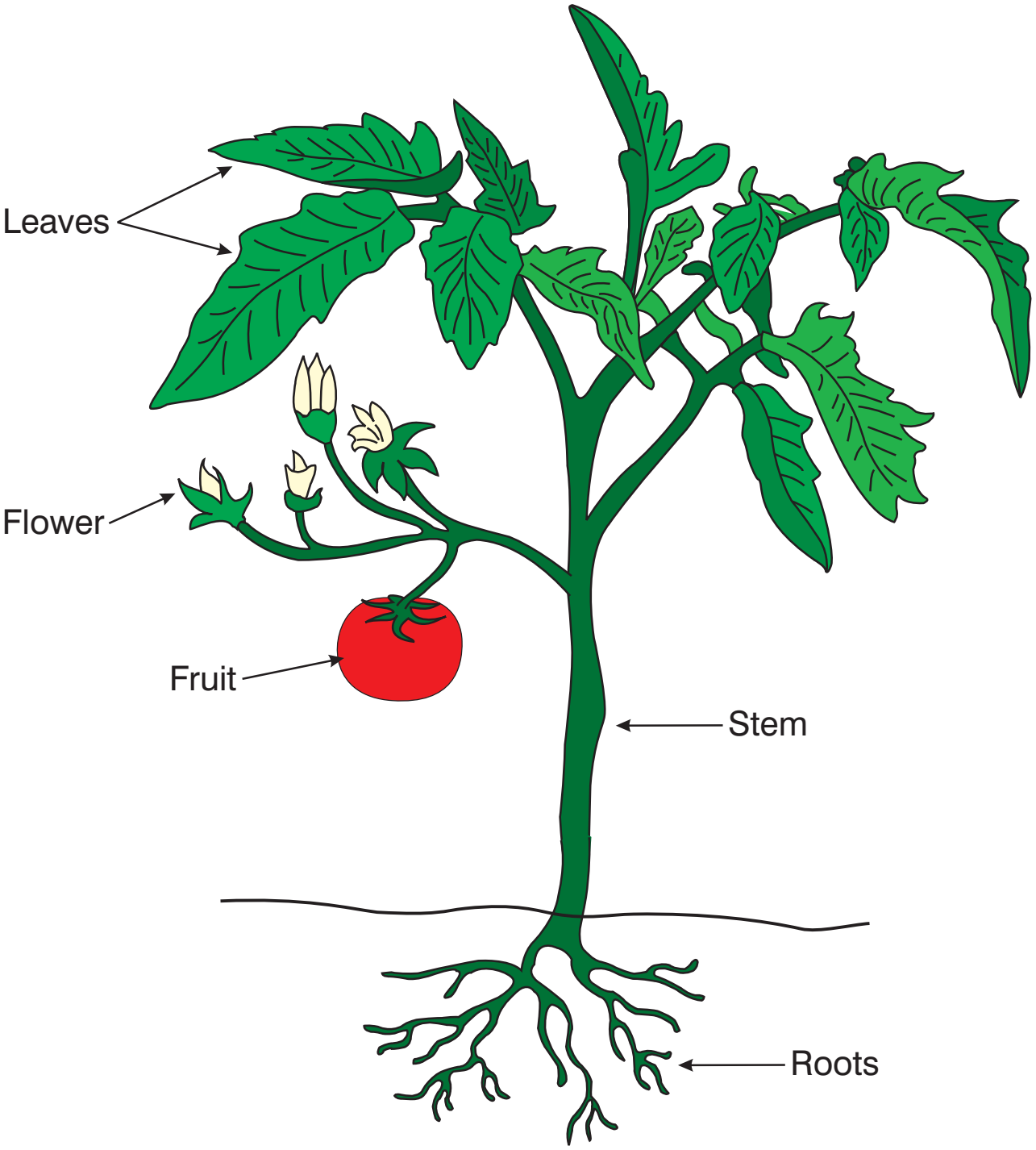
3. Name two leaves that humans eat.

4. Name two roots that humans eat.

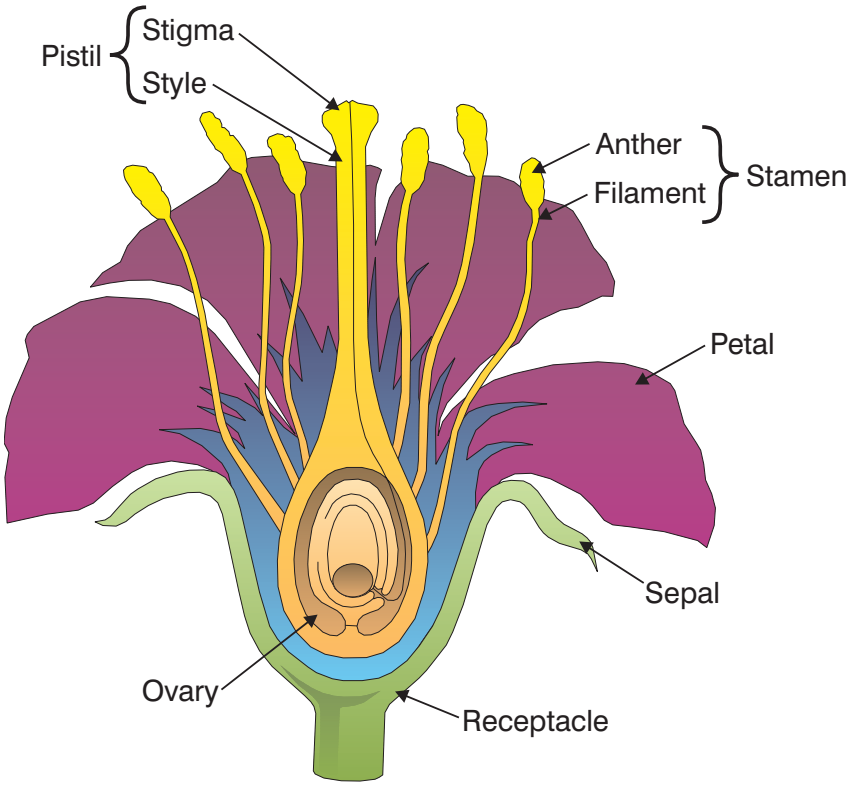
5. Name two seeds that humans eat.

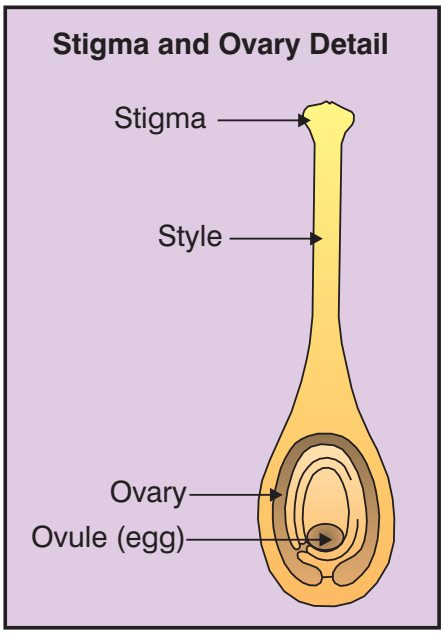
6. Name two stems that humans eat.

PARTS OF A TOMATO PLANT

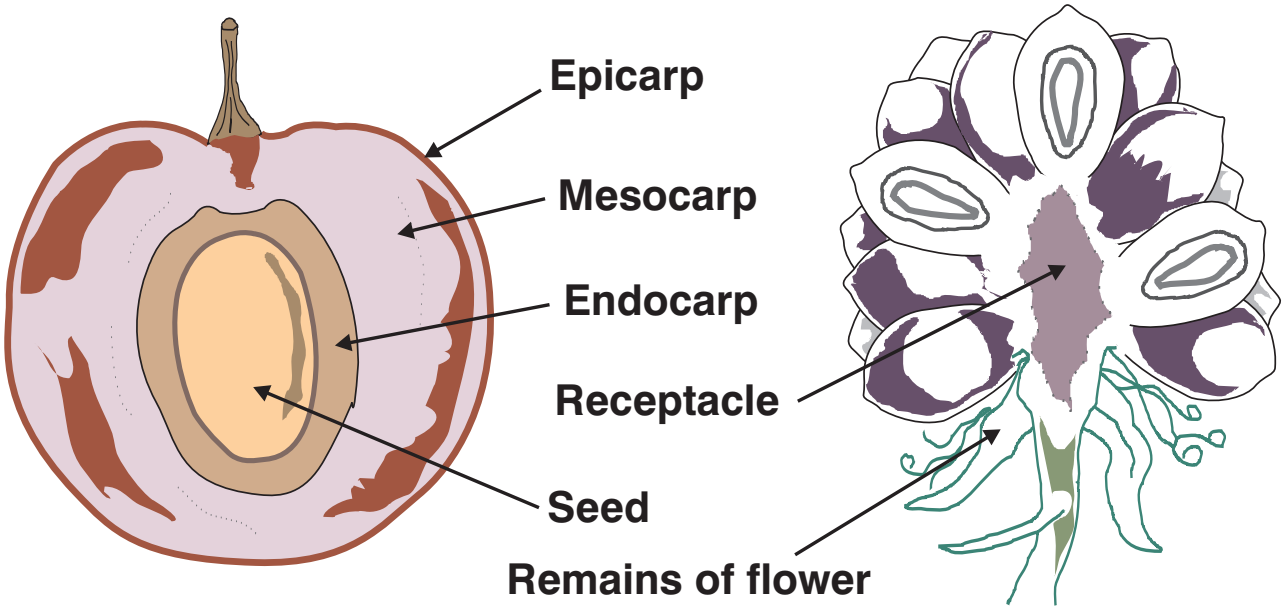


MAJOR PARTS OF A FLOWER



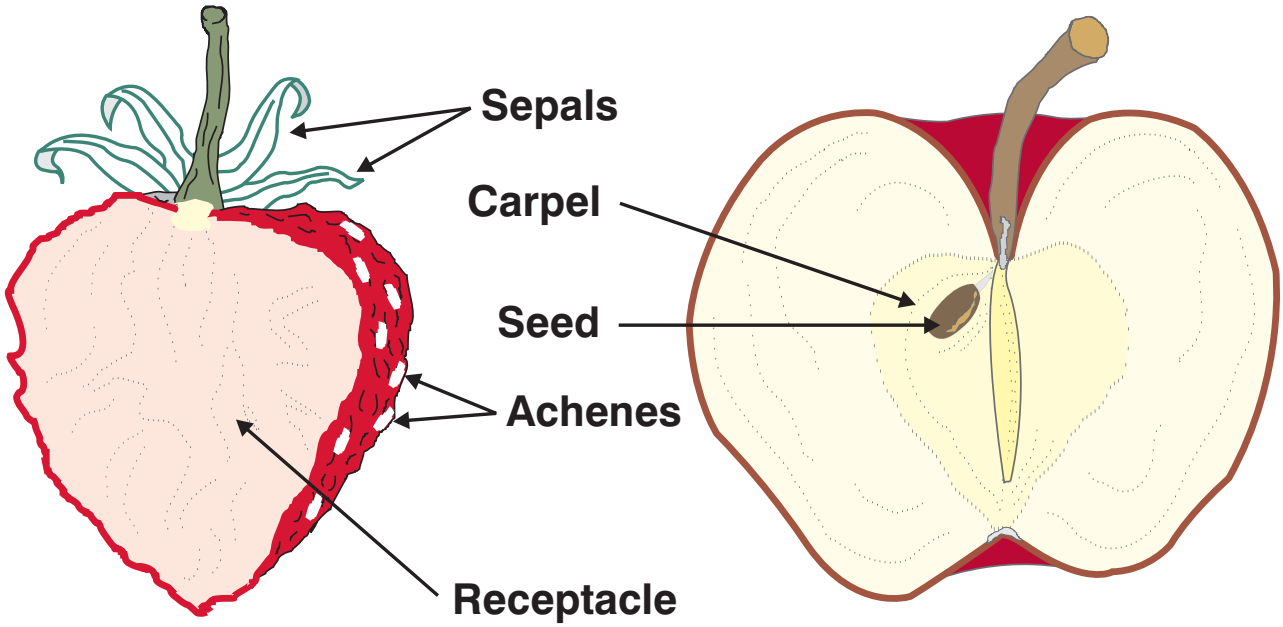


PARTS OF VARIOUS TYPES OF FRUITS



Cherry

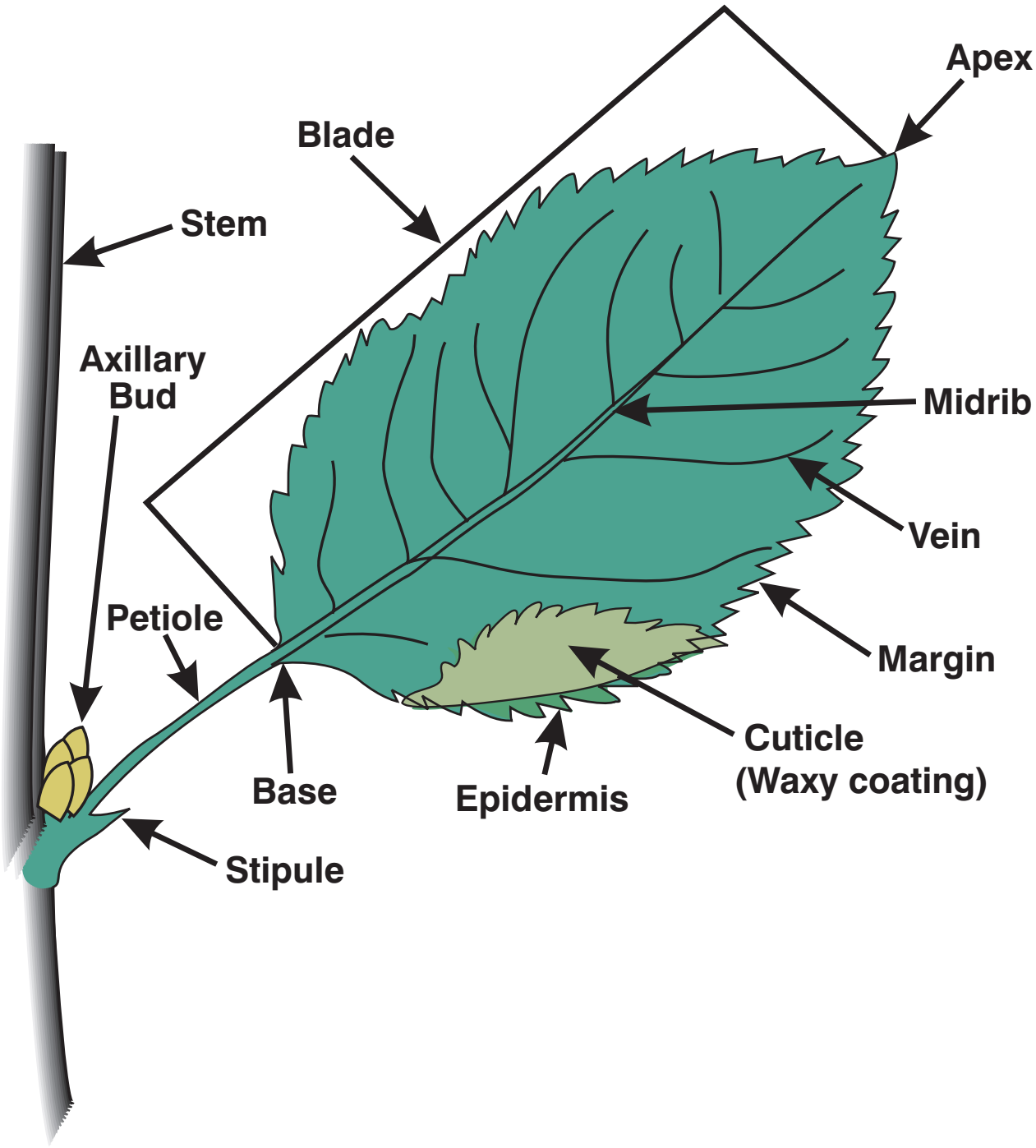
Blackberry



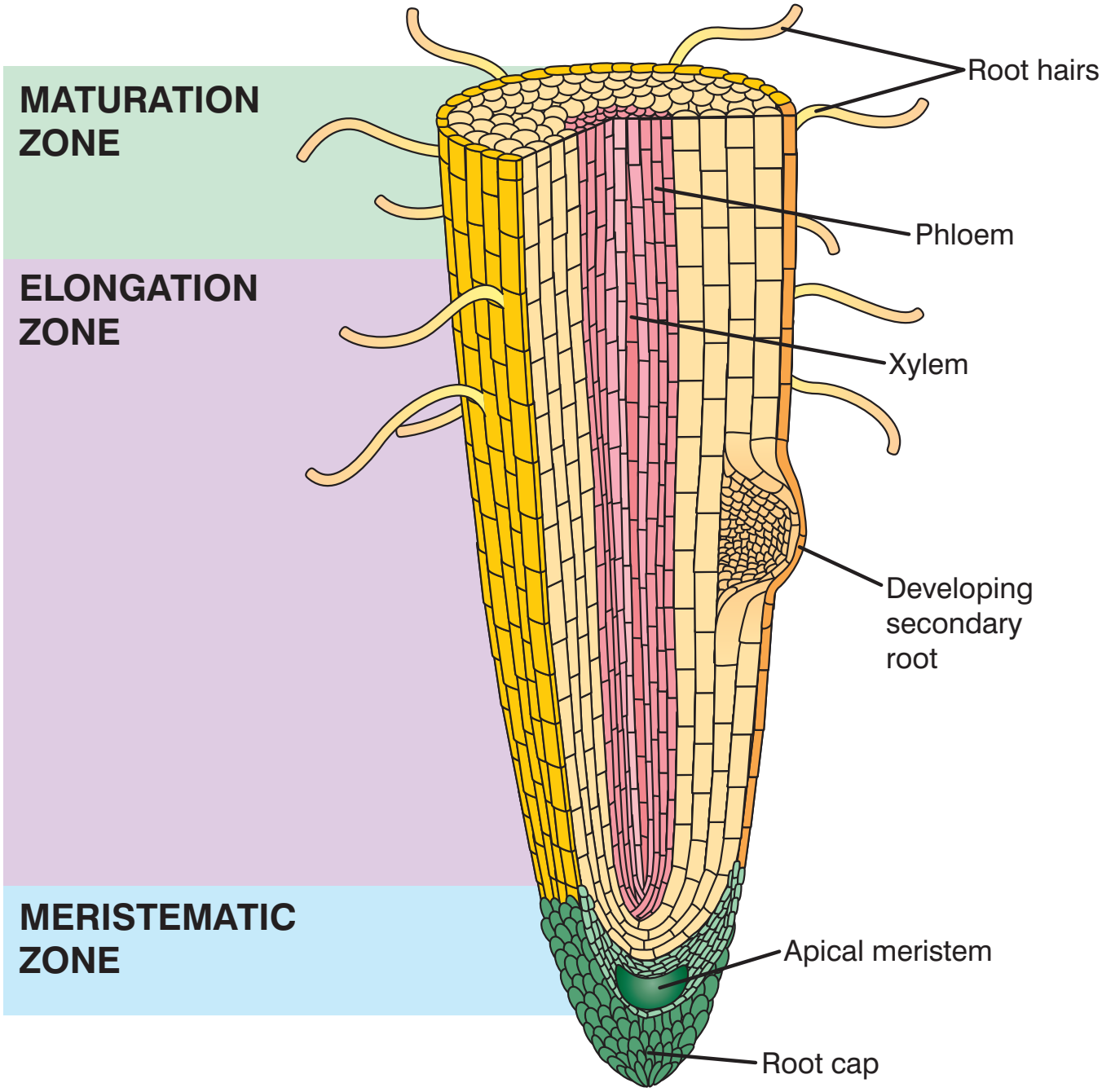
Strawberry

Apple

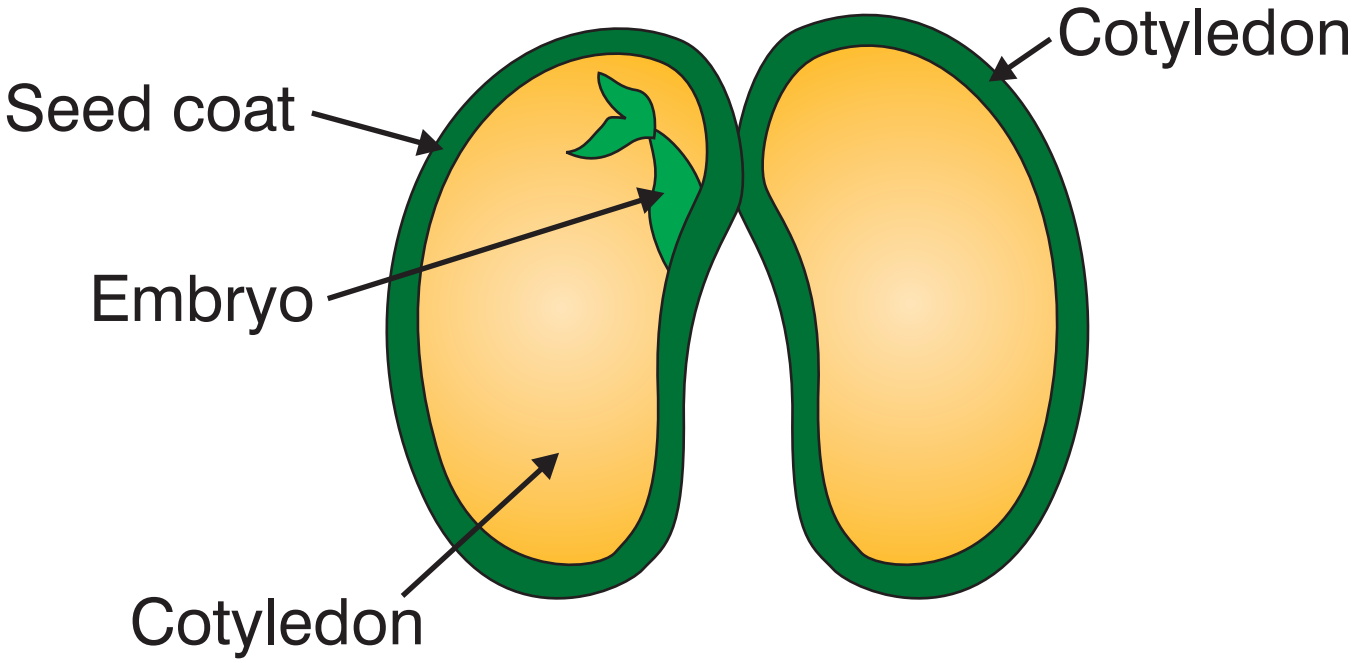
PARTS OF A SIMPLE LEAF



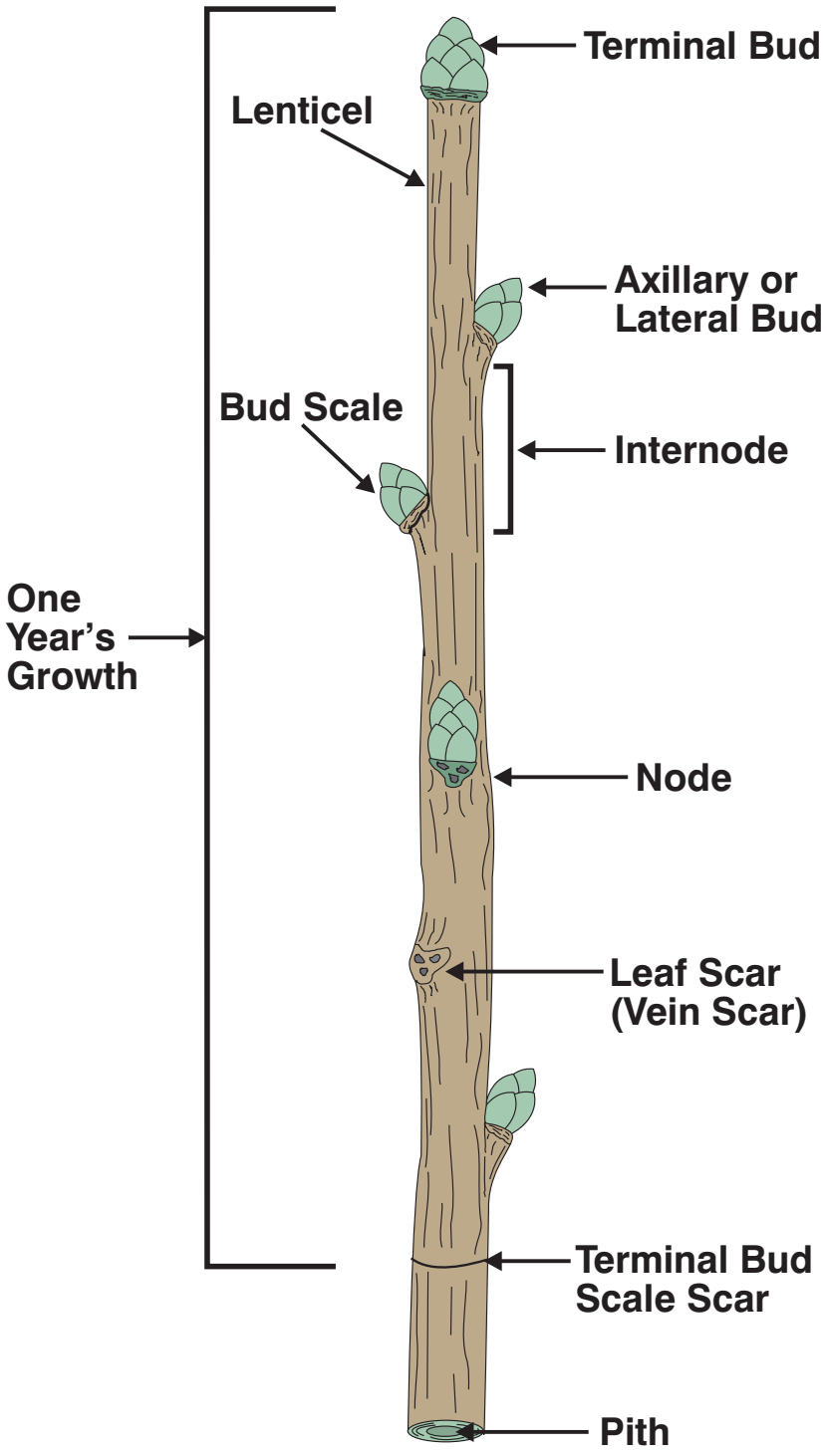
MICROSCOPIC VIEW OF A ROOT TIP



MAJOR PARTS OF A BEAN SEED

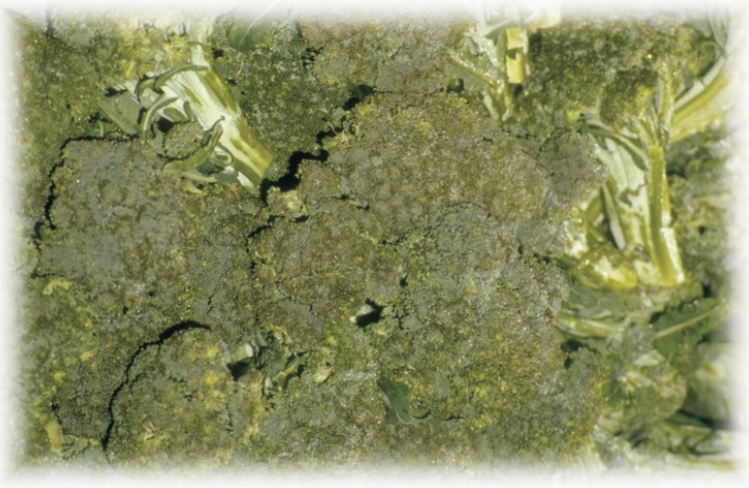


PARTS OF A TYPICAL STEM



FLOWERS WE EAT

- Broccoli
- Cauliflower
- Artichokes
- Whole cloves



FRUITS WE EAT

- Apples
- Grapes
- Strawberries
- Pears
- Watermelon
- Pumpkins
- Avocados
- Peaches
- Cherries
- Squash
- Cucumbers
- Tomatoes
- Eggplant
- Green peppers
- Zucchini
- Bananas

LEAVES WE EAT

- Cabbage
- Lettuce
- Parsley
- Brussels sprouts
- Spinach
- Oregano
- Basil

ROOTS WE EAT

- Beets
- Carrots
- Turnips
- Rutabagas
- Radishes
- Ginger root

SEEDS WE EAT

- Peas
- Beans
- Corn
- Sunflower seeds
- Nuts
- Peanuts
- Rice
- Popcorn

STEMS WE EAT

- Celery
- Asparagus
- Green onions
- Mushrooms
- Cinnamon
- Potatoes
- Yams
- Onions

WS: C–1A

Name _____

WHERE DOES THE FOOD FIT?

As a class, brainstorm to come up with a list of edible plant parts. Work in pairs or small groups to identify which category (flowers, fruits, leaves, roots, seeds, or stems) you think each of the foods belong in.

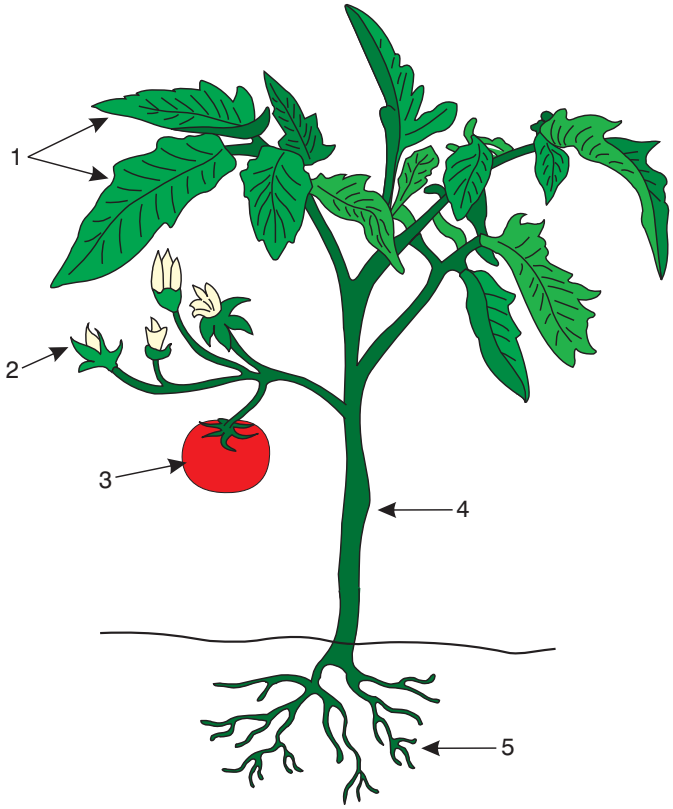
Flower	Fruit	Leaf	Root	Seed	Stem

Name _____

PLANT PARTS

Label the parts of the plant.

1. _____
2. _____
3. _____
4. _____
5. _____



PLANT PARTS KEY

1. Leaves
2. Flower
3. Fruit
4. Stem
5. Roots

WS: C–1C

Name _____

WHO HAS WHAT PART?

Information

Each of six students has a different part of a plant. Use the following clues to determine what student has each part. Use the chart to keep track of the clues. Put an "X" in the box when you have ruled out that plant part for a particular person. After eliminating all other options, place a ✓ in the box of the plant part that each person has.

Clues

1. Claire, Dalton, Grace, and Jesse's parts do not anchor the plant.
2. Grace and Jesse could not make "bouquets" out of their parts.
3. Jesse's plant part does not use chlorophyll, water, sunlight, and carbon dioxide to make food for the plant.
4. Amy, Claire, and Dalton cannot have a lettuce salad with sunflower seeds and tomatoes.
5. Brian and Jesse do not have French fries.
6. Amy, Brian, and Dalton cannot attract insects for pollination with their part.
7. Amy, Claire, and Grace cannot have cinnamon on their toast.
8. Brian cannot snack on grapes, carrots, or popcorn.
9. Grace cannot have lettuce and tomato on her bacon sandwich.
10. Jesse's plant part does not contain an embryo.

Chart

	Flower	Fruit	Leaf	Root	Seed	Stem
Amy						
Brian						
Claire						
Dalton						
Grace						
Jesse						

WHO HAS WHAT PART? KEY

	Flower	Fruit	Leaf	Root	Seed	Stem
Amy	X	X	X	✓	X	X
Brian	X	X	✓	X	X	X
Claire	✓	X	X	X	X	X
Dalton	X	X	X	X	X	✓
Grace	X	X	X	X	✓	X
Jesse	X	✓	X	X	X	X

Lesson C–2

GRAIN CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit C. Plant Science

Lesson 2. Grain Crops

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define grains.
2. Discuss corn and give examples of products made from corn.
3. Recognize that there are different types of wheat and the products that can be made from them.
4. Discuss barley and the ways it is used.
5. Discuss oats and understand how they are used.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Agriculture Renews Our Planet—Growing Energy for the Future AgriScience Kit.

www.ohiocorn.org

www.ncga.org

Bial, Raymond. *Corn Belt Harvest.* New York, New York: Houghton Mifflin Company, 1991.

Videos from the Illinois Corn Marketing Board.

Amazing Wheat 1999 (video). Produced by the University of Idaho in cooperation with the Wheat Foods Council.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Samples of corn, wheat, barley, and oats
- ✓ Mortar and pestle

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Biodegradable
- ➤ Ethanol
- ➤ Grain
- ➤ Hull

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

To introduce the information in the lesson, have students complete WS: C–2A.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define grains.

Anticipated Problem: What are grains?

I. Grains are very important to humans and animals for a variety of reasons. Grains may be used for both food and non-food products.

A. ***Grains*** are the seeds of certain plants that are members of the grass family.

B. There are many kinds of grains. The four types of grains this lesson will cover are corn, wheat, barley, and oats.

Use TM: C–2A to discuss the content of this objective. To complement this information, you may want to contact a local elevator for grain samples to show the students. Additionally, the class may use a mortar and pestle to grind the grain samples.

Objective 2: Discuss corn and give examples of products made from corn.

Anticipated Problem: What are some things made from corn?

II. There are three main types of corn: sweet corn, popcorn, and field corn. Sweet corn and popcorn are eaten by humans. About 90 percent of the corn you see growing is field corn that can be used a number of different ways.

A. The average ear of field corn is 12 to 14 inches long and has 800 kernels in 16 rows.

B. A bushel of field corn weighs 56 pounds and contains more than 72,000 kernels.

C. Corn can be processed into starch, syrup, dextrose (a sugar), oil, and gluten. Except gluten, all forms of processed corn can be used for both industrial and food, drug, and cosmetic purposes.

D. Some industrial by-products from corn are glue, chemicals, paper products, fireworks, paint, ink, soap, diapers, biodegradable plastics, and ethanol.

1. ***Biodegradable*** means that a product decomposes by the activity of microorganisms.
2. ***Ethanol*** is alcohol made by fermenting corn. It can be used as fuel by itself, or it can be blended with gasoline. Ethanol burns cleaner than ordinary gasoline and increases the power the engine puts out. Ethanol is a renewable resource that can be replenished each year.

E. Some food, drug, and cosmetic by-products from corn are baby food, soda, salad dressing, marshmallows, aspirin, mayonnaise, snack chips, and make-up.

Use TM: C–2B to illustrate some of the different products that we get from corn. Use TM: C–2C to show the major parts of a corn plant. Use WS: C–2B to reinforce the information in this objective.

Objective 3:

Recognize that there are different types of wheat and the products that can be made from them.

Anticipated Problem: How many different types of wheat are there and what can be made from them?

III. There are six main types of wheat. Each type grows best in certain areas of the United States, and each is best for different food products.

A. Hard red winter wheat—
   1. Grown in the Great Plains states
   2. Best for bread, rolls, and all-purpose flour
   3. The main U.S. wheat export

B. Hard red spring wheat—
   1. Grown in Montana, North Dakota, South Dakota, and Minnesota
   2. Best used in bagels, yeast breads, and rolls
   3. Has the highest protein of all wheat varieties

C. Soft red winter wheat—
   1. Grown east of the Mississippi River
   2. Best used in cakes, pastries, and flat breads

D. Durum wheat—
   1. Between 70 and 80 percent of the durum wheat in the United States is grown in North Dakota
   2. Mainly used in pasta and seminola flour
   3. Hardest of all U.S. wheat

E. Hard white wheat
   1. Best used in tortillas, oriental noodles, hard rolls, and yeast bread
   2. Milder and sweeter than red wheats

F. Soft white wheat
   1. Grown in the Pacific Northwest, California, Michigan, Wisconsin, and New York
   2. Best used in cakes, cookies, crackers, quick breads, muffins, snack foods, and pastries

Use TM: C–2D to illustrate the types of wheat and some products that can be made from them. Use TM: C–2E to show students the major parts of a wheat plant. Have students complete WS: C–2C to make tortillas in a bag.

Objective 4: Discuss barley and the ways it is used.

Anticipated Problem: How is barley used?

IV. Barley is a very important grain crop in the United States. Barley is usually planted in the spring and harvested in the fall.

A. There are two varieties of barley; both can be used in human foods.

1. Covered barley is a variety of barley with a ***hull*** (outer covering of the kernel) so tight to the kernel that it must be sanded off.
2. Hulless barley is a variety of barley with a hull so loose on the kernel that it practically falls off during harvest.

B. The top 10 barley-producing states are North Dakota, Montana, Idaho, Minnesota, Washington, South Dakota, California, Oregon, Colorado, and Wyoming.

C. In the United States, 55 percent of the barley is used for animal feed, 40 percent is used for malt production, 3 percent is used for seed, and 2 percent is used for human food.

D. For human consumption, barley can be used in soups, pilafs, stew, desserts, cold cereals, pancakes, muffins, and breads.

Use TM: C–2F to show the top 10 barley-producing states. Use TM: C–2G to illustrate the use of barley in the United States. Use WS: C–2D to further reinforce the uses of barley.

Objective 5: Discuss oats and understand how they are used.

Anticipated Problem: How are oats used after they are harvested?

V. Oats are the third leading cereal crop in the United States, only after corn and wheat.

A. Oats are grown in Iowa, South Dakota, North Dakota, Minnesota, and Wisconsin.

B. About 95 percent of all oats are fed to animals, especially horses.

C. The remaining 5 percent of oats is used in foods for human consumption. Food products made from oats include oat bran, oat flour, oatmeal, cookies, cakes, breads, muffins, and granola.

Use TM: C–2H to show students some examples of food products made from oats.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: C–2A, WS: C–2B, WS: C–2C, and WS: C–2D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached. The teacher may also use WS: C–2A, as a tool for evaluation.

Answers to Sample Test:

Matching

1. d
2. b
3. a
4. c

Fill-in-the-Blank

1. field
2. six
3. spring, fall
4. horses

Short Answer

1. Answers will vary. Use Objective 5 to score this question.
2. Answers will vary. Use Objective 4 to score this question.
3. Answers will vary. Use Objective 3 to score this question.
4. Answers will vary. Use Objective 2 to score this question.
5. Answers will vary. Use Objective 2 to score this question.

Test C–2

Name_____

GRAIN CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. grains
b. ethanol
c. biodegradable
d. hull

_____1. The outer covering of a kernel.
_____2. Alcohol made by fermenting corn.
_____3. The seeds of certain plants that are members of the grass family.
_____4. The ability of products to decompose by use of microorganisms.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. About 90 percent of the corn seen growing is _____ corn.
2. There are _____ main types of wheat.
3. In the United States, barley is usually planted in the _____ and harvested in the _____.
4. About 95 percent of all oats are fed to animals, especially _____.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name two foods that can be made from oats.
2. Name two foods that can be made from barley.
3. Name two foods that can be made from wheat.
4. Name two foods that can be made from corn.
5. Name two non-food products that can be made from corn.

TYPES OF GRAINS

- Corn
- Wheat
- Barley
- Oats

PRODUCTS MADE FROM CORN

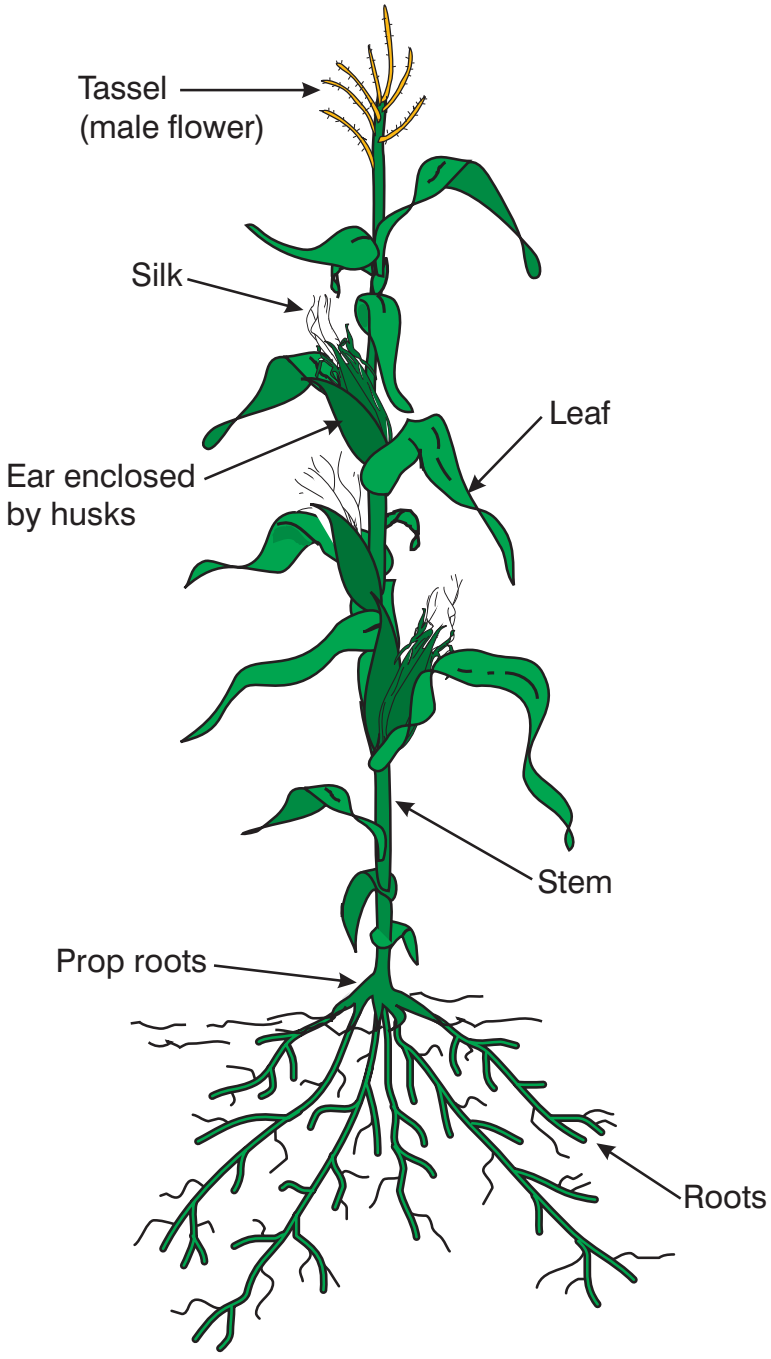
Industrial Products:

- Fireworks
- Chemicals
- Paint
- Glue
- Diapers
- Biodegradable plastics
- Ethanol

Food, Drug, and Cosmetic Products:

- Baby food
- Soda
- Salad dressing
- Aspirin
- Mayonnaise
- Make-up
- Marshmallows

MAJOR PARTS OF A MATURE CORN PLANT



TYPES OF WHEAT AND WHEAT PRODUCTS

Hard Red Winter Wheat

- Bread
- Rolls
- All-purpose flour

Hard Red Spring Wheat

- Bagels
- Yeast breads
- Rolls

Soft Red Winter Wheat

- Cakes
- Pastries
- Flat breads

(Courtesy, Agricultural Research Service, USDA)

Durum Wheat

- Pasta
- Seminola flour

Hard White Wheat

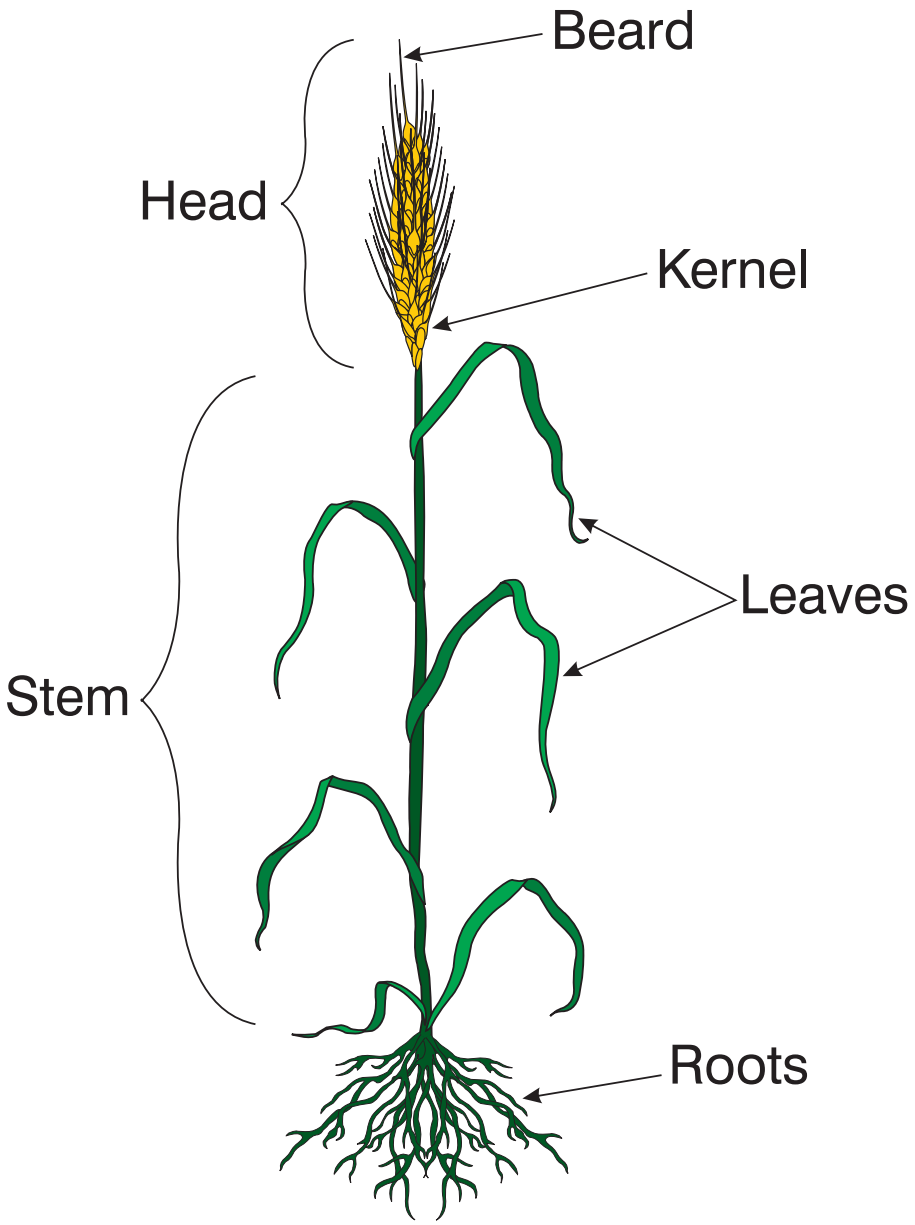
- Tortillas
- Oriental noodles
- Hard rolls
- Yeast bread

Soft White Wheat

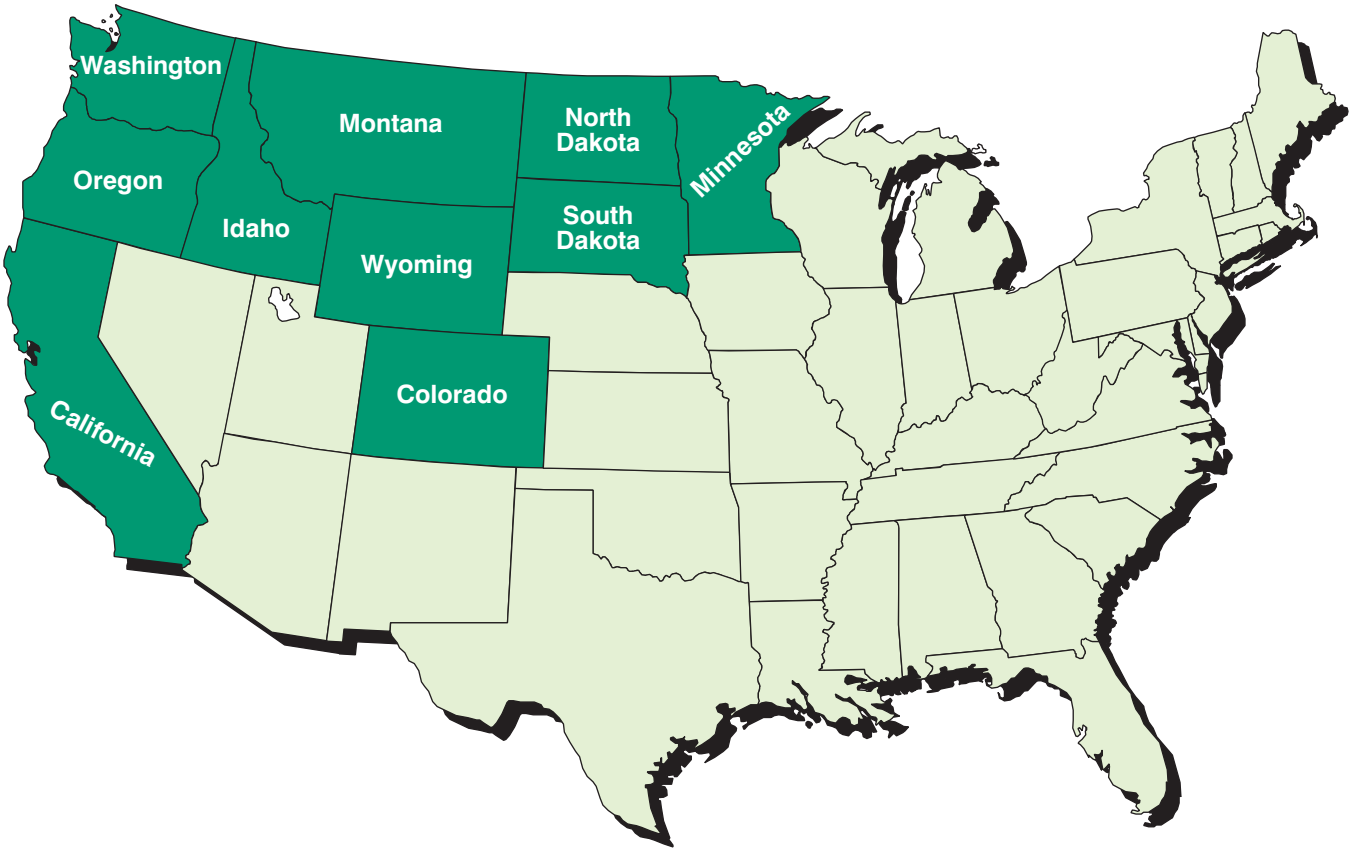
- Cakes
- Cookies
- Crackers
- Quick breads
- Muffins
- Snack foods
- Pastries

(Courtesy, Agricultural Research Service, USDA)

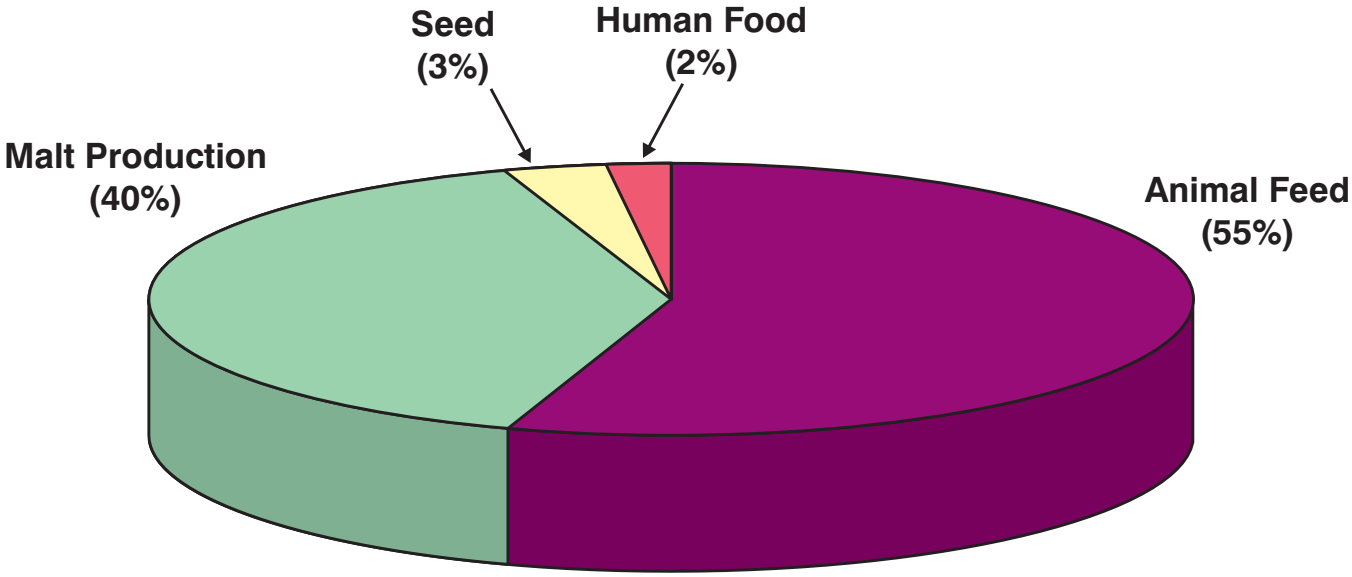
MAJOR PARTS OF A MATURE WHEAT PLANT



TOP 10
BARLEY-PRODUCING STATES



BARLEY USE IN THE UNITED STATES



FOOD PRODUCTS MADE FROM OATS

- Oat bran
- Oat flour
- Oatmeal
- Cookies
- Cakes
- Breads
- Muffins
- Granola

Name _____

WHAT ABOUT GRAINS?

Anticipation Guide

In the blanks provided, place a "T" next to any statement you think is true, and place an "F" next to any statement you think is false. After completing the lesson, check your answers based on what you learned about grains. How did you do? Did you learn anything that surprised you?

_____1. Grains are the seeds of any growing plant.

_____2. There are only two main types of corn: popcorn and sweet corn.

_____3. Breads, rolls, pastries, and tortillas are all made from wheat.

_____4. Most barley is used for animal feed.

_____5. Oats are the third leading cereal crop in the United States, only after corn and wheat.

WHAT ABOUT GRAINS? KEY

1. False. Grains are the seeds of *certain plants* that are members of the grass family.
2. False. There are *three* main types of corn: popcorn, sweet corn, and field corn.
3. False. Breads, rolls, pastries, and tortillas can all be made from different kinds of grains.
4. True. Barley is used 55 percent for animal feed, 40 percent for malt production, 3 percent for seed, and 2 percent for human food.
5. True. Oats *are* the third leading cereal crop in the United States.

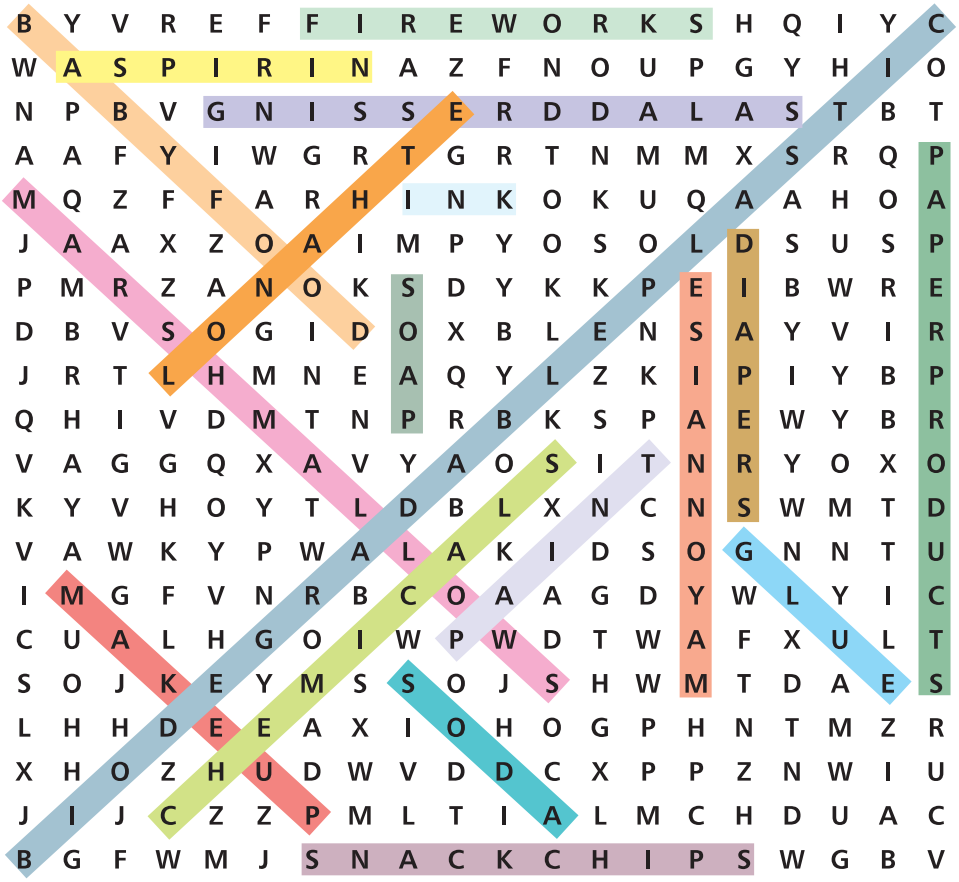
Name _____

CORN PRODUCTS

B Y V R E F F I R E W O R K S H Q I Y C
W A S P I R I N A Z F N O U P G Y H I O
N P B V G N I S S E R D D A L A S T B T
A A F Y I W G R T G R T N M M X S R Q P
M Q Z F F A R H I N K O K U Q A A H O A
J A A X Z O A I M P Y O S O L D S U S P
P M R Z A N O K S D Y K K P E I B W R E
D B V S O G I D O X B L E N S A Y V I R
J R T L H M N E A Q Y L Z K I P I Y B P
Q H I V D M T N P R B K S P A E W Y B R
V A G G Q X A V Y A O S I T N R Y O X O
K Y V H O Y T L D B L X N C N S W M T D
V A W K Y P W A L A K I D S O G N N T U
I M G F V N R B C O A A G D Y W L Y I C
C U A L H G O I W P W D T W A F X U L T
S O J K E Y M S S O J S H W M T D A E S
L H H D E E A X I O H O G P H N T M Z R
X H O Z H U D W V D D C X P P Z N W I U
J I J C Z Z P M L T I A L M C H D U A C
B G F W M J S N A C K C H I P S W G B V

ASPIRIN
BABY FOOD
BIODEGRADABLE PLASTIC
CHEMICALS
SNACK CHIPS
DIAPERS
ETHANOL
FIREWORKS
GLUE
INK
MAKE-UP
MARSHMALLOWS
MAYONNAISE
PAINT
PAPER PRODUCTS
SALAD DRESSING
SOAP
SODA

CORN PRODUCTS KEY



Name _____

TORTILLAS IN A BAG

Materials

- ✓ 1½ cups all-purpose flour
- ✓ 1 teaspoon salt
- ✓ ½ teaspoon baking powder
- ✓ 3 tablespoons shortening
- ✓ ½ cup hot water (125–130°F)
- ✓ 1 gallon-size resealable plastic bag
- ✓ Wax paper
- ✓ Rolling pin (optional)
- ✓ Electric skillet
- ✓ Spatula

Directions

1. In the gallon-size bag, combine flour, salt, and baking powder.
2. Seal the bag and shake to mix.
3. Add the shortening to the mixture in the bag.
4. Seal the bag and work the mixture with your fingers until it is crumbly and there are no large pieces of shortening visible.
5. Add the hot water to the bag.
6. Close the bag and mix with your fingers until the ingredients form a soft dough that pulls away from the sides of the bag.
7. Turn the dough out onto a lightly floured surface covered by waxed paper. Divide the dough into four equal pieces and shape them into balls.

8. Cover the dough with the plastic bag and let it rest for 15 minutes.
9. Roll or pat the dough into circles. You now have tortillas!
10. Heat the electric skillet to medium high and place the tortillas into the skillet. Cook the tortillas, using the spatula to flip them, until dark brown spots appear on both sides.
11. Eat your tortillas plain; top them with butter and sprinkle with cinnamon and sugar; roll them up with cheese, salsa, and refried beans; or come up with your own topping!

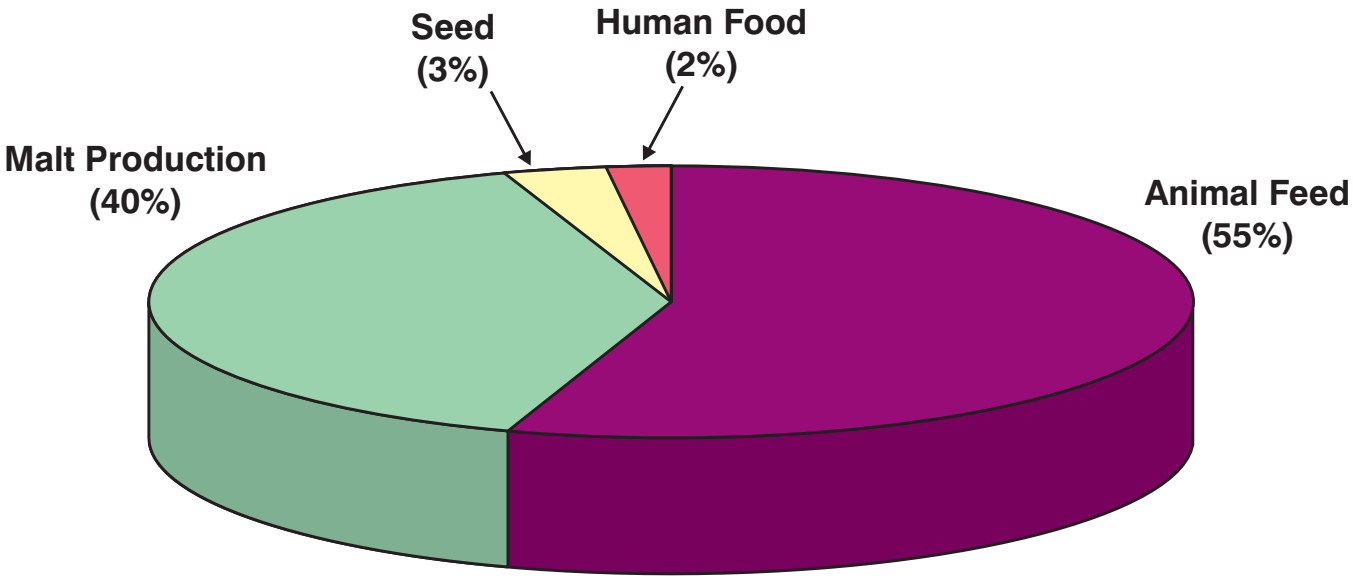
Name _____

BARLEY USES

Use the following information to create a pie graph of the main uses of barley.

- Animal Feed: 55%
- Malt Production: 40%
- Seed: 3%
- Human Foods: 2%

BARLEY USES KEY



Lesson C–3

SUGAR AND OIL CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit C. Plant Science

Lesson 3. Sugar and Oil Crops

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand the similarities and differences of sugar cane and sugar beets.
2. Name both edible and non-edible uses for soybeans.
3. Distinguish between the four main types of peanuts.
4. Give examples of uses for canola and sunflowers.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Pankey, Susan M. *Why the Brown Bean Was Blue.* Nebraska Foundation for Agricultural Awareness, 1999.

www.aboutpeanuts.com

www.soyohio.org/educosi.cfm

www.indianasoybeanboard.com

www.canola-council.org

www.sunflowernsa.com

www.sugar.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Samples of edible and non-edible products from sugar, soybeans, peanuts, canola, and sunflowers
- ✓ Indiana Farm Bureau Soybean Kit

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Combine
- ➤ Biodiesel
- ➤ Environ
- ➤ Peg
- ➤ Taproot

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Collect samples of both edible and non-edible products that can be made from sugar, soybeans, peanuts, canola, and sunflowers. Have students classify or group which products come from what commodity. (You may want to include a category named "none of these commodities" to give the students another option.)*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand the similarities and differences of sugar cane and sugar beets.

Anticipated Problem: How are sugar cane and sugar beets alike? How are they different?

I. Sugar from sugar cane and sugar beets is basically the same and is used the same. However, there are differences in how and where sugar cane and sugar beets are grown.

A. Sugar cane—

1. Sugar cane is a member of the grass family.
2. In the United States, sugar cane is grown primarily in Hawaii and southern states.
3. Sugar cane is grown from sections of stalk, not seed. These sections are called sets and are planted in trenches.
4. Stems may grow to more than 10 feet tall.
5. Inside the stem is a white pulp where the sugar is stored.
6. In Hawaii, sugar cane is harvested after two years. In the south, sugar cane is harvested after only seven months, though the yield is not as high.
7. Sugar cane may be harvested by hand (with a machete knife) or with a machine.
8. After being cut, sugar cane must be processed quickly because it begins to lose its sweetness as soon as it is cut.
9. To process, the cane is crushed to remove a brown liquid. This liquid is boiled and impurities are removed. The juice thickens as water evaporates. Brown crystals appear and are then melted down and cleaned to result in white crystals.
10. The same sugar cane field may be harvested several times before it needs to be replanted.
11. Sugar cane is the major source for molasses.
12. Brown sugar is processed white sugar with some molasses added back in.

B. Sugar beets—

1. Sugar beets are vegetables.
2. In the United States, sugar beets are grown in the western states and the Upper Midwest.
3. Sugar beets are grown from seeds.
4. Sugars accumulate in the ***taproot***, the large main root that grows downward in a taproot system.
5. The growing season for sugar beets is approximately five months.
6. Sugar beets are harvested by a machine that cuts off the tops and lifts the beets from the soil, usually after the beets weigh 2 to 4 pounds.

7. To process sugar beets, they must be washed, sliced, and soaked in hot water to separate the juice from the beet fiber. The juice is then purified, filtered, concentrated, and dried.
8. The tops and beet pulp residue of sugar beets can be used for livestock feed.

Use TM: C–3A to discuss the content of this objective. Use TM: C–3B and TM: C–3C to illustrate the major parts of a sugar cane stalk and a sugar beet plant. Have the students use WS: C–3A to record the similarities and differences in various types of sugar. The students could write a short paper based on the information they gather from the worksheet.

Objective 2: Name both edible and non-edible uses for soybeans.

Anticipated Problem: How are soybeans used?

II. There are many edible and non-edible uses for soybeans.

A. Soybeans have a long history.
1. They were discovered about 5,000 years ago in Northeast China.
2. Soybeans first came to America as ship weight in 1804.
3. The first U.S. soybeans were grown in Pennsylvania as ornamental plants.
4. By 1898, the U.S. Department of Agriculture was encouraging farmers to grow soybeans for livestock feed.
5. In 1904, George Washington Carver began to discover new ways to use soybeans other than as livestock feed.
6. In 1920, the ***combine***, a machine that cuts and threshes grain in the field, was first used to harvest soybeans.
7. In 1922, the first soybean processing plant in the United States opened.
8. Henry Ford produced a car using soy plastic in 1940.
9. Soy oil was the first ingredient removed from soybeans.

B. Knowledge of soybeans is important for production.
1. Soybeans are members of the legume family.
2. In 2001, Iowa, Illinois, Minnesota, Indiana, and Ohio were the states with the most planted acres of soybeans.
3. Approximately 70 million acres of soybeans are grown each year.
4. Average soybean yield is 30 bushels per acre, but yields throughout the Midwest can reach 60 to 70 bushels per acre.
5. A bushel of soybeans weighs about 60 pounds. Of that 60 pounds, 11 pounds are oil and 48 pounds are soy meal.
6. Soybean plants grow to about 3 feet high.
7. Each soybean plant has 20 to 30 pods with two or three seeds per pod.
8. Soybeans are ¼ inch in diameter and may be oval or round.

9. Seed color varies and may be beige, yellow, green, brown, black, or speckled.
10. In the Midwest, soybeans are planted in mid to late spring and harvested in September or October.
11. Before harvest, soybean leaves turn yellow and drop to the ground.
12. A combine is used to harvest soybeans.
13. About 40 to 50 percent of all soybeans grown in the United States are exported.
14. Soybean processing involves several steps.
    a. The hulls are removed.
    b. The soybeans are crushed and rolled, resulting in flakes with oil.
    c. Soaking then results in oil that is separate from the flakes with protein.
    d. Final products are soy flour, soy concentrate, and soy isolates.

C. There are many edible and non-edible uses for soybeans.
1. Edible uses include baby food and formula, medicines, candy, cereal, hot dogs, lunchmeat, noodles, soy milk, tofu, and soy sauce.
2. Non-edible uses include adhesives, cleaning materials, cosmetics, ink, paint, pet food, soap, shampoo, crayons, candles, ***biodiesel*** (an environmentally friendly alternative fuel made from soybean oil blended with diesel fuel), livestock feed, and ***Environ*** (a building material made from soy flour and recycled paper that is lighter than granite and harder than wood).

Use TM: C–3D to discuss the history of the soybean. Use TM: C–3E illustrate the some of the different uses for soybeans. Choose one of the activities from the Indiana Farm Bureau Soybean Kit to demonstrate some of the products that can be made from soybeans. Have students complete WS: C–3B.

Objective 3: Distinguish between the four main types of peanuts.

Anticipated Problem: What are the different types of peanuts?

III. Even though all peanuts are similar, they are grown in different areas of the United States and are used in different ways.

A. From planting to harvest, it takes four to five months to grow a peanut.
1. Peanuts are usually planted in April or May.
2. Plants grow about 18 inches tall.
3. Small yellow flowers appear on the peanut plant and pollinate themselves. After a flower loses its petals, a ***peg***, the enlarged ovary of the peanut plant, grows down into the ground where the actual peanut grows.
4. In 1 ton of in-shell peanuts, there are 500 pounds of peanut oil and 800 pounds of peanut oil meal; the other 700 pounds is mostly shell.

5. A special harvester loosens the peanut plant, cuts the taproot, lifts the plant from the soil, shakes the excess soil from plant, and lays the plant in a row to dry. The plants must dry for two or more days before being combined.

B. There are four main types of peanuts.
   1. Runner peanuts have kernels of a uniform size.
      a. Over half of all runner peanuts are used for peanut butter.
      b. Runner peanuts are grown in Alabama, Florida, and Georgia.
   2. Spanish peanuts have the smallest kernels.
      a. Spanish peanuts are used in peanut candies.
      b. They have a higher oil content than other types of peanuts.
      c. Spanish peanuts are grown in Oklahoma and Texas.
   3. Valencia peanuts have three or more kernels per pod.
      a. Valencia peanuts have the sweetest taste of all types of peanuts.
      b. They are mainly roasted and sold in their shell or boiled.
      c. Valencia peanuts are grown in New Mexico.
   4. Virginia peanuts have the largest kernels.
      a. They are mainly roasted and sold in or out of the shell.
      b. Virginia peanuts are grown in North Carolina, South Carolina, and Virginia.

C. Non-food uses for peanuts include livestock feed, detergent, salves, bleach, shaving cream, linoleum, cosmetics, paint, medicines, cat litter, ink, and shampoo.

Use TM: C–3F to discuss the different types of peanuts. As a follow-up, the students may use WS: C–3C to make homemade peanut butter.

Objective 4: Give examples of uses for canola and sunflowers.

Anticipated Problem: How are canola and sunflowers used?

IV. Canola and sunflowers both have edible and non-edible human uses.

A. Canola—
   1. Canola is a member of the mustard family.
   2. The canola plant was developed from the rapeseed plant in 1974 by researchers in Canada.
   3. China is the world's largest producer of canola, with the United States producing less than 2 percent of the world's supply.
   4. Minnesota and North Dakota produce most of the canola in the United States.
   5. The canola plant grows 2 to 4 feet tall and the pods are narrow and 1 to 3 inches long. Each pod contains 15 to 40 small round seeds.
   6. Canola can be harvested by direct combine or by being cut high on the stem, put in windrows, and then combined.

7. Canola has many uses.
    a. Rapeseed became popular in North America during World War II as a lubricant for marine engines.
    b. Until the 1940s, rapeseed was grown for lamp fuel, cooking oil, and as livestock forage.
    c. Edible uses for canola include cooking oil, salad oil, mayonnaise, and margarine.
    d. Non-edible uses for canola include cosmetics, pesticides, suntan oil, soap, paint, varnish, birdseed, and livestock feed.

B. Sunflowers—
1. Most of the sunflowers in the United States are grown in North Dakota, South Dakota, Minnesota, Kansas, Colorado, Nebraska, Texas, and California.
2. Sunflowers may grow up to 12 feet tall with roots 9 feet deep.
3. They usually have one stem with a large single flower or several smaller flowers.
4. Evidence suggests that sunflowers were cultivated by Native Americans in present-day Arizona and New Mexico about 3000 B.C.
5. Sunflowers are usually planted in May.
6. To get oil after the sunflower seeds are harvested, the outer husks are removed and then the seeds are crushed and gently heated to get rid of excess water.
7. There are both oil and non-oil types of sunflowers.
8. Sunflowers have many uses.
    a. Edible uses for sunflowers include snack food and cooking oil.
    b. Non-edible uses for sunflowers include soap, candles, birdseed, and ornamental plants.

Use TM: C–3G and TM: C–3H to discuss some of the uses of canola and sunflowers. Have students complete WS: C–3D.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: C–3A, WS: C–3B, WS: C–3C, and WS: C–3D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. e
3. c
4. a
5. d

Fill-in-the-Blank

1. beets, cane
2. 60
3. April, May
4. canola
5. Virginia

Short Answer

1. Runner, Spanish, Valencia, and Virginia
2. Answers will vary. Use Objective 2 to score this question.
3. Answers will vary. Use Objective 2 to score this question.
4. Answers will vary. Use Objective 4 to score this question.
5. Answers will vary. Use Objective 4 to score this question.

Test C–3

Name_____

SUGAR AND OIL CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. taproot
b. combine
c. biodiesel
d. peg
e. Environ

_____1. A machine that cuts and threshes grain in the field.

_____2. A building material made from soy flour and recycled paper that is lighter than granite and harder than wood.

_____3. An environmentally friendly alternative fuel made from soybean oil blended with diesel fuel.

_____4. A large main root that grows downward.

_____5. The enlarged ovary of the peanut plant that grows into the ground.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. In sugar _____, the sugar accumulates in the taproot and in sugar _____, the sugar is stored in the stem.
2. A bushel of soybeans weighs approximately _____ pounds.
3. Peanuts are usually planted in _____ or _____.
4. The _____ plant was developed from the rapeseed plant in 1974 by researchers in Canada.
5. _____ peanuts have the largest kernels.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name the four main types of peanut.

2. Name two edible uses for soybeans.

3. Name two non-edible uses for soybeans.

4. Name two non-edible uses for canola.

5. Name two non-edible uses for sunflowers.

SUGAR CANE VS. SUGAR BEETS

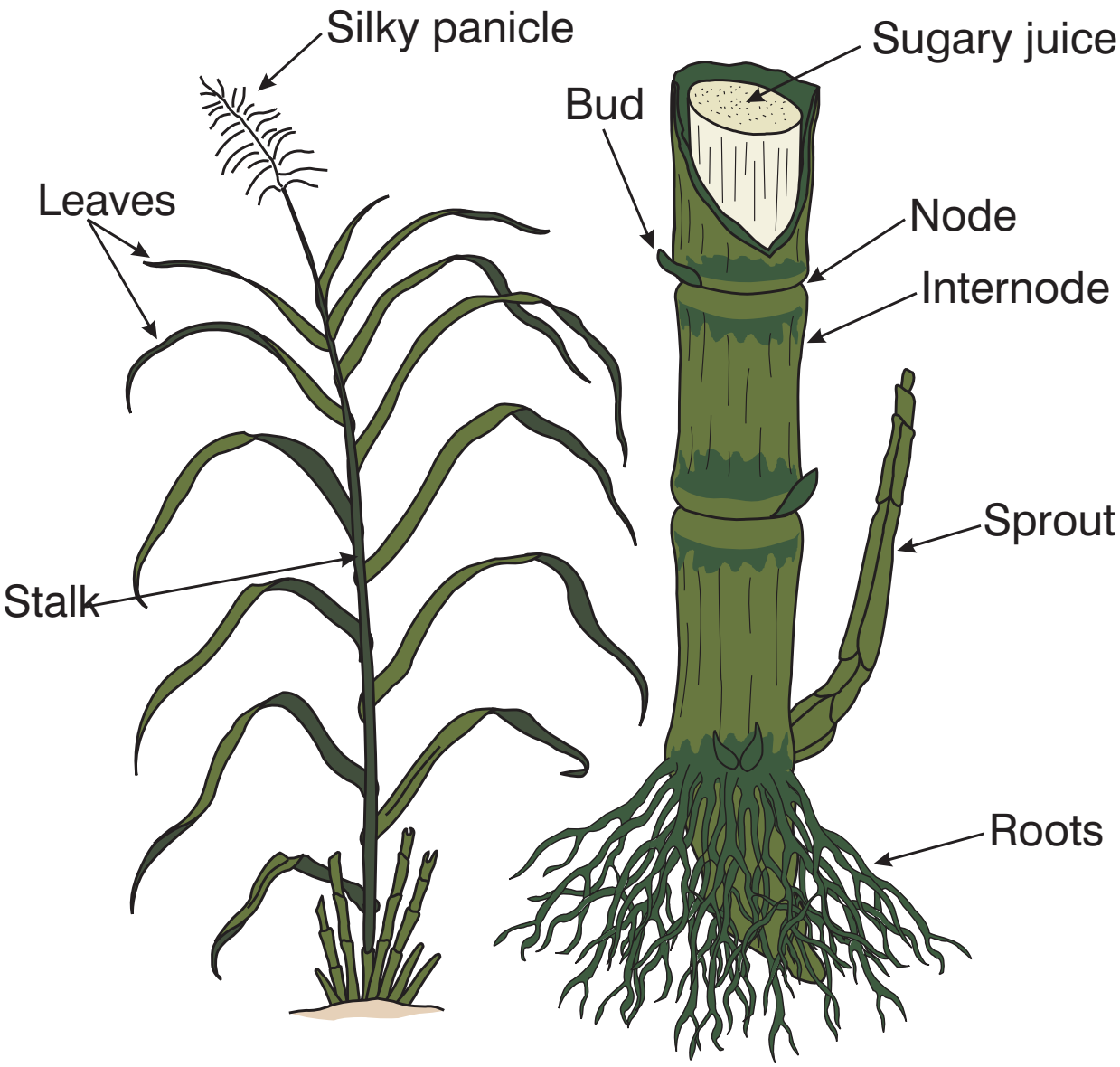
Sugar cane—

- Member of the grass family
- In the United States, grown primarily in Hawaii and southern states
- Grown from sections of stalk, called sets, planted in trenches
- Sugar is stored in the stem of the plant
- May be harvested by hand or with a machine

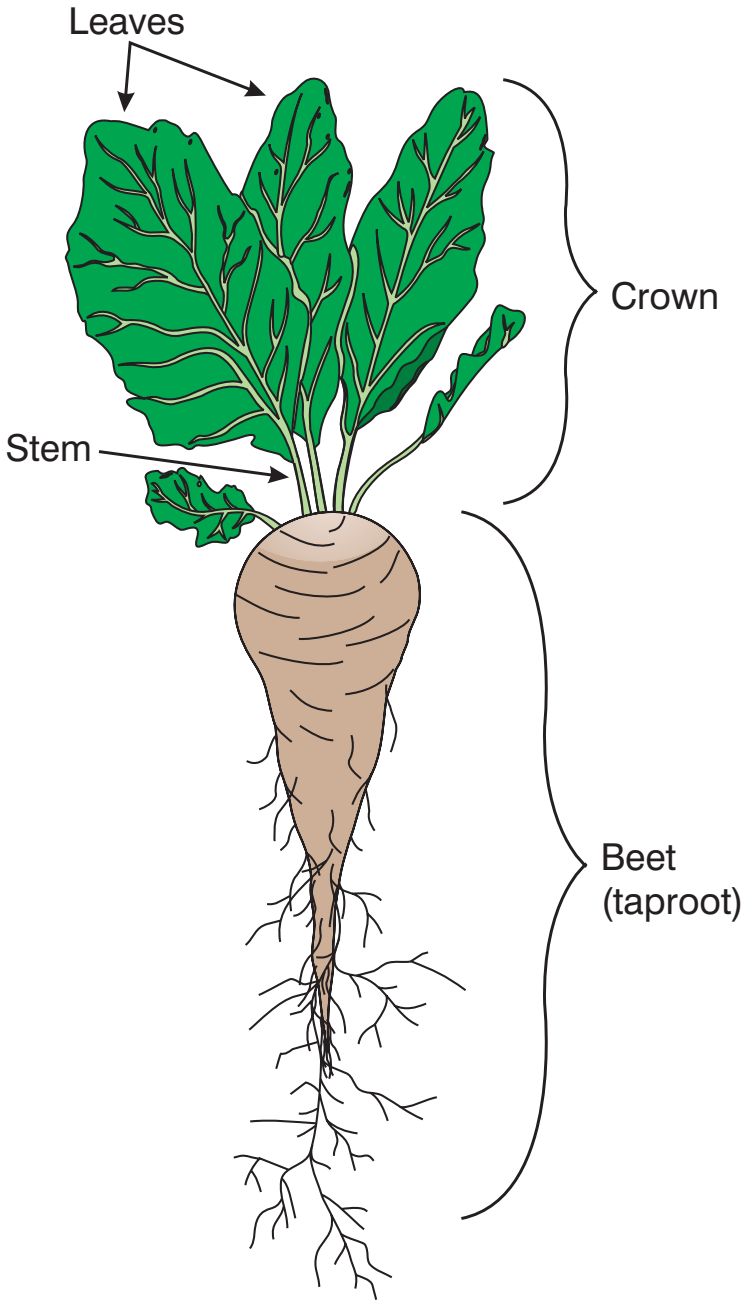
Sugar beets—

- They are vegetables
- In the United States, grown in the western states and the Upper Midwest
- Grown from seeds
- Sugars accumulate in the taproot
- Growing season is approximately five months
- Harvested by a machine that cuts off the tops and lifts the beets from the soil

STRUCTURE OF A SUGAR CANE STALK



MAJOR PARTS OF A SUGAR BEET PLANT



SOYBEAN HISTORY

- 5,000 years ago—discovered in Northeast China
- 1804—came to America as ship weight
- 1898—U.S. Department of Agriculture was encouraging farmers to grow soybeans for livestock feed
- 1904—George Washington Carver began to discover new ways to use soybeans other than as livestock feed
- 1920—the combine was first used to harvest soybeans
- 1922—the first soybean processing plant in the United States opened
- 1940—Henry Ford produced a car using soy plastic

(Courtesy, Agricultural Research Service, USDA)

(Courtesy, Agricultural Research Service, USDA)

SOYBEAN USES

Edible

- Baby food
- Candy
- Baby formula
- Noodles
- Cereal
- Lunchmeat
- Medicines
- Soy sauce
- Soy milk
- Tofu
- Hot dogs

Non-edible

- Adhesives
- Cosmetics
- Paints
- Soap
- Crayons
- Biodiesel
- Environ
- Cleaning materials
- Ink
- Pet food
- Shampoo
- Candles
- Livestock feed

TYPES OF PEANUTS

Runner peanuts—

- Kernels are uniform in size
- Over half are used for peanut butter
- Grown in Alabama, Florida, and Georgia

Spanish peanuts—

- Smallest kernels
- Used in peanut candies
- Higher oil content than other types of peanuts
- Grown in Oklahoma and Texas

Valencia peanuts—

- Three or more kernels per pod
- Sweetest taste of all types of peanuts
- Mainly roasted and sold in their shell or boiled
- Grown in New Mexico

Virginia peanuts—

- Largest kernels
- Mainly roasted and sold in or out of the shell
- Grown in North Carolina, South Carolina, and Virginia

CANOLA USES

Edible Uses

- Cooking oil
- Salad oil
- Mayonnaise
- Margarine

Non-edible Uses

- Cosmetics
- Pesticides
- Suntan oil
- Soap
- Paint
- Varnish
- Birdseed
- Livestock feed

SUNFLOWER USES

Edible Uses

- Food
- Cooking oil

Non-edible Uses

- Soap
- Candles
- Birdseed
- Ornamental plants

Name _____

SUGAR SAMPLING

Materials

- ✓ Sample of cane sugar
- ✓ Sample of beet sugar
- ✓ Sample of brown sugar
- ✓ Sample of molasses
- ✓ Sample of sugar substitute

Directions

1. Look at the samples and record their appearance in the Data Table.
2. Touch the samples and record their texture in the Data Table.
3. Smell each of the samples and record your findings in the Data Table.
4. Taste a small amount of each of the samples and record their flavor in the Data Table.
5. Write a short paper about the similarities and differences of the samples based on the information you gathered.

Data Table

	Look	Feel	Smell	Taste
Cane sugar				
Beet sugar				
Brown sugar				
Molasses				
Sugar substitute				

Name _____

SOYBEAN HISTORY

Number these important events in U.S. soybean history in the order that they occurred (1–7).

_____ Henry Ford produced a car using soybean plastic.

_____ Soybeans first came to America as weight in a ship.

_____ Combines were first used to harvest soybeans.

_____ George Washington Carver began discovering new uses for soybeans.

_____ Soybeans were discovered in Northeast China.

_____ The first soybean processing plant in the United States opened.

_____ The United States Department of Agriculture encouraged farmers to grow soybeans for livestock feed.

SOYBEAN HISTORY KEY

The order should be as follows:

7	(1940)	Henry Ford produced a car using soybean plastic.
2	(1804)	Soybeans first came to America as weight in a ship.
5	(1920)	Combines were first used to harvest soybeans.
4	(1904)	George Washington Carver began discovering new uses for soybeans.
1	(5,000 years ago)	Soybeans were discovered in Northeast China.
6	(1922)	The first soybean processing plant in the United States opened.
3	(1898)	The United States Department of Agriculture encouraged farmers to grow soybeans for livestock feed.

Name _____

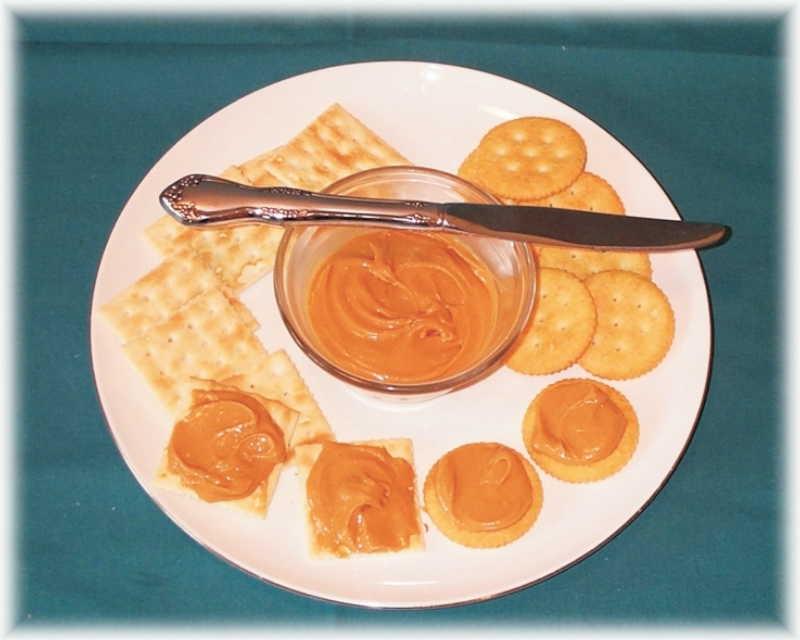
HOMEMADE PEANUT BUTTER

▶ Materials

- ✓ 1 cup salted, roasted peanuts
- ✓ 1½ teaspoons peanut oil
- ✓ Blender
- ✓ Spoon

▶ Directions

1. Place the peanuts and the peanut oil in the blender and put the top on.
2. Blend for about three minutes.
3. Take the top off the blender and scrape the sides of the blender with the spoon to push the peanuts to the bottom of the blender.
4. Put the top back on the blender and blend for about three more minutes.
5. Scoop out the peanut butter and spread it on crackers or bread. Enjoy!



Name _____

SUNFLOWER STATISTICS

1. Over the last five years, Kansas has harvested the following number of acres of soybeans: 168,000; 323,000; 229,000; 267,000; 175,000. What is the acreage difference between the year with the most acres and the year with the least acres?

2. In 2002, Texas planted 12,000 acres of oil sunflowers and 30,000 acres of non-oil sunflowers. What percentage of the total acres of sunflowers planted was non-oil?

3. In 2002, North Dakota harvested a total of 1,315,000 acres of sunflowers. Of those, 1,105,000 were oil sunflowers. How many were non-oil?

4. In South Dakota in 2002, 535,000 acres of sunflowers were planted. Only 375,000 acres of sunflowers were harvested. What percentage of the acres planted were harvested?

SUNFLOWER STATISTICS KEY

1. 155,000
2. 71%
3. 210,000
4. 70%

Lesson C–4

FIBER CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit C. Plant Science

Lesson 4. Fiber Crops

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand what kenaf is and how it is used.
2. Name products that are made from industrial hemp.
3. Give examples of products made from flax.
4. Explain how cotton is grown and processed into products for human use.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Unraveling Fibers: More Than Just Clothes AgriLearning Kit

L'Hommediue, Arthur John. *From Plant to Blue Jeans.* Danbury, Connecticut: Children's Press, 1997.

Keller, Patricia A. and Francis X. McCall, Jr. *Unraveling Fibers.* New York, New York: Atheneum Books for Young Readers, 1995.

Tractors, Cotton-Pickers and the Stuff Kids Wear. Just Our Size Videos, 1995.

www.fabrics.net

www.cotton.org

www.cottonsjourney.com

www.hempindustries.org

www.thehia.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Fabric samples from plant, animal, and synthetic sources
- ✓ Magnifying glass
- ✓ Cotton bolls or cotton balls

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Boll
- ➤ Linters
- ➤ Retting

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Bring fabric samples from plant, animal, and synthetic sources. Ask the students to examine the items by touching them and looking at them with a magnifying glass. Then have the students classify the items into the three categories (you may want the*

students to figure out the three categories without help). After the students classify the fabric samples, bring out samples of paper, paper money, animal bedding, and a diaper. Ask the students which category these items would fit in (plant fibers).

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand what kenaf is and how it is used.

Anticipated Problem: What is kenaf? How can it be used?

I. Kenaf is an annual non-wood crop related to okra and cotton. It has many uses that are similar to trees.

A. Kenaf grows from seed.

B. It can grow 12 to 14 feet tall in four to five months.

C. Kenaf is native to Central Africa.

D. Kenaf grows well in the southern and southwestern United States.

E. In Africa, kenaf leaves are used in animal and human diets. The stalks are burned for fuel.

F. Kenaf has two fiber types.

1. The bast, the outer fiber type, makes up 40 percent of the kenaf plant.
2. The core, the inner fiber type, makes up the remaining 60 percent of the kenaf plant.

G. Kenaf fibers can be used for all types of paper, construction materials, packing materials, animal bedding, and oil and chemical absorbents.

H. Young kenaf plants can be used for animal forage.

I. To harvest kenaf, the plant is cut at 12 feet and laid out in rows to dry. The semi-dry stalks are picked up after 10 days and cut into 1-foot pieces that are taken to a fiber yard for storage.

J. Kenaf fibers can be separated by a machine, like a cotton gin, or by ***retting*** (soaking) until the fibers separate easily.

K. In 1977, the *Peoria Journal Star* from Peoria, Illinois, was the first newspaper printed on kenaf paper.

Use TM: C–4A to discuss some of the products kenaf can be used to produce. Use WS: C–4A to have the students explore more uses for kenaf.

Objective 2: Describe products that are made from industrial hemp.

Anticipated Problem: What are some ways that industrial hemp can be used?

II. Industrial hemp can be made into many products.

A. History—

1. Until the late 1800s, almost all cloth and paper was made from hemp.
2. The first American Flag was sewn from hemp.
3. The *Declaration of Independence* was drafted, but not written, on hemp paper.
4. In the 1930s, a new machine called a decorticator was invented to strip hemp fiber from the stalk (it worked like a cotton gin).
5. During World War II, the U.S. Department of Agriculture encouraged hemp production for lines and riggings for the Navy fleet.
6. After World War II, hemp production declined again.
7. In 1994, Canada harvested its first industrial hemp crop after more than 50 years of prohibition.
8. In 1999, Hawaii got a hemp permit for an experimental plot. It was the first in 40 years and has since been renewed.

B. Production—

1. Hemp can grow in all 50 states.
2. It grows 5 to 16 feet tall in four months.
3. Three raw materials are produced from hemp.
   a. Hemp fiber makes up 20 percent of the stalk and can be made into textiles, cordage, and paper.
   b. Hurds make up 80 percent of the stalk and can be made into paper, particle board, plastic, and animal bedding.
   c. Hemp seed is 30 percent oil. That oil is used for food, fuel, paint, lubricants, and varnish. Seed cakes are left after oil extraction and can be used to supplement wheat flour or can be eaten as a snack, like sunflower seeds, or used in birdseed.

Use TM: C–4B to discuss some of the products hemp can be used to produce. Use WS: C–4B to have the students explore more uses for hemp.

Objective 3: Give examples of products made from flax.

Anticipated Problem: How is flax used?

III. Both fiber and seed from the flax plant are processed into products.

A. Flax is grown from seed.

B. It is planted in spring and harvested in late July or August. In the southeastern United States, flax is planted between October and December, depending on the climate of the area.

C. Flax grows to maturity in 90 to 180 days.

D. Depending on the variety, the flax plant grows from 12 to 48 inches high.

E. Most U.S. flax is grown in North Dakota, South Dakota, Minnesota, and Wisconsin.

F. Flax was grown in North America as early as 1626 and was probably the most important textile fiber crop until the invention of the cotton gin.

G. To harvest flax, the plants are either pulled up by the roots or cut with a drum mower. In either case, the flax is laid out to dry. After it is dry, the flax is deseeded and then soaked, or retted, to release individual fibers. After retting, the flax is cut in a mechanical turbine to extract fibers.

H. Flax fiber is used to make linen cloth. Flax seed can be made into linseed oil, linoleum, flour, and oil for animal and human foods.

Use TM: C–4C to discuss some of the products flax can be used to produce. Use WS: C–4C to have the students explore more uses for flax.

Objective 4: Explain how cotton is grown and processed into products for human use.

Anticipated Problem: How is cotton grown and used?

IV. Cotton is an important crop. Both the fiber and seeds from cotton are used to produce many products.

A. History—

1. Cotton has been grown for at least 7,000 years.
2. Cotton was first planted in Florida in 1556 and in Virginia gardens in 1607.
3. In 1641, cotton textile manufacturing began in England.
4. In 1793, Samuel Slater emigrated and established the first successful U.S. cotton yard in Rhode Island.
5. Eli Whitney patented the cotton gin in 1793.
6. In 1813, the world's first factory to produce cotton yarn and cloth by machines all under one roof was begun.

B. Fiber production—

1. Cotton is the leading U.S. cash crop.
2. Cotton is grown from seed.
3. Cotton is planted anywhere from February to June, depending on the climate of the area.
4. Although it is grown in 17 states, there are 14 major cotton-producing states—Alabama, Arizona, Arkansas, California, Georgia, Louisiana, Mississippi, Missouri, New Mexico, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas.
5. The cotton growing season is 150 to 180 days.
6. Cotton fibers grow inside a ***boll***, the pod or capsule of the cotton plant.
7. Each cotton boll contains approximately 28 to 35 cotton seeds.
8. After the bolls break open, the cotton is harvested with a cotton-picker.
9. After harvest, cotton is stored in modules and then transported to the gin where it is sucked into the building through pipes.
10. The seed and lint (cotton fibers) are separated and the lint is pressed into bales and taken to the textile mill.
11. At the mill, the lint is cleaned and mixed and goes to a carding machine to be cleaned further.
12. After carding, the combing machine finishes cleaning and straightening the fiber and twists it into a rope called a sliver.
13. The sliver goes through a drawing frame and a slubber to pull the soft rope and begin twisting it.
14. The spinning frame winds cotton yarn onto bobbins.
15. The cotton yarn is turned into fabric on looms.
16. After it is woven, the fabric is sent to a finishing plant to be bleached, pre-shrunk, dyed, and printed before being turned into clothing or other products.
17. A bale of cotton weighs approximately 480 pounds and can make 249 bed sheets, 3,085 diapers, 215 pairs of jeans, 4,321 socks, 2,104 boxer shorts, 1,256 pillowcases, 1,217 T-shirts, or 313,600 one hundred dollar bills.
18. For every 100 pounds of cotton, there is 165 pounds of cotton seed.
19. ***Linters***, the short fuzz on the cotton seed, are used for plastics, explosives, paper products, padding for furniture, mattresses, and car cushions.
20. Cotton seed oil is used for shortening, cooking oil, and salad dressing.
21. Cotton seed meal and hulls are used for fertilizer as well as feed for livestock, poultry, and fish.

Use TM: C–4D and TM: C–4E to discuss some information about cotton. Use WS: C–4D to have the students explore more uses for cotton. You may want to have students hand-gin cotton bolls and practice twisting cotton fibers into yarn. If cotton bolls aren't available, students may use cotton balls to twist fibers.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: C–4A, WS: C–4B, WS: C–4C, WS: C–4D, and WS: C–4E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. a
3. c

Fill-in-the-Blank

1. Central Africa
2. hemp
3. fiber, seed
4. 480

Short Answer

1. Answers will vary. Use Objective 1 to score this question.
2. Answers will vary. Use Objective 2 to score this question.
3. Answers will vary. Use Objective 3 to score this question.
4. Answers will vary. Use Objective 4 to score this question.

Test C–4

Name_____

FIBER CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. linters
b. retting
c. boll

_____1. Soaking fiber crops like kenaf and flax to separate fibers.

_____2. Short fuzz on cotton seed.

_____3. The part of the cotton plant that contains the cotton fiber and seeds.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Kenaf is native to _____ _____.
2. The first American Flag was sewn from _____.
3. Both _____ and _____ from the flax plant are processed into products.
4. A bale of cotton weighs approximately _____ pounds.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name two products that can be made from kenaf.

2. Name two products that can be made from industrial hemp.

3. Name two flax products.

4. Name two cotton products.

KENAF PRODUCTS

- All types of paper
- Construction materials
- Packing materials
- Animal bedding
- Oil and chemical absorbents

(Courtesy, Agricultural Research Service, USDA)

HEMP PRODUCTS

- Fiber
- Paper
- Particle board
- Plastic
- Animal bedding
- Oil
- Food
- Fuel
- Paint
- Lubricants
- Varnishes
- Seed cakes
- Birdseed
- Wheat flour supplement

FLAX PRODUCTS

- Fiber
- Linen cloth
- Seed
- Linseed oil
- Linoleum
- Flour
- Oil for animal and human use

A BALE OF COTTON CAN MAKE...

- 249 bed sheets
- 3,085 diapers
- 215 pairs of jeans
- 4,321 socks
- 2,104 boxer shorts
- 1,256 pillowcases
- 1,217 T-shirts
- 313,600 one hundred dollar bills

FROM COTTON TO FABRIC

- After the bolls break open, cotton is harvested with a cotton-picker.
- Cotton is stored in modules before being transported to the cotton gin.
- Seed and lint is pressed into bales to go to the textile mill.
- The lint is cleaned and mixed and is carded to further clean it.

- The combing machine finishes cleaning and straightening fiber and twists it into a sliver.
- After the sliver goes through a drawing frame and a slubber to pull it and begin twisting it, a spinning frame winds it into cotton yarn.
- The yarn is turned into fabric on looms.
- After being woven, it is sent to a finishing plant to be bleached, pre-shrunk, dyed, and printed before being turned into clothing or other products.

Name _____

KENAF PRODUCTS

Using the information you learned in this lesson, the Internet, and other resource materials, list 10 products that come from some part of the kenaf plant.

Name _____

HEMP PRODUCTS

Using the information you learned in this lesson, the Internet, and other resource materials, list 10 products that come from some part of the hemp plant.

Name _____

FLAX PRODUCTS

Using the information you learned in this lesson, the Internet, and other resource materials, list 10 products that come from some part of the flax plant.

Name _____

COTTON PRODUCTS

Using the information you learned in this lesson, the Internet, and other resource materials, list 10 products that come from some part of the cotton plant.

Name _____

FIBER CROP MATH

1. If the bast fibers of kenaf account for 40% of the plant and the core, or inner fibers, make up the rest, what percentage is the core?

2. You have five separate areas of your farm planted with flax: 540 acres, 50 acres, 112 acres, 260 acres, and 326 acres. How many total acres of flax do you have?

3. Hemp fiber makes up 20 percent of the hemp stalk and hurds make up 80 percent of the hemp stalk. If you have 520 pounds of hemp stalk, how many pounds are fiber and how many pounds are hurds?

4. If for every 100 pounds of cotton, there is 165 pounds of cotton seed, figure the following:

   a. There are 500 pounds of cotton, how many pounds of cotton seed are there?

   b. There are 600 pounds of cotton, how many pounds of cotton seed are there?

FIBER CROP MATH KEY

1. 60%
2. 1,288 acres
3. hemp fiber = 104 pounds; hurds = 416 pounds
4. a. 825 pounds
   b. 990 pounds

Lesson C–5

FORESTS AND WOOD PRODUCTS

Indiana Agricultural Literacy Lesson Plan Library

Unit C. Plant Science

Lesson 5. Forests and Wood Products

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe what a forest is and why forests are important to the environment.
2. Identify and explain the difference between the three types of forests.
3. Give examples of products that come from trees.
4. Understand what pulp is and how it is made.
5. Summarize the process used to make maple syrup.
6. Distinguish between hardwood and softwood trees and give examples of each.
7. Understand the year-round processes involved in Christmas tree farming.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Camp, William G., and Thomas B. Daugherty. *Managing Our Natural Resources.* Albany, New York: Delmar Publishers, 1997.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Department of Natural Resources District Forester

Soil and Water Conservation District Representative

Project Learning Tree Activity Guide

www.fw.vt.edu/dendro/wwwmain.html

www.aces.edu/N4HFI/

www.safnet.org/education/learn.cfm

www.afanpa.org

www.jmg.tamu.edu

www.juniormastergardener.tamu.edu

www.oplin.lib.oh.us/products/tree

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Cellulose
- ➤ Commercial forests
- ➤ Cord
- ➤ Forest
- ➤ Native forests
- ➤ Transpiration
- ➤ Urban forests

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Stimulate prior knowledge by asking students to list 10 ways that they use wood products in their daily lives. See if the students can determine what part of the tree was used to make the product (sap, bark, cellulose, or wood). Use this discussion to lead into the content of the lesson.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1:

Describe what a forest is and why forests are important to the environment.

Anticipated Problem: What is a forest and why are forests important to the environment?

I. A ***forest*** is a community of trees, plants, and animals that live together and benefit from each other. Forests are beneficial to the environment in many ways.

A. Trees and other plants in the forest help recycle by absorbing nutrients through their roots. As things like leaves, twigs, dead animals, and dead insects decompose (break down), they become new nutrients for the trees and plants.

B. Trees help cool the environment in ways other than by shading. Through a process called ***transpiration***, water is absorbed by the roots, used in the tree, and expelled by the leaves. This water release lowers the temperature in the area.

C. Animals inhale oxygen and exhale carbon dioxide. Trees and other plants balance out this process by taking in and using carbon dioxide and giving off fresh oxygen for animals to use. This is a continual process.

D. The roots of trees and other plants not only anchor the plants but also help to keep the soil in place. When trees are grown near water sources, they help control erosion and cool water temperature, which contributes to clean drinking water.

E. Everything needs a place to live. Without forests, many types of wildlife, from the microscopic to human-sized or larger, would be homeless.

> *Use TM: C–5A to discuss forests and the ways that they benefit the environment. If possible, take a trip to a local forest and allow students to examine the community of trees, plants, and animals that live there.*

Objective 2: Identify and explain the difference between the three types of forests.

Anticipated Problem: What are the three types of forests?

II. Although forests come in all shapes and sizes and share the same basic characteristics, there are subtle differences in where they are and how they ended up there. There are three main types of forests to consider.

A. ***Native forests*** are areas where trees grow voluntarily. Examples of native forests would be standing timber on farm ground, state park areas, wildlife refuge areas, and conservation reserve areas.

B. ***Commercial forests*** are places where trees are grown, harvested, and sold specifically to make wood products. Examples of commercial forests would be Christmas tree farms, tree nurseries, or forests owned by a lumber mill that replaces harvested trees with newly planted trees.

C. ***Urban forests*** are areas in cities or towns where trees are planted and cared for. Examples of urban forests would be beautification areas or trees used for landscaping in a park.

Use TM: C–5B to discuss the different types of forests.

Objective 3: Give examples of products that come from trees.

Anticipated Problem: What are some products that we get from trees?

III. Trees are very important to the everyday life of most people. If we took away all of the things humans use every day that come from trees, life would be much different.

A. Examples of things humans get from the sap of trees are soap, paper dyes, printing ink, wax, chewing gum, fireworks, sugar and syrup, crayons, varnish, and shoe polish.

B. Examples of things humans get from the bark of trees are cork, tannin (for curing leather), drugs and oils, and dye.

C. Examples of things humans get from the ***cellulose*** (cell walls of trees) of trees are cellophane, rayon fabric, shatterproof glass, suntan lotion, toilet paper, wrapping paper, wallpaper, and books.

D. Examples of things that humans get directly from wood are furniture, toothpicks, pencils, and spools.

1. A ***cord*** of wood is 4 feet × 4 feet × 8 feet and was once the measurement used to sell pulpwood.
2. From a cord of wood, you could make each of the following: 7,500,000 toothpicks; 945 one-pound books; 460,000 personal checks; 1,200 copies of *National Geographic* magazine; 2,700 copies of the average (35-page) daily newspaper; 61,370 business-size envelopes; 30 rocking chairs; or 12 dining room tables that seat eight people.

Use TM: C–5C through TM: C–5G to discuss the content of this objective. Use WS: C–5A to have students create a collage of products they use that come from trees. You may also have the class help measure out a cord of wood either in the classroom or outside in the schoolyard.

Objective 4: Understand what pulp is and how it is made.

Anticipated Problem: Where does pulp come from and how is it made?

IV. ***Pulp*** comes from grinding and using chemicals to break apart the fibers that make wood strong. Trees go through a process before the pulp can be used to make paper and paper products.

A. Logs are cut and debarked.
B. Logs are sent through a series of chippers to break them into smaller fragments.
C. These small fragments are pressure cooked with chemicals in a digester (large vat) to separate fibers.
D. Wood pulp is cleaned, refined, and bleached.
E. Pulp is run through beaters until it is a fine slush.
F. Additives (color, texture) may be added.
G. The slush is pumped onto a large screen, the beginning of a continuous piece of paper.
H. Water is removed from the paper and purified before it is returned to the stream or river.
I. As excess water is drained, the crude paper is called a web.
J. The web is squeezed through rollers to insure uniform size and thickness and to remove any leftover water.
K. Paper is rolled onto parent rolls that may be 30 feet wide and weigh 25 tons.
L. Parent rolls are cut down and products (paper, envelopes, facial tissue, toilet tissue, books, and wallpaper) are packaged for shipment.

Use TM: C–5H to discuss the process trees go through before the pulp can be used to make paper and paper products. Use WS: C–5B to make recycled paper in class. You may have students turn their paper into a card or other art project they can take home.

Objective 5: Summarize the process used to make maple syrup.

Anticipated Problem: How is maple syrup made?

V. Maple trees are a great source of one of the best complements to pancakes and waffles—maple syrup! There are many steps involved in getting maple syrup from the tree to the table.

A. Maple trees accumulate starch.

B. When the weather starts to warm, the starch turns to sugar.

C. The sugar mixes with absorbed groundwater to form sap.

D. Sap begins to flow because of pressure changes in the tree due to the weather fluctuating between freezing at night and thawing during the day.

E. Since there is no set time to begin harvesting sap, the producer must be aware of nature's clues.

F. Tapping trees is the first step to maple syrup.

1. Trees must be 10 inches in diameter before they can be tapped. Trees also need to be healthy.
2. A $^{7}/_{16}$ inch diameter hole must be drilled 3 inches deep in order to tap the tree. The hole is usually drilled away from recent tap holes and at about waist height.

G. If trees are tapped when they are healthy and tapped correctly, the process does not hurt the tree. In fact, healthy trees may provide sap for more than 100 years.

H. Most trees are capable of being tapped one or two times per year.

I. There are two main systems for collecting sap from a tapped tree.

1. With the bucket or bag method, after the tree is tapped, a spout is inserted into the drill hole with the bucket or bag suspended from it.
   a. Buckets used for sap collecting have special lids to keep out the rain that can dilute the sap and falling debris that can disturb the flavor.
   b. When the sap begins to run, the buckets or bags must be emptied every few hours so that the sap doesn't spoil.
   c. Buckets or bags of sap are emptied into gathering tanks and transferred to the sugarhouse.
2. With the tubing collection system, sap drips through a spout in the tapped tree to a plastic tube. The plastic tubes from each tree are joined to a "mainline" that carries the sap down to a storage tank either at the sugarhouse or to a tank where it will be taken to the sugarhouse.

J. Regardless of the collection method, all sap is transformed into syrup using an evaporator.

1. Heat is necessary to run the evaporator. Sources of heat include wood, oil, gas, or steam.
2. As the sap is heated, the water evaporates and the liquid becomes sweeter.

3. The sap that comes from the tree is about 98 percent water and 2 percent sugar. After the sap is turned into syrup, it is only about 33 percent water and 67 percent sugar. It takes approximately 40 gallons of sap to make 1 gallon of syrup.

K. After leaving the evaporator, the syrup is filtered, packaged, and sold.

Use TM: C–5I to summarize the maple syrup production process. Use WS: C–5C to have students rate four different kinds of syrup. Make sure that the students do not see the labels on the syrup so that brand names do not influence their decisions.

Objective 6: Distinguish between hardwood and softwood trees and give examples of each.

Anticipated Problem: What are hardwood and softwood trees and what are some examples of each?

VI. All trees fall into one of these two categories: hardwood or softwood. Hardwood and softwood trees can be found in all 50 states. A person can look at a tree and usually be able to determine which category it fits in.

A. Hardwood trees—
   1. Have leaves
   2. Seeds are usually found in fleshy fruits or nuts
   3. Most are ***deciduous*** (lose their leaves in the fall)
   4. Examples: white ash, balsa, chestnut, Dutch elm, hickory, mahogany, maple, red oak, sycamore, and black walnut

B. Softwood trees—
   1. Have needles
   2. Seeds are usually found in cones or woody fruits
   3. Most are ***evergreen*** (keep their needles year-round)
   4. Examples: Douglas fir, larch, pine, European redwood, yew, and yellow cedar

Use TM: C–5J to discuss the differences between hardwood and softwood trees. Use TM: C–5K and TM: C–5L to illustrate some examples of hardwood and softwood trees. Use WS: C–5D to have students collect and identify leaves. Combine all of the students' worksheets into a book of leaves. Use the Internet, reference books, or other resources to help the students identify their samples. (A good web site might be www.oplin.lib.oh.us/products/tree/)

Objective 7: Understand the year-round processes involved in Christmas tree farming.

Anticipated Problem: What are the processes involved in Christmas tree farming?

VII. Christmas tree farmers have many decisions to make throughout the year regarding their crop. A lot of planning, patience, and hands-on work go into Christmas trees.

A. When a person decides to begin a Christmas tree farm, the first thing he or she must understand is that, on average, the trees will need to grow for seven years before they can be harvested.

B. The Christmas tree farmer must do research to determine which varieties and sizes of trees to order and plant. The size and variety will determine what the farmer's cost is per tree. When ordering trees, farmers need to take into consideration that white pine and scotch varieties grow relatively fast (1 foot per year) and that fir varieties grow slower, so the price the customer pays will be more.

C. After a harvest, three to five trees will need to be planted for every tree that is cut down. These new trees need to be planted in March or April.

D. The farmer must check the trees for damage from insects and other pests continuously during the spring and summer. It is helpful if the farmer understands the life cycles of the insects that can be harmful to the trees.

E. June is when shearing takes place. Shearing is when the farmer cuts off parts of the tree in order to shape it into the desired conical shape. Shearing can only begin once the candles (new growth) have hardened off.

F. Throughout the spring and summer, the grass and weeds around the trees must be mowed.

G. During the late spring and early summer after a harvest, the old stumps must be removed and the holes filled with soil.

Use TM: C–5M to discuss the processes involved in Christmas tree farming. Use WS: C–5E to help students become more familiar with the Christmas tree farming process.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: C–5A, WS: C–5B, WS: C–5C, WS: C–5D, and WS: C–5E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. f
3. d
4. g
5. a
6. c
7. e

Fill-in-the-Blank

1. sap
2. deciduous
3. evergreen
4. Shearing
5. Pulp

Short Answer

1. Answers will vary. Use Objective 3 to score this question.
2. Answers will vary. Use Objective 3 to score this question.
3. Answers will vary. Use Objective 3 to score this question.
4. Answers will vary. Use Objective 3 to score this question.

Test C–5

Name_____

FORESTS AND WOOD PRODUCTS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. forest
b. transpiration
c. cellulose
d. cord
e. commercial forest
f. urban forest
g. native forest

_____1. A process by which water is absorbed through the roots, used in the tree, and expelled by the leaves.

_____2. The type of forest found in cities.

_____3. This measures 4 feet × 4 feet × 8 feet.

_____4. This type of forest is where trees grow voluntarily.

_____5. A community of trees, plants, and animals living together.

_____6. The cell walls of trees.

_____7. The type of forest in which trees are grown, harvested, and sold for use.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Maple trees are tapped for their _____ to make syrup.
2. Most hardwood trees are _____, meaning they lose their leaves in the fall.
3. Most softwood trees are _____, meaning they keep their needles year round.
4. _____ is when the farmer cuts off parts of the tree in order to shape it into the desired conical shape.
5. _____ comes from grinding and using chemicals to break apart fibers that make wood strong.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name two things humans get from the sap of trees.

2. Name two things humans get from the bark of trees.

3. Name two things humans get from the cellulose of trees.

4. Name two things humans get directly from the wood of trees.

BENEFITS OF FORESTS

- Trees and other plants in the forest help recycle by absorbing nutrients through their roots.
- Trees help cool the environment.
- Trees and other plants take in and use carbon dioxide and give off fresh oxygen for animals to use.
- The roots of trees and other plants help control erosion.
- Forests provide homes for many types of wildlife.

TYPES OF FORESTS

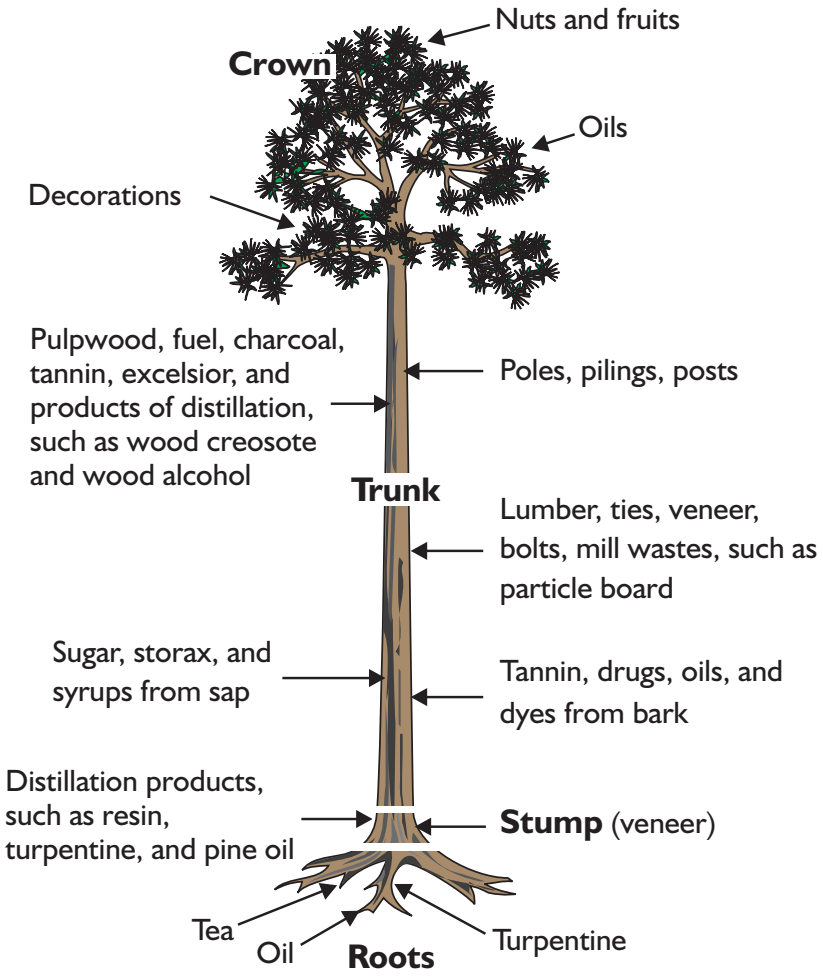
- Native forests are areas where trees grow voluntarily. Examples: standing timber on farm ground, state park areas, wildlife refuge areas, conservation reserve areas.
- Commercial forests are places where trees are grown, harvested, and sold specifically to make wood products. Examples: Christmas tree farms, tree nurseries, forests owned by a lumber mill.
- Urban forests are areas in cities or towns where trees are planted and cared for. Examples: beautification areas, trees used for landscaping in a park.

THINGS HUMANS GET FROM THE SAP OF TREES

- Soaps
- Paper dyes
- Printing ink
- Waxes
- Chewing gum
- Fireworks
- Sugar and syrup
- Crayons
- Varnishes
- Shoe polish

THINGS HUMANS GET FROM THE BARK OF TREES

- Cork
- Tannin
- Dye
- Drugs and oils



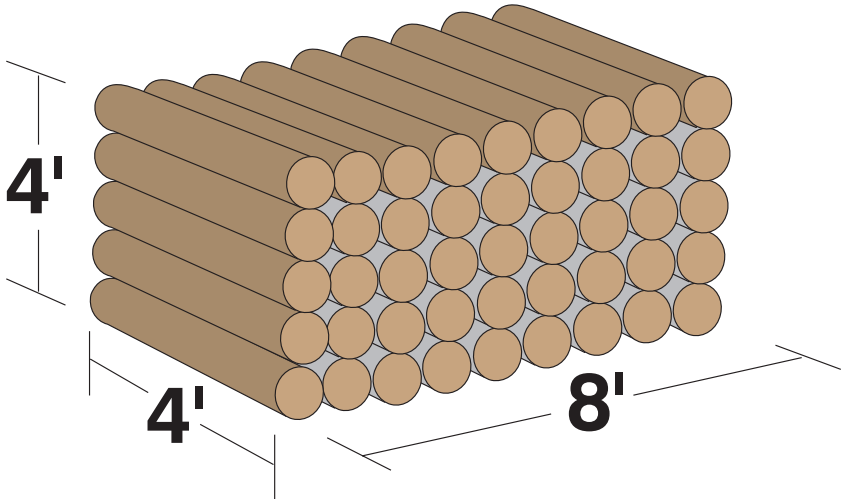
THINGS HUMANS GET FROM THE CELLULOSE OF TREES

- Carpeting
- Cellophane
- Rayon fabric
- Suntan lotion
- Shatterproof glass
- Toilet paper
- Books

THINGS HUMANS GET DIRECTLY FROM WOOD

- Spools
- Pencils
- Chairs
- Desks
- Boards
- Rulers
- Tables
- Ladders
- Toothpicks
- Firewood

A CORD OF WOOD YIELDS...



- 7,500,000 toothpicks
- 945 one-pound books
- 61,370 business-size envelopes
- 460,000 personal checks
- 1,200 copies of *National Geographic* magazine
- 30 rocking chairs
- 2,700 copies of the average (35-page) daily newspaper
- 12 dining room tables that seat eight people

PAPER-MAKING PROCESS

- Logs are cut and debarked.
- Logs are sent through a series of chippers to break them into smaller fragments.
- The small fragments are pressure cooked with chemicals in a digester to separate fibers.
- Wood pulp is cleaned, refined, and bleached.
- Pulp is run through beaters until it is a fine slush.
- Additives are added.
- The slush is pumped onto a large screen.
- Water is removed from the paper and purified.
- The web is squeezed through rollers to insure uniform size and thickness and to remove any left-over water.
- Paper is rolled onto parent rolls that may be 30 feet wide and weigh 25 tons.
- Parent rolls are cut down and products are packaged for shipment.

THE MAPLE SYRUP PROCESS

- Maple trees accumulate starch.
- When the weather starts to warm, the starch turns to sugar.
- The sugar mixes with absorbed groundwater to form sap.
- Sap begins to flow because of pressure changes in the tree due to the weather fluctuating between freezing at night and thawing during the day.
- The trees are tapped to collect the sap.
- The sap is transformed into syrup using an evaporator.
- After leaving the evaporator, the syrup is filtered, packaged, and sold.

HARDWOOD TREES VS. SOFTWOOD TREES

Hardwood trees—

- Have leaves
- Seeds are usually found in fleshy fruits or nuts.
- Most are deciduous
- Examples: white ash, balsa, chestnut, Dutch elm, hickory, mahogany, maple, red oak, sycamore, and black walnut

Softwood trees—

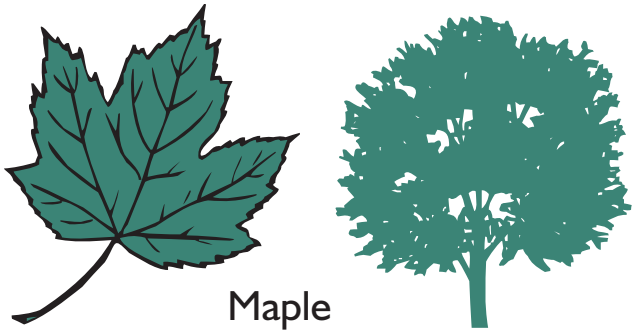
- Have needles
- Seeds are usually found in cones or woody fruits
- Most are evergreen
- Examples: Douglas fir, larch, pine, European redwood, yew, and yellow cedar

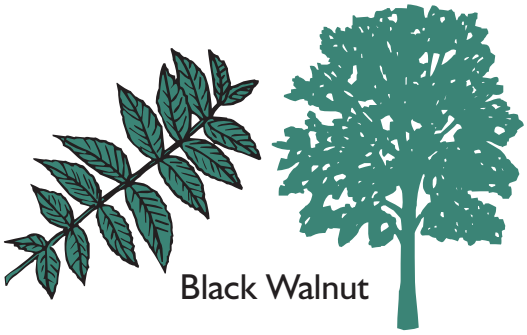
EXAMPLES OF HARDWOOD TREES

- White ash
- Balsa
- Chestnut
- Hickory
- Mahogany
- Maple
- Black walnut


White ash

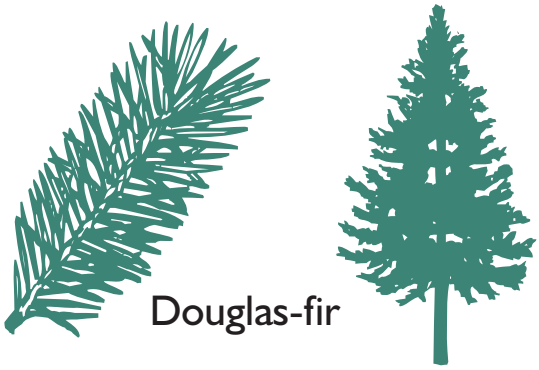

Hickory

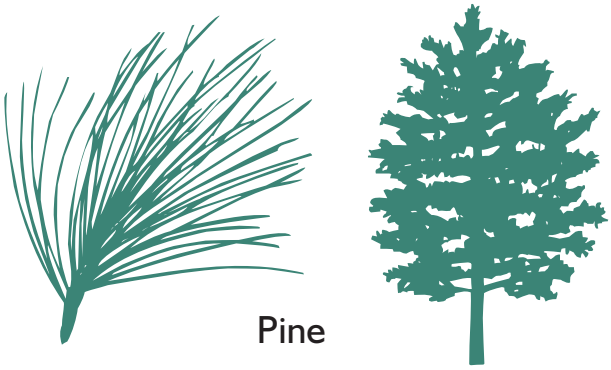

Maple


Black Walnut

EXAMPLES OF SOFTWOOD TREES

- Douglas fir
- Larch
- Pine
- European redwood
- Yew
- Yellow cedar


Douglas-fir


Pine


European redwood

CHRISTMAS TREE FARMING

- On average, trees will need to grow for seven years before they can be harvested.
- Do research to determine which varieties and sizes of trees to order and plant. The size and variety will determine what the production cost per tree will be.
- After a harvest, three to five trees will need to be planted for every tree that is cut down. These new trees need to be planted in March or April.
- Trees must be checked for damage from insects and other pests continuously during the spring and summer.
- June is when shearing takes place.
- Throughout the spring and summer, the grass and weeds around the trees must be mowed.
- During the late spring and early summer after a harvest, the old stumps must be removed and the holes filled with soil.

Name _____

TREE COLLAGE

Materials

- ✓ Magazines and catalogs with pictures of tree products
- ✓ Scissors
- ✓ Glue
- ✓ Poster board

Directions

Make a collage of products that come from trees. If you cannot find a picture you want, draw your own. Cut out the pictures and paste them on some poster board. Combine all of the collages from your class into a bulletin board to show other students all of the products that we get from trees.

Name _____

RECYCLED PAPER

Materials

- ✓ Newspaper
- ✓ Water
- ✓ Square plastic dishpan
- ✓ Screen cut slightly larger than desired paper size with duct tape along all the sharp edges
- ✓ 2 pieces of felt (cut slightly larger than the screen)
- ✓ Rolling pin
- ✓ Drying rack
- ✓ Blender (optional)
- ✓ Iron (optional)

Procedure

1. Tear newspaper into small (less than 1-inch) squares. Add colored paper for variety, if you want.
2. Place the newspaper pieces in the plastic dishpan and add enough warm water to cover the paper.
3. Let the paper soak for 10 minutes.
4. Carefully pour or skim off any excess water which has not been absorbed by the paper, but be sure to leave some water.
5. Blend the mixture to break up the paper pieces. This will make a slurry. (You may use a blender to make the slurry. Make sure there is plenty of water in the blender. You may want to use an old blender, as the slurry makes the blender motor work very hard and it gets very hot.)
6. Dip a screen into the slurry mixture and raise it out of the dishpan.
7. Place one hand on the bottom of the screen while using the other hand to gently press the slurry on the top of the screen, squeezing excess water out of the newspaper.
8. Continue to press and squeeze out water. When most of the water is pressed out by hand, place the "paper" and screen between two pieces of felt cut slightly larger than the screen. Use a rolling pin to squeeze out more water.
9. Place your paper on a drying rack and turn it once a day until it is dry. For faster drying, you may use an iron instead.

Name _____

MAPLE SYRUP TASTE TEST

▶ Materials

- ✓ 4 different types of maple syrup

▶ Directions

1. Based on your preference, rank the color, clearness, thickness, smell, and taste of each syrup sample on a scale from 1 to 5 (1 is the lowest; 5 is the highest) in the Data Table below.
2. Compare your Data Table with the rest of the class. How do your choices match theirs? Do you prefer a different type of syrup?

▶ Data Table

	Sample A	Sample B	Sample C	Sample D
Color				
Clearness				
Thickness				
Smell				
Taste				

WS: C–5D

Name _____

WHAT LEAF IS THIS?

Find a leaf outside and try to identify the tree it came from. Fill in the information below about the tree.

Common Name: _____

Scientific Name: _____

Leaf Characteristics: _____

_____

_____

Fruit Characteristics: _____

_____

_____

Tree Size: _____

Uses: _____

_____

_____

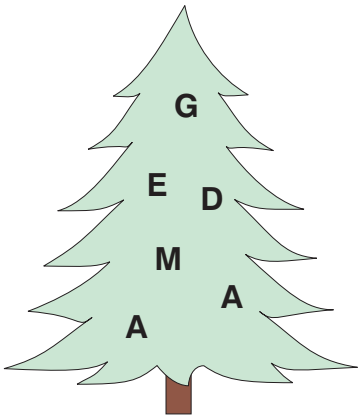
Attach the leaf sample here.

Name _____

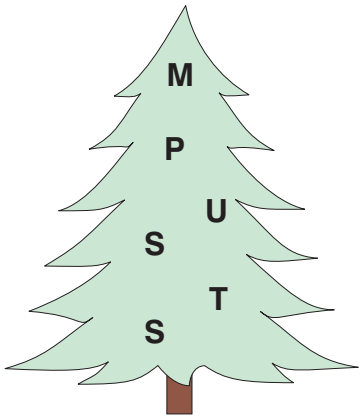
CHRISTMAS TREE FARMING

▶ Directions

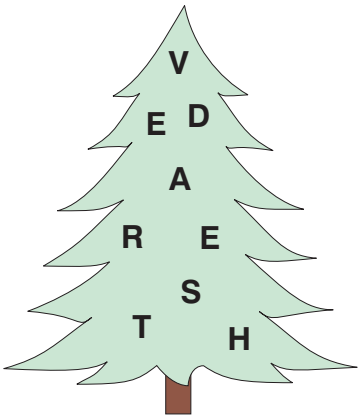
Unscramble the letters in each Christmas tree to create a word that will fill in one of the blanks in the statements below. Write each unscrambled word on the line under its tree and on the line in the statement it completes.



Word: _____



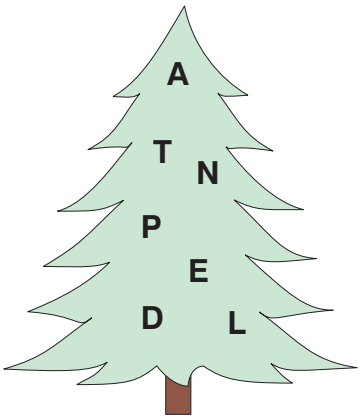
Word: _____



Word: _____

Word: _____

Word: _____



Word: _____

1. On average, Christmas trees will need to grow for seven years before they can be _____.
2. The Christmas tree farmer must do research to determine which _____ and sizes of trees to order and plant.
3. After a harvest, three to five trees will need to be _____ for every tree that is cut down.
4. Trees must be checked for _____ from insects and other pests continuously during the spring and summer.
5. _____ is when the farmer cuts off parts of the tree in order to shape it into the desired conical shape.
6. During the late spring and early summer after a harvest, the old _____ must be removed and the holes filled with soil.

CHRISTMAS TREE FARMING KEY

1. harvested
2. varieties
3. planted
4. damage
5. Shearing
6. stumps

Lesson D–1

HOW PLANTS GROW

Indiana Agricultural Literacy Lesson Plan Library

Unit D. Horticulture Science

Lesson 1. How Plants Grow

Indiana's Academic Standard. **Science:** 4.4.4 — Observe and describe that some source of energy is needed for all organisms to stay alive and grow.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define horticulture.
2. Explain the process of photosynthesis.
3. Name and define three types of tropisms.
4. Explain the environmental requirements needed for plants to grow.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Newton's Apple. www.tpt.org/newtons. Teacher Guides Index

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Various plants from each area of horticulture
- ✓ Paper and a pen or pencil for each group of three or four students

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Chlorophyll
- ➤ Geotropism
- ➤ Glucose
- ➤ Horticulture
- ➤ Photosynthesis
- ➤ Phototropism
- ➤ Thigmotropism
- ➤ Tropisms

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Divide the students into groups of three or four students. Give each group a plant that comes from the horticulture industry. Have the groups come up with ideas on possible processes and/or requirements that are needed for the plant to thrive. Have each group write the ideas on a sheet of paper to be discussed later. Each group should also identify what they believe the horticulture industry is.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define horticulture.

Anticipated Problem: What is horticulture?

I. ***Horticulture*** is an area of agriculture that produces plants for food, comfort, and beauty. Horticulture involves several areas of plant growth, including ornamental crops, vegetable crops, and fruit and nut crops.

A. Ornamental crops are plants that are used for their beauty (flowers, bushes, shrubs, foliage plants, etc.)

B. Vegetable crops are plants that produce vegetables (corn, carrots, beans, etc.)

C. Fruit and nut crops are plants that produce fruits (strawberries, apples, cherries, etc.) and nuts (walnuts, pistachios, pecans, etc.).

Use TM: D–1A through TM: D–1C to cover the content of the objective. Have students discuss additional plants that could be included in each of the three horticulture areas presented on the transparencies. Have students complete WS: D–1A to help them understand how horticulture can affect our daily lives. Have a horticulturalist from your area visit the class to discuss the different types of horticulture products he or she produces and/or the type of work he or she does.

Objective 2: Explain the process of photosynthesis.

Anticipated Problem: How does the photosynthesis process work?

II. Green plants manufacture their own food. ***Photosynthesis*** is the process plants use to make food.

A. Photosynthesis has two major phases: energy gathering and sugar making.

1. Energy is gathered from sunlight by the ***chlorophyll***—a green pigment in the leaves of the plant. The light energy is changed to chemical energy.
2. Sugar is produced when the chemical energy rearranges the combinations of carbon dioxide and water in the plant.

B. Photosynthesis produces two products: oxygen and glucose.

1. Most of the oxygen is given off into the air. It replenishes the oxygen used by animals, the combustion of engines, and other activities. The plant also uses some of the oxygen.

2. The sugar made by photosynthesis is known as ***glucose***, or simple sugar. Sugar is transported to various parts of the plant and stored for future use.

C. For photosynthesis to occur, plants must be in an environment that supports the process. Plants need the following for photosynthesis:
   1. Chlorophyll—Chlorophyll is located in bundles known as chloroplasts. Sugar is made in the chloroplasts.
   2. Sunlight—Chlorophyll transforms the light energy of the sun into chemical energy.
   3. Carbon dioxide—Plants get carbon dioxide from the air through stomata. Carbon dioxide is a major substance from which glucose is made.
   4. Water—Water is absorbed by the roots of a plant and goes to the leaves through the vascular system. Chemical energy splits water apart and partially combines it with the elements of carbon dioxide.

D. Photosynthesis can be expressed as an equation that shows the splitting apart and recombining of ingredients. A simplified equation for photosynthesis is:

$$\underset{\text{(from the air)}}{\text{Carbon dioxide}} + \underset{\text{(from soil)}}{\text{Water}} \xrightarrow[\text{Chlorophyll}]{\text{Light}} \underset{\text{(stored in plant)}}{\text{Sugar}} + \underset{\text{(released into air)}}{\text{Oxygen}} + \underset{\text{(released into air)}}{\text{Water}}$$

Use TM: D–1D and TM: D–1E to aid in the discussion of the process of photosynthesis. Have students complete WS: D–1B to further their understanding of the photosynthesis process.

Objective 3: Name and define three types of tropisms.

Anticipated Problem: What are three types of tropisms?

III. A ***tropism*** is a change in a plant's growth in response to a stimulus. There are several types of tropisms. The three most common tropisms are phototropism, geotropism, and thigmotropism.

A. ***Phototropism*** is a plant's response to light. The stems and the leaves of plants grow toward the light. For example, a plant sitting in a window sill will bend toward the window or light. If the plant is turned around, it will bend toward the window again, if given enough time.

B. ***Geotropism*** is a plant's response to gravity. Roots grow downward because of geotropism. If you turn a seed upside down in its pot, it will still send its root downward and its shoot upward.

C. ***Thigmotropism*** is a plant's response to physical contact with another object. For example, a plant may wind around a pole or grow in a curving line once it touches a post or other solid object.

Use TM: D–1F through TM: D–1H to cover the content of the objective. Use WS: D–1C to demonstrate to students the effects of gravity on germinating seeds.

Objective 4: Explain the environmental requirements needed for plants to grow.

Anticipated Problem: What are the environmental requirements plants need to grow?

IV. In order for plants to grow, there are certain conditions that need to be met. The most important requirements are light, air, and water. Each of the requirements is necessary in plant growth, specifically the photosynthesis process. When all of these requirements are met, plants will thrive, but some plants may require different amounts of each. For example, a cactus requires sunlight but not a lot of water.

A. Light can be either natural or artificial. Natural light comes from the sun. There are many sources of artificial light, including incandescent lights, fluorescent lights, metal halide lamps, low pressure sodium lamps, high pressure sodium lamps, etc.

B. Air is important because it carries the necessary carbon dioxide that plants need to make food. Air flows through the stomatas in the leaves of the plant.

C. Water is an important environmental factor for plant growth. The water flows from the roots throughout the plant system. It breaks down during the photosynthesis process to help the plant make food. Water is used in the transpiration process to help the plant stay at its healthiest temperature.

Use TM: D–1I to cover the content of the objective. Have students do the activity presented in WS: D–1D. This activity will demonstrate to students the importance of water in the plant growth cycle. Visit a local greenhouse and allow students to observe the environmental conditions that are present there. Have the greenhouse owner explain to students the different methods used to maintain the requirements needed for plant growth.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: D–1A, WS: D–1B, WS: D–1C, and WS: D–1D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. c
3. d
4. a

Fill-in-the-Blank

1. photosynthesis
2. glucose
3. Horticulture
4. chlorophyll

Short Answer

1. Answers will vary. Students should name the tropisms discussed in this lesson—phototropism, geotropism, thigmotropism—and give an example of each.
2. Answers will vary. Students should name the three plant growth areas—ornamental crops, vegetable crops, fruit and nut crops—and give an example of each.
3. light, air, and water

Test D–1

Name_____

HOW PLANTS GROW

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. phototropism
b. tropism
c. geotropism
d. thigmotropism

_____1. A change in a plant's growth in response to a stimulus.

_____2. A plant's response to gravity.

_____3. A plant's response to physical contact with another object.

_____4. A plant's response to light.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. The process in which plants make food is called _____.
2. The sugar made by photosynthesis is as known _____.
3. _____ is an area of agriculture that produces plants for food, comfort, and beauty.
4. The green pigment in the leaves of a plant is known as _____.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. Name the three most common tropisms and give an example of each.

2. Name the three areas of plant growth involved in horticulture and give an example of each.

3. Name the three most important requirements for plant growth.

ORNAMENTAL CROPS







VEGETABLE CROPS


Turnips


Potatoes


Celery


Cabbage


Red Peppers


Radishes


Green Beans

FRUIT AND NUT CROPS


Pistachios


Fig


Grapes


Pears


Cherries


Walnuts


Oranges

REQUIREMENTS FOR PHOTOSYNTHESIS

For photosynthesis to occur, plants must be in an environment that supports the process. Plants need the following for photosynthesis:

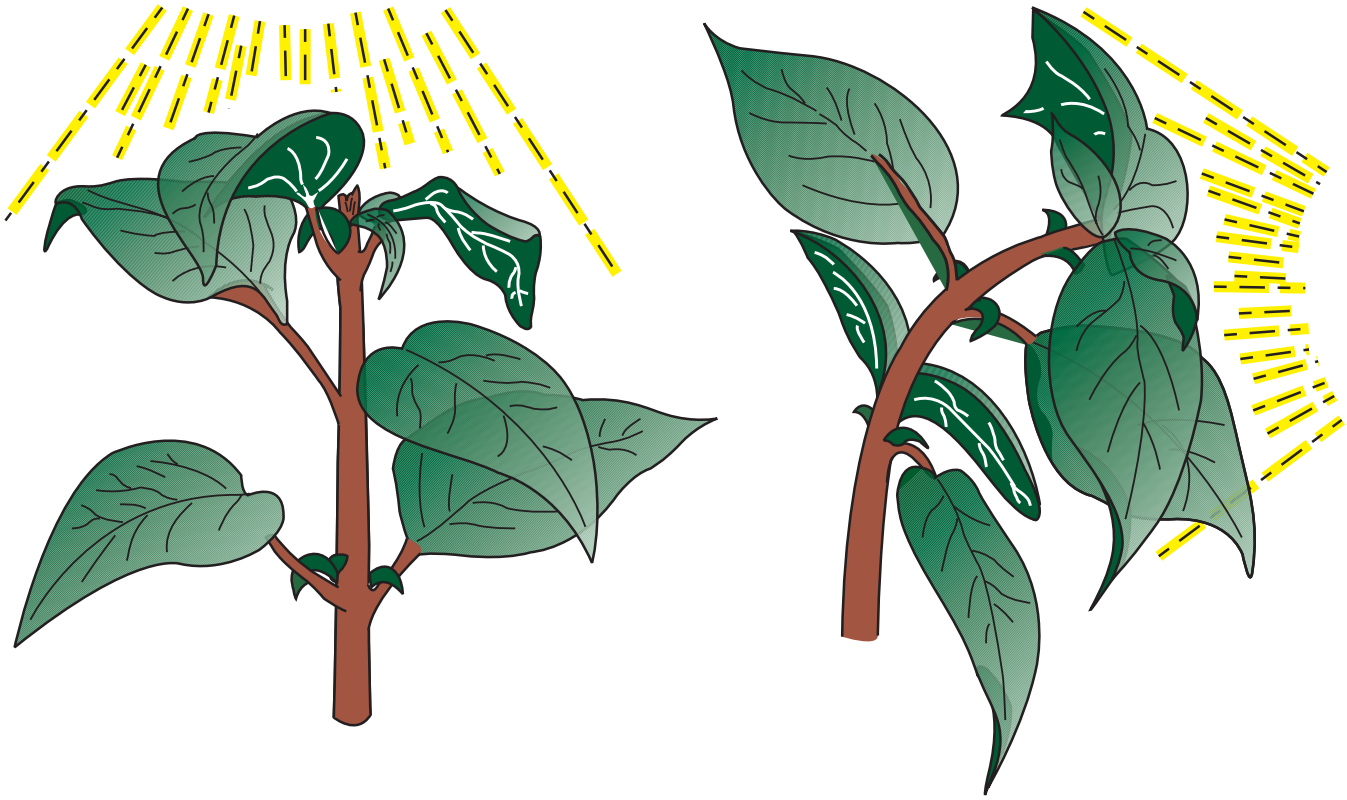
- Chlorophyll—Chlorophyll is located in bundles known as chloroplasts. Sugar is made in the chloroplasts.
- Sunlight—Chlorophyll transforms the light energy of the sun into chemical energy.
- Carbon dioxide—Plants get carbon dioxide from the air through stomata. Carbon dioxide is a major substance from which glucose is made.
- Water—Water is absorbed by the roots of a plant and goes to the leaves through the vascular system. Chemical energy splits water apart and partially combines it with the elements of carbon dioxide.

PHOTOSYNTHESIS

Carbon dioxide (from the air) + Water (from soil) —Light, Chlorophyll→ Sugar (stored in plant) + Oxygen (released into air) + Water (released into air)

PHOTOTROPISM

Phototropism is a plant's response to light.



GEOTROPISM

Geotropism is a plant's response to gravity.

THIGMOTROPISM

Thigmotropism is a plant's response to physical contact with another object.

This oak seedling encountered an obstruction and redirected its growth.

ENVIRONMENTAL REQUIREMENTS FOR PLANT GROWTH

The most important requirements are:

- Light—natural or artificial
- Air—carries the necessary carbon dioxide that plants need to make food
- Water—flows from the roots throughout the plant system

Name _____

HORTICULTURE IN OUR DAILY LIVES

Directions

Read the following scenario and underline each of the "contacts" that are made to horticulture. Use a red pen or pencil for ornamental crops, a green pen or pencil for vegetable crops, and a blue pen or pencil for fruit and nut crops.

Scenario

Brittany wakes up and gets ready to go to school. She takes time to water the ivy plant in the hallway outside her room. For breakfast, Brittany has a plate of blueberry pancakes and some orange juice. For lunch, she packs a chicken sandwich with lettuce and mayonnaise, an apple, a bottle of grape juice, and some sliced peaches for dessert. On her way out the door, she stops to smell the roses that have just begun blooming on the bushes outside her house. Brittany waits for the bus under the flowering cherry tree at the end of the driveway. On the way to school, Brittany's best friend, Hunter, offers her a chocolate bar with almonds to repay her for the candy bar she gave Hunter at lunch yesterday. After arriving at their school, Brittany and Hunter pass by the flowering dogwood tree that was just recently planted by one of the other classes. In biology class, their teacher, Mr. Bryant, is proudly displaying the flower arrangement he just received for his birthday. At lunchtime, Brittany grabs her bag lunch while Hunter gets in line for the cafeteria lunch. Hunter chooses pizza with tomato sauce, cheese, and onion; a side dish of green beans; some sliced pears; and cranapple juice. For dessert, she chooses a brownie with walnuts. After lunch, Brittany and Hunter go back to their classes to complete the rest of their day.

Conclusions

How many times did the students in the scenario come into contact with horticulture products? _____

Is horticulture an important part of your life? On a separate sheet of paper, make a list of the products related to the horticulture industry that you have had contact with recently. Divide your list into ornamental crops, vegetable crops, and fruit and nut crops. Which area of horticulture do you have the most contact with? Compare your list to other students' to see if you left anything out. Discuss how your lives would be different without horticulture.

WS KEY: D–1A

HORTICULTURE IN OUR DAILY LIVES KEY

Brittany wakes up and gets ready to go to school. She takes time to water the ivy plant in the hallway outside her room. For breakfast, Brittany has a plate of blueberry pancakes and some orange juice. For lunch, she packs a chicken sandwich with lettuce and mayonnaise, an apple, a bottle of grape juice, and some sliced peaches for dessert. On her way out the door, she stops to smell the roses that have just begun blooming on the bushes outside her house. Brittany waits for the bus under the flowering cherry tree at the end of the driveway. On the way to school, Brittany's best friend, Hunter, offers her a chocolate bar with almonds to repay her for the candy bar she gave Hunter at lunch yesterday. After arriving at their school, Brittany and Hunter pass by the flowering dogwood tree that was just recently planted by one of the other classes. In biology class, their teacher, Mr. Bryant, is proudly displaying the flower arrangement he just received for his birthday. At lunchtime, Brittany grabs her bag lunch while Hunter gets in line for the cafeteria lunch. Hunter chooses pizza with tomato sauce, cheese, and onion; a side dish of green beans; some sliced pears; and cranapple juice. For dessert, she chooses a brownie with walnuts. After lunch, Brittany and Hunter go back to their classes to complete the rest of their day.

There are 18 references to horticulture mentioned in the scenario. Help students realize how horticulture is an important part of our daily lives.

WS: D–1B

Name _____

PHOTOSYNTHESIS

Use the terms below to fill in the equation for photosynthesis.

Terms

- Sugar
- Water (used twice)
- Carbon dioxide
- Oxygen
- Chlorophyll

Equation

Light

_____ + _____ ⟶ _____ + _____ + _____

(from the air) (from soil) (stored in plant) (released into air) (released into air)

PHOTOSYNTHESIS KEY

Carbon dioxide	+	Water	Light / Chlorophyll →	Sugar	+	Oxygen	+	Water
(from the air)		(from soil)		(stored in plant)		(released into air)		(released into air)

Name _____

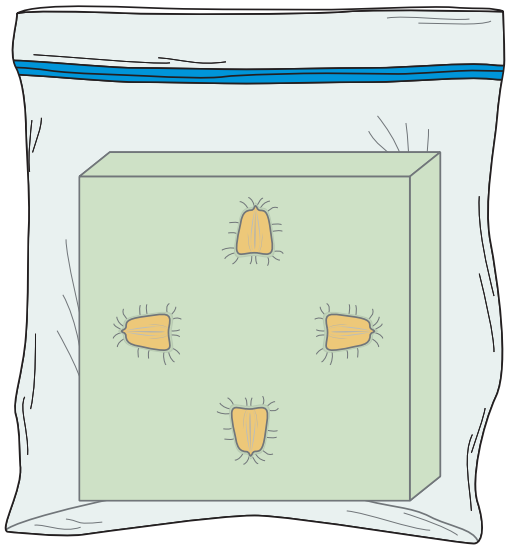
OBSERVING GEOTROPISM IN GERMINATING SEEDS

Introduction

Plant roots respond to geotropism. They grow downward through the soil in response to gravity. In this activity, we will be observing the effects of gravity on germinating seeds.

Materials

- ✓ One ½-inch slice of floral foam
- ✓ Sandwich-size sealable plastic bag
- ✓ Water
- ✓ 4 corn seeds that have been soaked in water overnight



Procedure

1. Push four corn seeds firmly into the floral foam. Place each seed in a different direction—pointed side up, pointed side down, pointed side to the right, and pointed side to the left.
2. Place the slice of floral foam into the plastic bag.
3. Add enough water to saturate the foam. Pour off excess water and close the bag.
4. Place the bag in a bright location. Avoid putting the bag in direct sunlight because heat could build up and kill the seeds.
5. Observe the seeds daily.

Predictions and Observations

1. What do you think the seeds will do?

2. How quickly did the roots emerge from the seeds?

3. What direction did the roots grow?

Name _____

ENVIRONMENTAL NEEDS OF PLANTS

Objective

Perform an experiment to test the effect water has on plant growth.

Materials

- ✓ 2 bean plants, 3–4 weeks old, in 4" containers with saucers
- ✓ Watering can
- ✓ Water
- ✓ Ruler
- ✓ Writing utensil and paper

Procedure

1. Label one plant "A" and one plant "B".
2. Measure the height of the plants and count the number of leaves. Record this information on a separate sheet of paper.
3. Place the plants in a sunny location.
4. For the next three weeks, water the "A" plants every day and water the "B" plants only once a week. For each watering, add water until it begins to come out the bottom drainage hole. After 15 minutes, dump the excess water out of the saucer.
5. Measure the plants and count the number of leaves once a week and record the results. Also write down your observations about the appearance of the plants. (What color are the leaves? Are all the plants standing up? Are the leaves extended or are they drooping?)
6. Continue the same watering pattern for eight weeks and keep track of your observations. What happens to the plants? What does this tell you about the importance of water to plant growth? Discuss your findings and comments in class.

Lesson D–2

PLANT PROPAGATION

Indiana Agricultural Literacy Lesson Plan Library

Unit D. Horticulture Science

Lesson 2. Plant Propagation

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define plant propagation.
2. Describe seed germination and the proper conditions for it.
3. Describe three types of plant cuttings.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

The Great Plant Escape, www.urbanext.uiuc.edu/gpe/index.html, University of Illinois Extension, Urban Programs Resource Network.

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Texas Agricultural Extension Service. *Junior Master Gardener Handbook*. Texas A&M University, 1999.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Several different potted plants
- ✓ Nursery catalogs
- ✓ 3 × 5 index cards

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Dormant
- ➤ Germination
- ➤ Node
- ➤ Plant cutting
- ➤ Plant propagation

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Bring in several different potted plants. Discuss with the class how they think the plants were started. For example, they may have started in a nursery from seed, as a cutting from a friend, dug up from the garden, etc. Try to navigate the students toward the actual facts that the plants may have started from seeds or from other plants. Give the students copies of nursery catalogs. Instruct them to choose a plant that they find interesting. Have the students write the name of the plant and how to take care of it on an index card. Discuss with students the ways they could start their chosen plant.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define plant propagation.

Anticipated Problem: What is plant propagation?

I. The horticulture industry relies on plant propagation to produce the plants they need.

A. ***Plant propagation*** is the reproduction of new plants from seeds and vegetative parts like leaves, stems, or roots.

B. Plant propagation allows producers to create more plants from old ones and keep a plant variety going.

Use TM: D–2A to help cover the content of the objective. Discuss with students the importance of plant propagation in the horticulture industry. Invite a plant producer from the local area to visit the class and explain what method of plant propagation he or she uses to create new plants and maintain existing varieties. Before the visit, have students prepare a list of questions they would like to have answered.

Objective 2: Describe seed germination and the proper conditions for it.

Anticipated Problem: What is seed germination and what conditions are needed for a seed to germinate?

II. Plants can be grown from seeds. Some plants grow best when they are started from seeds.

A. A seed is ***dormant***, or in a resting state, before it grows into a plant.

B. ***Germination*** is the process by which a seed starts to grow. It begins with the breaking of the seed coat and the growth of a root into the soil. Germination is complete when the stem and leaves have emerged from the ground and the plant can support itself.

C. Seeds are designed to wait for favorable conditions to begin growth. When the water, oxygen, temperature, and light requirements are met, the seed should begin to grow. Not all seeds need the same amount of each condition. For example, some seeds may need to be consistently exposed to light, while others may need to be in a darker area.

Use TM: D–2B to show the students examples of seed germination. Use WS: D–2A to have students prepare a Beanie-in-a-Bag Necklace. This activity will help students better understand the seed germination process and the environmental requirements necessary for a seed to germinate.

Objective 3: Describe three types of plant cuttings.

Anticipated Problem: What are three ways to begin new plants from cuttings?

III. Plants can be reproduced by cuttings. A ***plant cutting*** is a part of an existing plant that is used to make new plants. Plant cuttings generally can come from a stem, leaf, or root. Sometimes a cutting is dipped in a growth hormone to help it begin to root.

A. Stem cuttings are taken by removing a section of a stem with at least two ***nodes*** (place on the stem where a leaf begins) from an existing plant. The stem can then be planted in the soil. Ficus and geranium plants can be started from stem cuttings.

B. Leaf cuttings are taken by removing a leaf from an existing plant and cutting it into smaller sections. The sections are then planted in the soil. African violets and begonias can be started from leaf cuttings.

C. Root cuttings are taken by removing a section of the root of the existing plant and cutting it into three or four sections. The sections are then planted in the soil. Root cuttings are not as common as stem and leaf cuttings. Carrot and blackberry plants can be started from root cuttings.

Use TM: D–2C to discuss stem cuttings. Use TM: D–2D to discuss leaf cuttings. Use WS: D–2B to demonstrate the three types of plant cuttings discussed. Plan a visit to a local greenhouse and arrange to have a demonstration on the proper methods of taking plant cuttings.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: D–2A and WS: D–2B. As an additional activity, have the students bring in plants to be propagated. Have the students research to discover the best way to propagate the plants, whether by seed or by cuttings. After the new plants have started, the students can transplant them into their own containers. They can opt to hold a plant exchange for Mother's Day or sell the new plants as a class project.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. e
3. a
4. c
5. d

Fill-in-the-Blank

1. leaf, stem, root
2. seed coat
3. dormant
4. propagation

Short Answer

Answers will vary. A plant can be propagated by seed germination, which simply means to plant a seed in the proper conditions. A plant can also be propagated by plant cuttings. A plant stem, leaf, or root can be used from an existing plant to start a new one.

Test D–2

Name_____

PLANT PROPAGATION

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. Plant propagation
b. Dormant
c. Germination
d. Plant cutting
e. Node

_____1. In a resting state.

_____2. A place on a stem where a leaf begins.

_____3. The reproduction of new plants from seeds and vegetative parts like leaves, stems, or roots.

_____4. The process by which a seed starts to grow.

_____5. A part of an existing plant that is used to make new plants.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Three types of plant cuttings are _____, _____, and _____.
2. Germination begins with the breaking of the _____ _____and the growth of a root into the soil.
3. All seeds begin in a(n) _____ state until the conditions are met for growth.
4. The horticulture industry relies on plant _____ to produce the plants they need.

▶ Short Answer

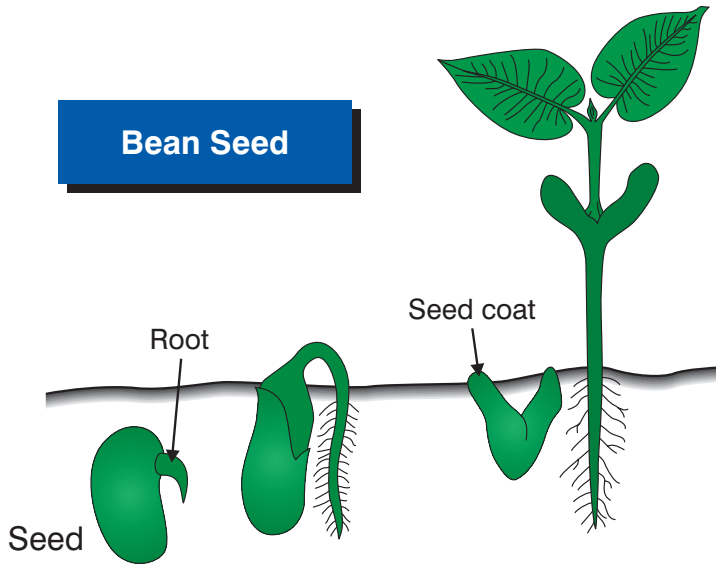
***Instructions*. Answer the following question.**

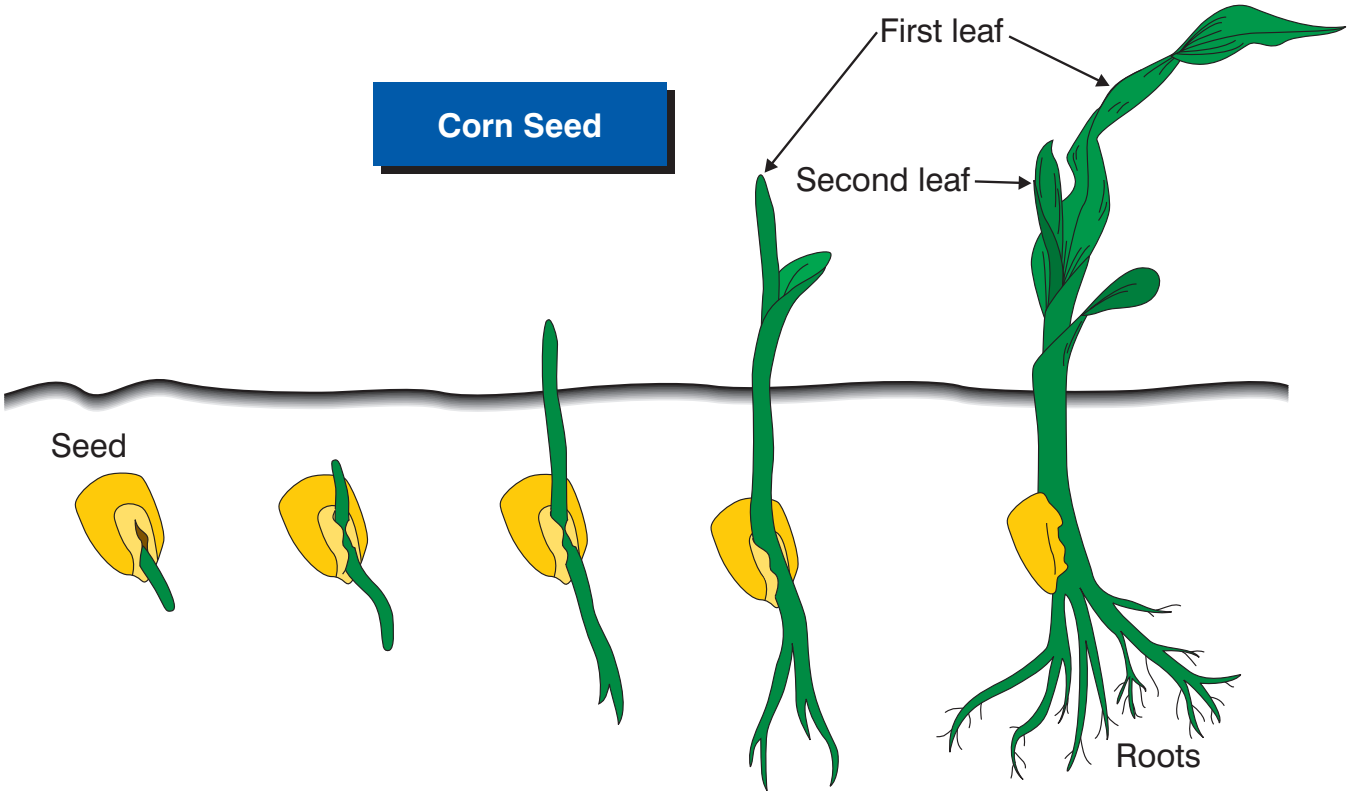
Define and describe two ways a plant can be propagated.

PLANT PROPAGATION

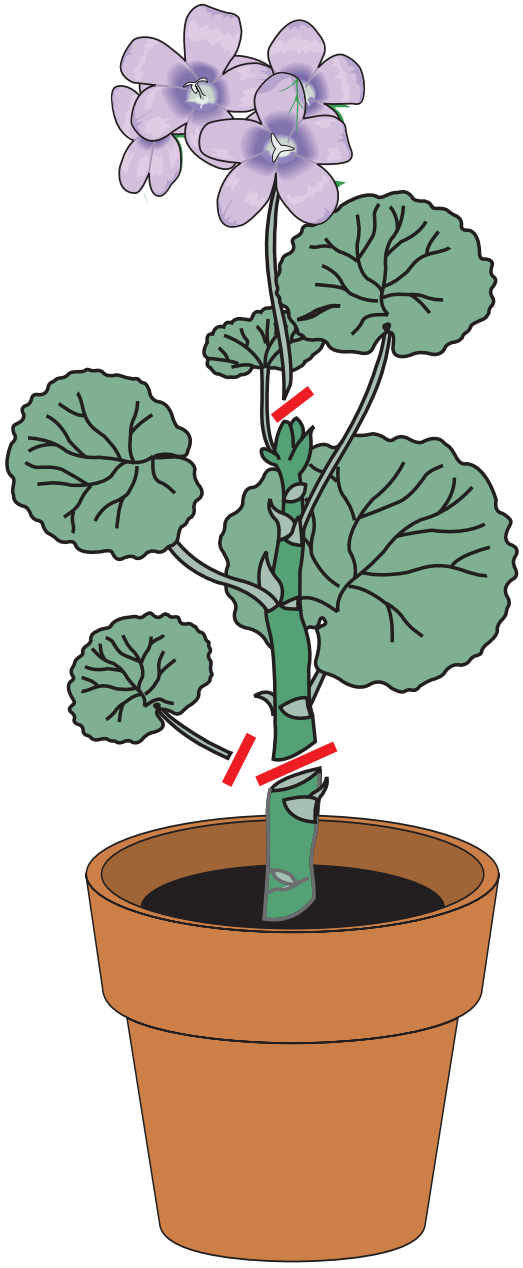
- The horticulture industry relies on plant propagation to produce the plants they need.
- Plant propagation is the reproduction of new plants from seeds and vegetative parts like leaves, stems, or roots.
- Plant propagation allows producers to create more plants from old ones and keep a plant variety going.

SEED GERMINATION

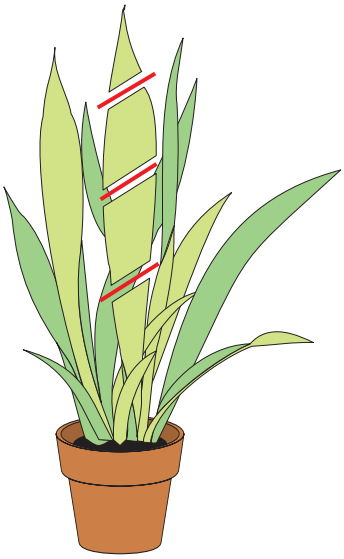


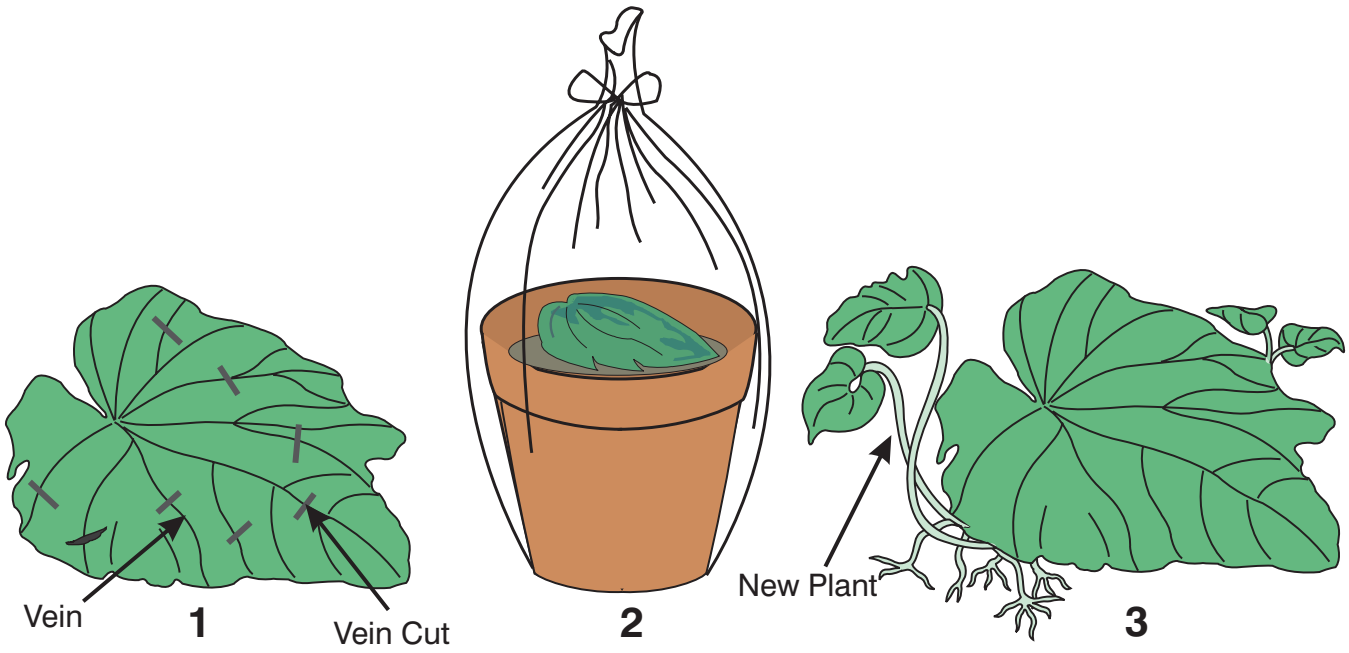


STEM CUTTINGS



LEAF CUTTINGS





Name _____

BEANIE-IN-A-BAG NECKLACE

Objective

Create a good environment for a soybean seed to germinate.

Materials

- ✓ Plastic jewelry bag (found in craft or some office supply stores)
- ✓ ¼ teaspoon watering crystals (found in any home and garden department)
- ✓ Soybeans
- ✓ 1 tablespoon water
- ✓ Yarn
- ✓ Hole punch

Procedure

1. Punch a hole in the top of your jewelry bag (above the seal).
2. Place ¼ teaspoon of watering crystals into the bag.
3. Add 1 tablespoon of water. This will create a gel from the watering crystals.
4. Gently push two soybeans into the gel.
5. Seal the bag firmly.
6. Insert the yarn trough the hole in the plastic bag to make a necklace.
7. Wear your Beanie-in-a-Bag around your neck and under your shirt to keep it warm and dark.
8. Check your seed periodically for germination. Record the growth.

Name _____

A CUT ABOVE THE REST

Objective

Propagate plants from different types of cuttings.

Materials

- ✓ Different types of plants to take cuttings from (carrots, blackberry plants, ficus, geraniums, African violets, begonias, etc.)
- ✓ Small clippers or sharp scissors
- ✓ Medium-sized potting container
- ✓ Potting soil
- ✓ Clear plastic wrap
- ✓ Permanent marker
- ✓ Water

Procedure

1. Research the proper cutting methods that can be used for the plants you have available.
2. Determine which plant can be started from a leaf cutting, and take a cutting from the plant.
3. Determine which plant can be started from a stem cutting, and take a cutting from the plant.
4. Determine which plant can be started from a root cutting, and take a cutting from the plant.
5. Plant your three cuttings in a container.
6. Use a permanent marker to label the container with your name and a list of the plants.
7. Water your cuttings and make sure they get plenty of moisture.
8. Cover the containers with clear plastic wrap and place them in a lighted area.
9. Continue to care for your cuttings and record their growth. Be sure to note which cutting rooted first.
10. Once the plants are large enough, they can be transplanted to their own containers.

Lesson D–3

ORNAMENTAL CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit D. Horticulture Science

Lesson 3. Ornamental Crops

Indiana's Academic Standard. **Science:** 4.4.4 — Observe and describe that some source of energy is needed for all organisms to stay alive and grow.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe four types of ornamental crops.
2. Explain the career of a landscape designer.
3. Explain the purpose of a greenhouse.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Brickell, Christopher. *American Horticultural Society Encyclopedia of Gardening.* Dorling Kindersley, New York, 1993.

The Great Plant Escape, www.urbanext.uiuc.edu/gpe/index.html, University of Illinois Extension, Urban Programs Resource Network.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Texas Agricultural Extension Service. *Junior Master Gardener Handbook.* Texas A&M University, 1999.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Digital camera
- ✓ Color printer
- ✓ Horticulture reference books

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Bedding plant
- ➤ Foliage plant
- ➤ Greenhouse
- ➤ Landscape designer
- ➤ Ornamental crops
- ➤ Turf
- ➤ Woody plant

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ornamental crops are used in many landscapes. Take a nature hike in a local park or in the school yard. Have the students take digital photos of all the different ornamental plants they see. Print color copies of the digital images and arrange them into a class book. Include information on where the photo was taken, what plant is shown*

in the photo, etc. Students may need to look in reference books to identify some of the ornamental plants.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe four types of ornamental crops.

Anticipated Problem: What are four types of ornamental crops?

I. Horticulture deals with using plants for personal appeal or food. Plants used for their beauty and appeal are known as ***ornamental crops***. Ornamental plants make our lives and surroundings more pleasant. There are many types of ornamental crops.

A. ***Foliage plants*** are plants that are grown and sold for their beautiful colored leaves or stems. Foliage plants are often sold in pots for use as houseplants. Many offices and businesses use these plants to create an attractive interior environment.

B. ***Woody plants*** are plants like shrubs, trees, or certain vines that have hard stems and produce wood. Woody plants are often used to beautify the landscape around homes and offices.

C. ***Turf*** is short-growing, matted grasses or other plants that are used and maintained for aesthetic, recreational, or functional purposes. Lawns and areas around homes and businesses, in parks, and on sport playing fields are more attractive with quality turf. Turf also helps protect the soil and prevent erosion.

D. ***Bedding plants*** are herbaceous (soft stemmed) annual plants used for ornamental display or vegetable production. Bedding plants are selected for their colorful flowers or interesting foliage. They are often seen growing in flowerbeds, window boxes, or planters.

Use TM: D–3A, TM: D–3B, TM: D–3C, and TM: D–3D to cover the content of the objective. Have the students label the photos in the class book as foliage plants, woody plants, turf, or bedding plants. Bring in samples of foliage plants, woody plants, turf species, and bedding plants for students to examine. Use WS: D–3A to encourage students to plant a "rainbow garden" with bedding plants. Plants can be grown from seed or purchased from a nursery.

Objective 2: Explain the career of a landscape designer.

Anticipated Problem: What does a landscape designer do?

II. A ***landscape designer*** is a person who is trained in the art of design and the science of growing horticultural plants. A landscape designer uses plants to create an attractive and useful area. A landscape designer must take many factors into account when planning a landscape design.

A. Climate, soil type, drainage of water, and exposure to light all influence the selection and placement of plants.

B. The size of the space will affect what types of plants can thrive in the area.

C. It is very important to find plants that complement each other in color.

D. The use of the area should be taken into consideration.

Use TM: D–3E to cover the content of the objective. Use WS: D–3B to have students "design" their own landscape with pictures. Invite a landscape designer from the area to visit the class and discuss with students the education required to become a landscape designer and the type of work involved in the job. Ask him or her to bring photographs of designs he or she has done. Before the visit, have students prepare a list of questions they would like to have answered. If time allows, choose an area around your school that could use a little sprucing up. Have the students design a plan on paper to make the area more attractive. Encourage the students to use all types of ornamental plants, including turf, bedding plants, woody plants, and foliage plants.

Objective 3: Explain the purpose of a greenhouse.

Anticipated Problem: What is a greenhouse?

III. A ***greenhouse*** is a structure of glass or plastic that provides the ideal environment for the growth of plants.

A. Without greenhouses, plants that are sensitive to certain elements would die.

B. Temperature, light, water, and air can be controlled in a greenhouse.

C. Plants can be grown year-round in a greenhouse.

D. Diseases and insects can be carefully monitored in a greenhouse.

Use TM: D–3F to illustrate some examples of greenhouses. Use WS: D–3C to have students create their own miniature greenhouse. Plan a trip to a local greenhouse. Have students observe the types of plants that are grown in the greenhouse. Have the greenhouse manager explain to students the different methods used to control the environment inside the greenhouse (temperature, light, water, air).

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: D–3A, WS: D–3B, and WS: D–3C.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. g
2. a
3. c
4. f
5. d
6. e
7. b

Fill-in-the-Blank

1. erosion
2. complement
3. year-round

Short Answer

Answers will vary. Use Objective 2 to score this question.

Test D–3

Name_____

ORNAMENTAL CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. ornamental crops
b. foliage plants
c. woody plants
d. turf
e. bedding plants
f. landscape designer
g. greenhouse

_____1. A structure of glass or plastic that provides an ideal environment for plants to grow.

_____2. Plants used for their beauty and appeal.

_____3. Plants like shrubs, trees, or certain vines that have hard stems and produce wood.

_____4. A person who is trained in the art of design and the science of growing horticultural plants.

_____5. Short-growing, matted grasses or other plants that are used and maintained for aesthetic, recreational, or functional purposes.

_____6. Herbaceous annual plants used for ornamental display or vegetable production.

_____7. Plants that are grown and sold for their beautiful colored leaves or stems.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Turf helps protect the soil and prevent _____.
2. In a landscape design, it is very important to find plants that _____ each other in color.
3. Plants can be grown _____ in a greenhouse.

▶ Short Answer

***Instructions*. Answer the following question.**

Name three elements that need to be taken into consideration by a landscape designer who is designing an outside area.

FOLIAGE PLANTS

WOODY PLANTS

TURF

BEDDING PLANTS

LANDSCAPE DESIGNER

- Trained in the art of design and the science of growing horticultural plants
- Uses plants to create an attractive and useful area
- Must take many factors into account when planning a landscape design
  - ➔ Climate, soil type, drainage of water, and exposure to light
  - ➔ The size of the space
  - ➔ Complementary colors
  - ➔ Use of the area

GREENHOUSES

WS: D–3A

Name _____

PLANT A RAINBOW GARDEN

Objective

Bedding plants can be found in almost every color imaginable! Bedding plants can be grown in containers outside to beautify an area. In this activity, you will create a rainbow garden of bedding plants for you and others to enjoy all summer long.

Materials

- ✓ Plants representing each color of the rainbow
- ✓ Containers
- ✓ Potting soil
- ✓ Nursery and seed catalogs

Procedure

1. Using nursery and seed catalogs, find a plant for each color of the rainbow. Write the plant names that you find below. (Although some green flowers are now available, it may be easier to plan to let the leaves of the other plants fill that spot in your rainbow.)

   Red: _____

   Orange: _____

   Yellow: _____

   Green: _____

   Blue: _____

   Violet: _____

2. Choose the type of plant for each color that you like the best and plant them in containers.
3. Arrange the containers in an available area so that they form a rainbow.
4. Continue to care for and enjoy your plants!

Name _____

PICTURE-SCAPE

Objective

Landscape designers use plants to create attractive and useful areas. They must take many factors into account when designing the landscape. In addition to looking pleasing, plants used in the landscape must also be suitable to the climate, soil type, drainage, light exposure, size, and use of the area. The landscape will not be very nice to look at for long if all of the plants die because they are not planted in a proper location! In this activity, you will create a "picture-scape" by using pictures of ornamental crops to create your own landscape.

Materials

- ✓ Gardening catalogs (or other materials with pictures and information about ornamental plants)
- ✓ Scissors
- ✓ Glue
- ✓ Posterboard
- ✓ Markers

Procedure

1. The posterboard is your "site" to be landscaped. Determine the characteristics of the site by filling in the following information about the area in which you live:
   a. Climate (plant hardiness zone) : _____
   b. Soil type: _____
   c. Drainage: _____
2. Decide the following about your area:
   a. Light exposure (sunny? shady? mixture?): _____
   b. Use (play? entertaining? attracting butterflies?): _____
3. Use the gardening catalogs to find pictures of ornamental plants that you like. Be sure to select only plants that will survive in your particular area and plants that will fit the purpose of your landscaping site.
4. Cut out the pictures of the plants you selected and glue them to your posterboard. You can include bedding plants, woody plants, turf, and any other ornamental plants. Arrange them in a way that you think is pleasing but that also allows them to grow and thrive as they should. Be sure to label what each plant is. If you can't find a picture of a plant you want, you can use markers to draw the plant.
5. When your picture-scape is complete, evaluate it. Are all of the plants suitable for the area? Do the colors complement each other? Are any of the plants too large for the area? Do the plants interfere with the use of the site? Compare your picture-scape with other students' and give/receive feedback. Make any changes that you feel are necessary.
6. Create a class bulletin board to showcase your picture-scapes. Based on your experience, do you think you would like to become a landscape designer?

Name _____

BUILD YOUR OWN GREENHOUSE

Objective

A greenhouse is a structure of glass or plastic that provides the ideal environment for the growth of plants. In this activity, you will create your own miniature greenhouse!

Materials

- ✓ Bottoms from two clear plastic 2-liter bottles (one cut 4 inches high and one cut 9 inches high)
- ✓ Sand
- ✓ Small rocks
- ✓ Potting soil
- ✓ Seeds
- ✓ Tape
- ✓ Permanent marker

Procedure

1. The shorter bottle section is the bottom of the greenhouse. The taller section is the greenhouse roof.
2. In the shorter bottle, place a small amount of sand.
3. Next, place some small rocks to allow better drainage.
4. Add some potting soil on top of the rocks.
5. Plant your seeds in the potting soil according to the directions on the package.
6. Water your seeds.
7. Slip the "roof" of your greenhouse in place. Use tape to secure the roof, if necessary.
8. Label your greenhouse with your name and the type of seeds you planted.
9. Set your greenhouse in a safe, sunny spot.
10. Depending on the type of seeds you used, your plants should appear in two to five days.
11. Continue to monitor and care for your plants. Add water only when necessary (once or twice a week). Did your greenhouse provide an ideal environment for your plants?

Lesson D–4

VEGETABLE CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit D. Horticulture Science

Lesson 4. Vegetable Crops

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define vegetable.
2. Name the plant parts that vegetables come from.
3. Explain important factors to consider when planning a vegetable garden.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

The Great Plant Escape, www.urbanext.uiuc.edu/gpe/index.html, University of Illinois Extension, Urban Programs Resource Network.

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Texas Agricultural Extension Service. *Junior Master Gardener Handbook*. Texas A&M University, 1999.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Vegetable seed packets (varieties from each of the plant parts represented)
- ✓ Shallow containers and potting soil (for creating a container vegetable garden)

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Bulb
- ➤ Herbaceous plant
- ➤ Tubers
- ➤ Vegetable

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Before beginning the lesson, gather several packets of vegetable seeds. Be sure to have varieties from each of the plant parts. Have the students choose a vegetable seed from the gathered packets. Have them draw a picture of the seed and a picture of what the plant will look like before it is harvested. Have students guess what part of the plant they think the vegetable comes from. Let them know that after completing this lesson, they will know whether their guess is correct or not.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define vegetable.

Anticipated Problem: What is a vegetable?

I. There are various definitions of a ***vegetable***, but those in the horticulture industry define it as a food that grows on a ***herbaceous plant*** (a plant with a soft stem).

A. Vegetables are a nutritious part of our daily diet. They provide essential vitamins and minerals the body needs to be healthy.

B. Vegetables can be eaten raw or cooked. Vegetables can also be processed by canning or freezing.

C. Examples of vegetables are asparagus, broccoli, carrots, cauliflower, potatoes, spinach, sweet corn, and green peppers

Use TM: D–4A to aid in the discussion of this objective. Have students name as many examples of vegetable as they can. Record all of the vegetables they name on the writing surface. Use WS: D–4A to have students create a poster of the different vegetables they like to eat.

Objective 2: Name the plant parts that vegetables come from.

Anticipated Problem: What part of the plant do vegetables come from?

II. Vegetables come from all parts of the plant. They come from the bulb, flower, fruit, leaves, roots, seeds, seedpods, stems, and tubers.

A. An onion is the bulb of the plant. A ***bulb*** is a large underground bud made up of scale-like leaves that store food for the small shoot inside. (Other example: garlic.)

B. Cauliflower is the flower of the plant. (Other examples: artichoke, broccoli.)

C. A pumpkin is the fruit of the plant. (Other examples: bell pepper, eggplant, tomato, watermelon.)

D. Cabbage is the leaves of the plant. (Other examples: Brussels sprout, kale, lettuce, spinach.)

E. A carrot is the root of the plant. (Other examples: beet, radish, sweet potato, turnip.)

F. Peas are the seeds of the plant. (Other examples: corn, lima bean, pumpkin seed, kidney bean.)

G. Okra is the seedpod of the plant. (Other examples: chili pepper, green bean, snow pea pod, wax beans.)

H. Asparagus is the stem of the plant. (Other examples: celery, leek, rhubarb)

I. Potatoes come from the tuber of the plant. A ***tuber*** is a fleshy underground stem that is used to store food. (Other example: yam.)

Use TM: D–4B through TM: D–4L to cover the content of the objective. Display the transparencies and have students name other vegetables that come from each part of the plant. Have the students complete WS: D–4B to match the vegetables with the plant parts they come from. Use WS: D–4C to have students name vegetables that come from each plant part.

Objective 3: Explain important factors to consider when planning a vegetable garden.

Anticipated Problem: What information is important when planning a vegetable garden?

III. There are many important factors to consider when planning a vegetable garden.

A. Deciding what to plant is important. Do not grow something you do not want. Select only vegetables that you like to eat.

B. Locate the garden in an area that receives full sun and one that is close to a source for water.

C. Decide what size garden is needed. Allow enough room to plant everything you want, but don't make it so large that you cannot care for it properly.

D. Determine what precautions you must take to keep your garden safe from damage caused by animals, such as deer, rabbits, or even the family pet.

E. The garden should be arranged in rows to take advantage of available sunlight. Plant tall vegetables, such as sweet corn, on the side away from the sun.

F. Decide what plants you want to grow from seed and which plants you want to purchase and transplant.

G. When growing vegetables from seeds, check the back of the seed packet to find the best conditions to grow the particular vegetable. The seed packet should list information about the following:

1. What time of the year is best for growing the particular vegetable.
2. How much sun is needed to grow the plant.
3. How many days the seeds will take to germinate.
4. How deep to plant the seeds.
5. How far apart to plant the seeds.

H. Be sure to wait until after the last frost date in your area before transplanting tender vegetable varieties.

I. Obtain any supports your plants might need. Tomatoes generally grow best when supported by a cage; sweet peas and other vining plants may require a fence or trellis on which to climb.

Use TM: D–4M and TM: D–4N to cover the content of the objective. Use WS: D–4D to let students observe how lettuce grows in a plastic bag. As an additional activity, divide the students into groups of two or three and give each group a seed packet. Have the group use WS: D–4E to decide how their seeds should planted. After completing the worksheet, you may want to have the students plant their seeds and create a container vegetable garden. The students can use the harvested vegetables to make vegetable soup.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: D–4A, WS: D–4B, WS: D–4C, WS: D–4D, and WS: D–4E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. c
2. a
3. d
4. b

Fill-in-the-Blank

1. root
2. stem
3. leaves
4. seeds

Short Answer

Answers will vary. Use Objective 3 to score this question.

Test D–4

Name_____

VEGETABLE CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. bulb
b. herbaceous plant
c. tubers
d. vegetable

_____1. A fleshy underground stem that is used to store food.

_____2. A large underground bud made up of scale-like leaves that store food for the small shoot inside.

_____3. A food that grows on a plant with a soft stem.

_____4. A plant with a soft stem.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A carrot is the _____ of the plant.
2. Asparagus is the _____ of the plant.
3. Cabbage is the _____ of the plant.
4. Peas are the _____ of the plant.

▶ Short Answer

***Instructions*. Answer the following question.**

List four important factors to consider when planning a vegetable garden.

EXAMPLES OF VEGETABLES

- Asparagus
- Broccoli
- Carrots
- Cauliflower
- Potatoes
- Spinach
- Sweet corn
- Green peppers
- How many other can you name?

BULB

An onion is the bulb of the plant. What other bulbs do we eat?

FLOWER

(Courtesy, Agricultural Research Service, USDA)

Cauliflower is the flower of the plant. What other flowers do we eat?

FRUIT

A pumpkin is the fruit of the plant. What other fruits do we eat?

LEAF

(Courtesy, U.S. Department of Agriculture)

Cabbage is the leaves of the plant. What other leaves do we eat?

ROOT

A carrot is the root of the plant. What other roots do we eat?

SEED

Peas are the seeds of the plant. What other seeds do we eat?

SEEDPOD

(Courtesy, U.S. Department of Agriculture)

Okra is the seedpod of the plant. What other seedpods do we eat?

STEM

Asparagus is the stem of the plant. What other stems do we eat?

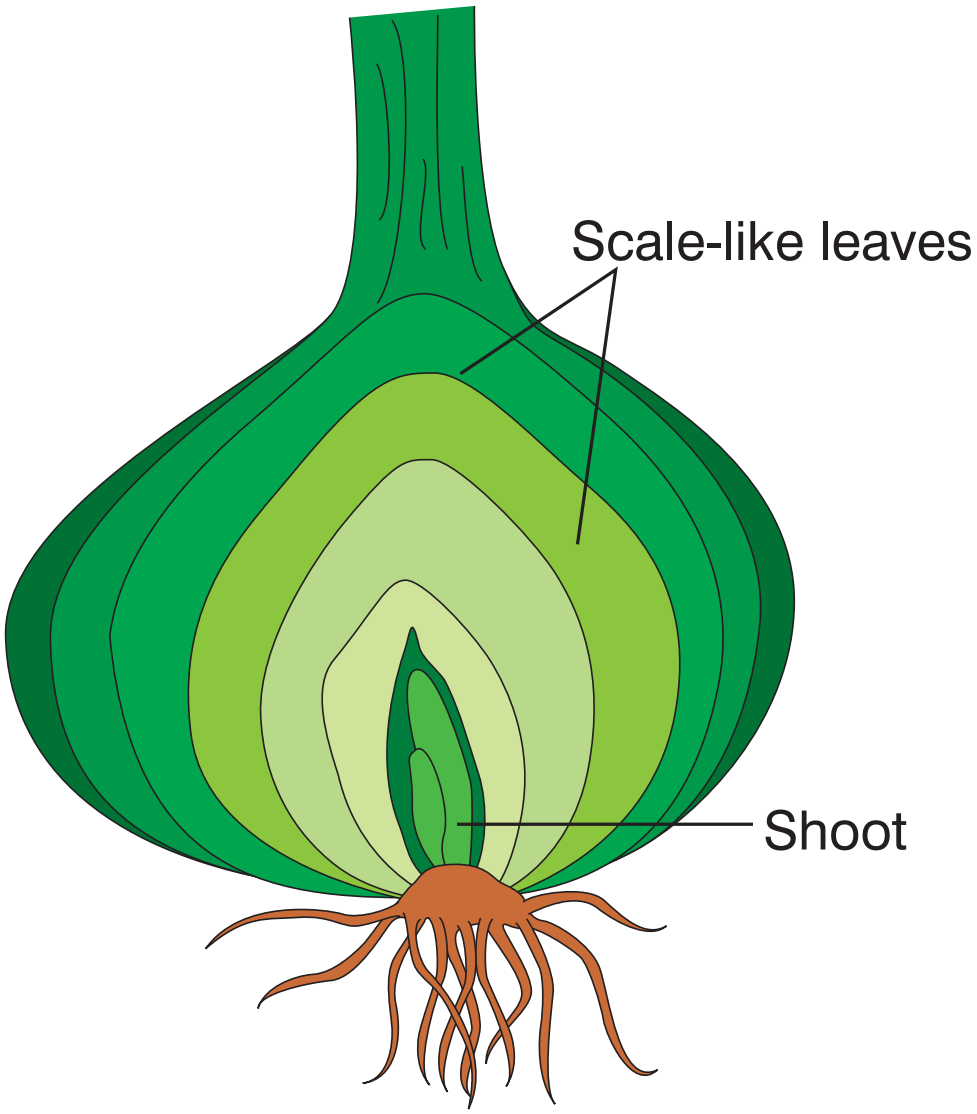
TUBER

(Courtesy, Agricultural Research Service, USDA)

A potato is the tuber of the plant. What other tubers do we eat?

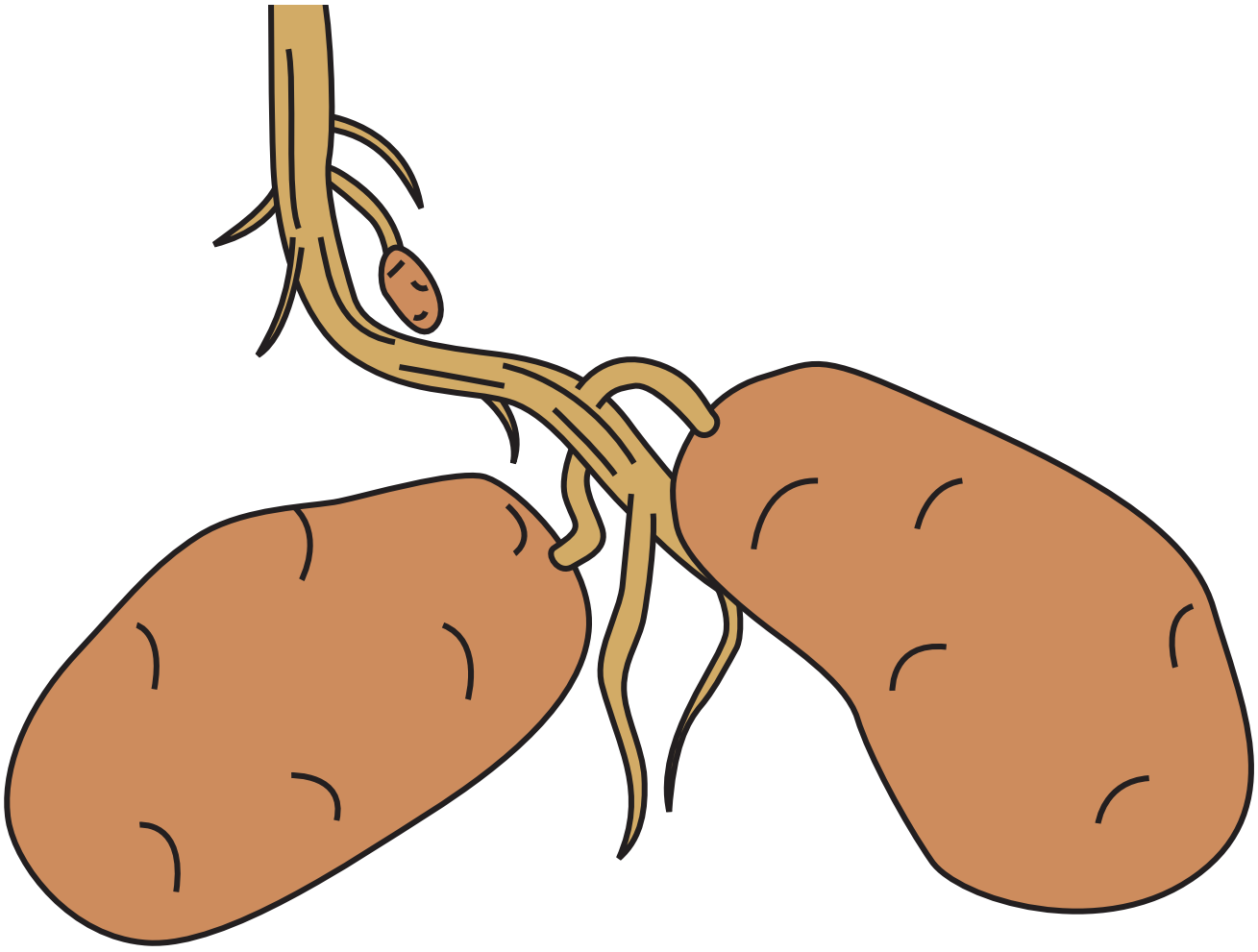
STRUCTURE OF A BULB

A bulb is a large underground bud made up of scale-like leaves that store food for the small shoot inside.



STRUCTURE OF A TUBER

A tuber is a fleshy underground stem that is used to store food.



IMPORTANT FACTORS TO CONSIDER WHEN PLANNING A VEGETABLE GARDEN

- What to plant
- Location
- Size
- Protection from animals
- Row arrangement
- Seeds or transplants
- Growing conditions
- Frost date
- Plant supports

SEED PACKET INFORMATION

Name _____

VEGGIE BUFFET

Materials

- ✓ Magazines and gardening catalogs with pictures of vegetables
- ✓ Scissors
- ✓ Glue
- ✓ Posterboard
- ✓ Markers

Procedure

1. Use magazines and gardening catalogs to find pictures of your 10 favorite vegetables.
2. Cut out the pictures and arrange them on your posterboard.
3. Under each picture, write the name of the vegetable.
4. To the side of each picture, write three things that you like to eat that include this vegetable. (For example, next to a picture of an onion, you could list pizza if you like onion as a pizza topping. Next to a picture of a potato, you could list french fries.)
5. Share your poster with the rest of the class. Do you all like the same vegetables?
6. Create a veggie buffet bulletin board to showcase your posters!

Name _____

VEGETABLE MATCH-UP

Directions

Write the letter of the vegetable on the line next to the plant part it comes from.

Plant Part

a. bulb
b. tuber
c. seed
d. seedpod
e. flower
f. leaf
g. fruit
h. root
i. stem

Vegetables

_____1. Peas

_____2. Pumpkin

_____3. Cauliflower

_____4. Potato

_____5. Okra

_____6. Asparagus

_____7. Onion

_____8. Cabbage

_____9. Carrot

VEGETABLE MATCH-UP KEY

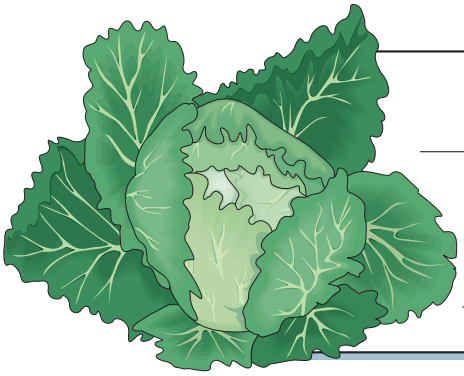
1. c
2. g
3. e
4. b
5. d
6. i
7. a
8. f
9. h

Name _____

WHAT ARE YOU EATING?

Directions

Think of the vegetables that you like to eat. List three vegetables that come from the three plant parts below.

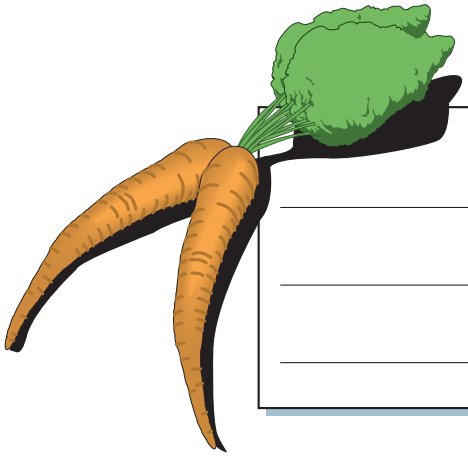


Leaf

_____

_____

_____

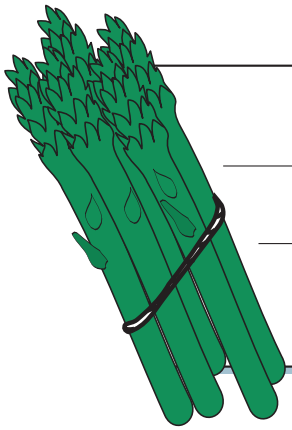


Root

_____

_____

_____



Stem

_____

_____

_____

Name _____

LET-TUCE GROW A SALAD IN A BAG

Materials

- ✓ Heavy-duty re-sealable plastic freezer bag (pint or quart size)
- ✓ Lettuce seeds
- ✓ Potting soil
- ✓ Spray bottle
- ✓ Water
- ✓ Permanent marker

Procedure

1. Fill the bag ¾ of the way with moist potting soil.
2. Sprinkle a small number of lettuce seeds on the surface of the soil. (Too many seeds will cause the plants to become crowded.)
3. Cover the seeds lightly with about 1/8 inch of soil.
4. Water the seeds with a light spray.
5. Close the bag, but leave a 1-inch gap.
6. Label the bag with your name and the planting date.
7. Set the bag in a sunny window.
8. When little green shoots appear, open the bag so the plants can breathe and have room to grow.
9. Continue to care for your plants. Water them properly and make sure they get enough light.
10. As the plants begin to get large and grow together, cut them and use them in a salad!

Name _____

READING A SEED PACKET

Materials

- ✓ Seed packet
- ✓ Writing utensil

Procedure

Use your seed packet to fill in the information below.

1. Name of the plant: _____
2. When is the best time to plant? _____
3. How deep should the seed be planted? _____
4. How long will it take for seedlings to emerge? _____
5. How far apart should the seeds be planted? _____
6. How much sun is needed? _____
7. What can this vegetable be used for? _____
8. Draw a picture below of what the seedling will look like.

Using the information you have learned from the seed packet, you can plant your seeds and watch them grow into healthy plants!

Lesson D–5

FRUIT AND NUT CROPS

Indiana Agricultural Literacy Lesson Plan Library

Unit D. Horticulture Science

Lesson 5. Fruit and Nut Crops

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe fruit and nut crops.
2. Explain how fruits grow.
3. Explore how nuts are produced.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Brickell, Christopher. *American Horticultural Society Encyclopedia of Gardening.* Dorling Kindersley, New York, 1993.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Texas Agricultural Extension Service. *Junior Master Gardener Handbook.* Texas A&M University, 1999.

University of Illinois, College of Agricultural, Consumer, and Environmental Sciences. *Getting to the Core: Apples and Orchards AgriLearning Kit.*

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Different kinds of fruits and nuts
- ✓ Blindfold

Terms. The following terms are presented in this lesson (shown in bold italics):

- Bushel
- Cane fruit
- Dry fruit
- Fleshy fruit
- Fruit
- Nut
- Orchard
- Peck
- Pruning
- Tree fruit
- Vine fruit

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Check for allergies prior to the activity. Bring in some fresh fruits and nuts. Have a blindfolded taste test with the students. Have them try to guess what kind of fruit or

nut they have tasted. This works best if you allow the students to try some exotic fruit, like kiwi or papaya.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe fruit and nut crops.

Anticipated Problem: What are fruit and nut crops?

I. Fruit and nut crops are an important part of our everyday lives. They are excellent sources of the vitamins and minerals we need to stay healthy.

A. A ***fruit*** is the edible ripened ovary of a tree, shrub, or vine.

1. Most fruits contain seeds. Several improved varieties do not, such as seedless grapes and seedless watermelons.
2. In general, all fruit is either fleshy or dry.
   a. ***Fleshy fruit*** is fruit that has large fibrous structures surrounding the seed. Examples include apples, pears, blackberries, oranges, and grapes.
   b. ***Dry fruit*** is fruit that develops as a pod or in a hull. Peas, nuts, and many grains are dry fruits.
3. Fruits sold from farms are often sold in units of measurement called bushels or pecks. A ***peck*** is a unit of measurement equal to 8 quarts. A ***bushel*** is a unit of measurement equal to 32 quarts or 4 pecks.

B. A ***nut*** is the mature shell-covered seed of a tree or shrub. Some examples of nuts are pecans, pistachios, almonds, and walnuts.

1. Many people consider the peanut a nut, but it actually is a legume.
2. Nuts are good sources of protein.
3. Nuts are often used in cooked or baked items, such as candy with almonds or cake with walnuts.

Use TM: D–5A and TM: D–5B to show students examples of various fruits and nuts. Use TM: D–5C to illustrate bushel and peck measurements. Use WS: D–5A, WS: D–5B, and WS: D–5C to help students apply the content of this objective. Have students brainstorm a list of fruits and nuts. Help them name as many different fruits and nuts as possible. Record the list on the writing surface and have students copy it in their notebooks. Encourage students to try any of the fruits and nuts they have never tasted before.

Objective 2: Explain how fruits grow.

Anticipated Problem: How do fruits grow?

II. Fruits grow on different types of woody plants. The type of plant on which fruit is produced is used to classify the fruits. Three main categories are tree fruits, cane fruits (also called bush fruits), and vine fruits.

A. A ***tree fruit*** is a fruit that grows on trees, such apples, oranges, lemons, grapefruit, cherries, pears, apricots, peaches, and plums.

1. Tree fruits are eaten fresh or processed for use as juices, jams, jellies, dried fruit, or canned fruit.
2. Tree fruit producers generally grow fruit in a field or area with many trees called an ***orchard***.
3. In order to produce abundant fruit, some fruit trees must be cross-pollinated with pollen from another tree. Many producers keep bee hives in their orchard to help with the cross-pollination.
4. In general, fruit trees grow best a good, well-drained soil.
5. Fruit trees should be evenly spaced so they don't compete with one another for sunlight, moisture, and minerals. Correct spacing also makes it easier for the producer to care for the trees and to harvest the fruit.
6. As young fruit trees mature, they must be pruned to help them develop a strong framework of branches. ***Pruning*** is the removal of branches, twigs, or fruit to gain the desired plant growth. The purpose of pruning is to develop a framework of strong branches that will support the heavy load of the fruit. Well-spaced branches also allow easier harvest of fruit and reduce some disease problems. Each type of fruit tree is pruned in a different way.
7. Fruit trees must be protected from insects that may attack and damage the fruit. Rabbits, deer, and mice can also harm the trees by chewing bark and eating buds.

B. A ***cane fruit*** (also called bush fruit) is a fruit that grows on small perennial plants, never trees. Some of the most common cane fruits are blueberries, blackberries, currants, gooseberries, raspberries, cranberries, and strawberries.

1. Cane fruits require less care than tree fruits, and they start producing fruit much sooner than tree fruits.
2. Cane fruits grow best in a loose, well-drained, organic soil.
3. Because of their small size and ease of growing, cane fruits are popular in home gardens.

C. A ***vine fruit*** is a fruit that grows on a woody plant that requires support. The most important vine fruit is the grape.

Use TM: D–5D to show students examples of the different categories of fruits based on plant type. Use WS: D–5D to apply the content of this objective. Arrange a visit to a local fruit orchard and have the owner discuss with the class how the fruits in his or

her orchard are grown. Also have the owner talk with the students about the maintenance and care required to keep the plants in the orchard healthy and productive. If there isn't a fruit orchard nearby, simply have students locate and examine fruit-producing plants in the local area.

Objective 3: Explore how nuts are produced.

Anticipated Problem: How are nuts produced?

III. Nut-bearing trees and shrubs are grown across the United States.

A. Some common nuts are walnut, pecan, chestnut, almond, filbert, hazelnut, macadamia, and coconut.

B. Most nuts are commercially produced in certain parts of the country in large orchards. Some nut-bearing plants are used in the home landscape, but protecting the ripening nuts from wildlife is difficult.

C. Winter cold, spring frosts, early fall freezes, droughts, wet humid weather, and the length of a frost-free growing season affect nut production.

D. In orchards, nut plants are evenly spaced in rows. They must sometimes be spaced quite far apart because some nut-bearing trees (walnut, hickory, pecan) can grow very large

E. Different nut-bearing tree varieties must be cross-pollinated to ensure a good crop.

F. Nut-bearing trees are pruned to develop a desirable shape and branching structure.

G. Nut crops must be protected from a insect and disease pests. Birds and squirrels also reduce nut harvests.

Use TM: D–5E to help illustrate the content of this objective. Use WS: D–5E to have students create information cards about nuts. Be sure to assign a different nut to each students so that a variety of information will be available on the final bulletin board. Have students research the nut industry on the Internet. Instruct them to find out where most nuts are produced in the United States. Also have them locate information about nut imports and exports. A good starting point might be the International Tree Nut Council's website at www.inc.treenuts.org

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: D–5A, WS: D–5B, WS: D–5C, WS: D–5D, and WS: D–5E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. e
3. c
4. a
5. d

Fill-in-the-Blank

1. orchard
2. peck
3. bushel

Short Answer

Answers will vary. Students should list the three categories of fruits based on plant type—tree fruits, cane fruits, and vine fruits—and give an example of each.

Test D–5

Name_____

FRUIT AND NUT CROPS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. fruit
b. nut
c. pruning
d. fleshy fruit
e. dry fruit

_____1. The mature shell-covered seed of a tree or shrub.

_____2. Fruit that develops as a pod or in a hull.

_____3. The removal of branches, twigs, or fruit to gain the desired plant growth.

_____4. The edible ripened ovary of a tree, shrub, or vine.

_____5. Fruit that has large fibrous structures surrounding the seed.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

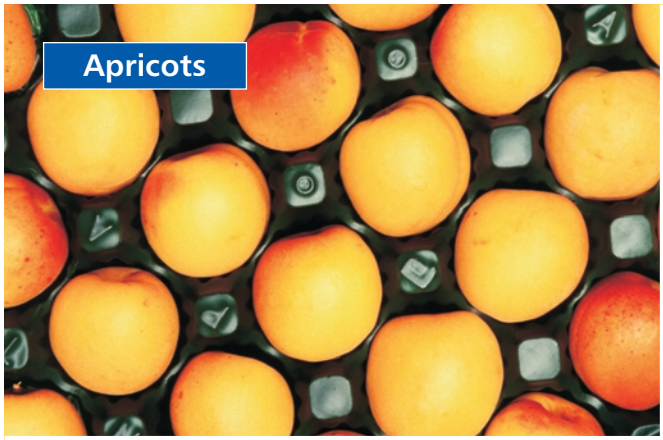
1. Tree fruit producers generally grow fruit in a field or area with many trees called a(n) _____.
2. A(n) _____ is a unit of measurement that is equal to 8 quarts.
3. A(n) _____ is a unit of measurement that is equal to 32 quarts.

▶ Short Answer

***Instructions*. Answer the following question.**

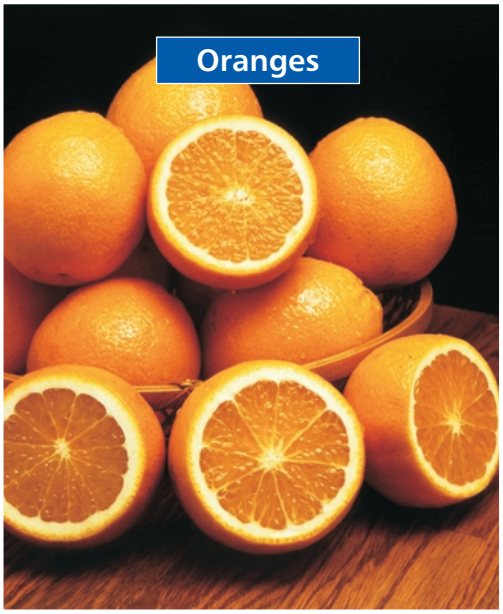
Name the three main categories of fruits based on plant type and give an example of each.

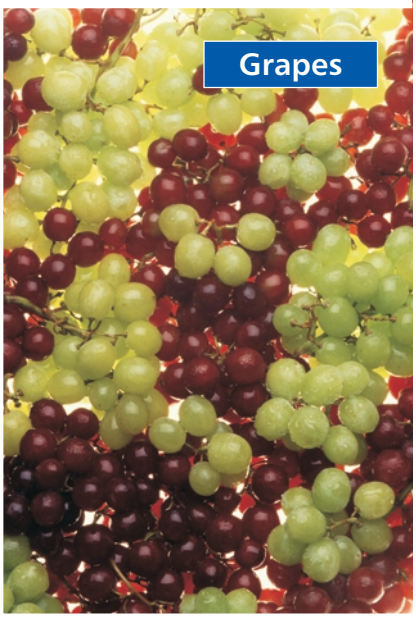
FRUITS


Apricots


Apples


Blackberries

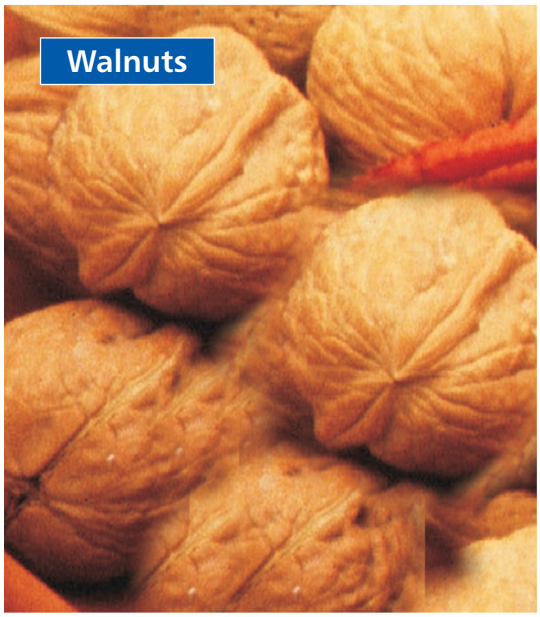

Oranges


Grapes

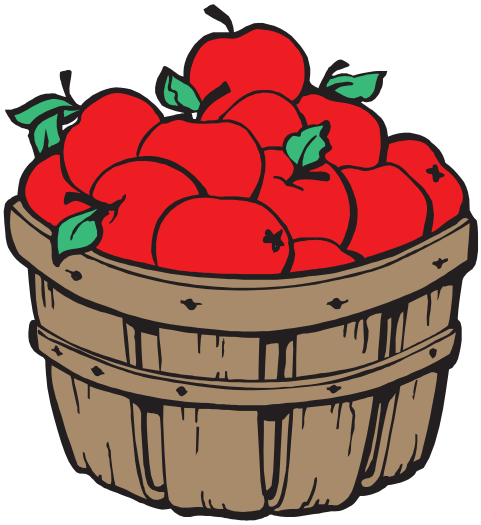

Strawberries


Lemons

NUTS



BUSHELS AND PECKS



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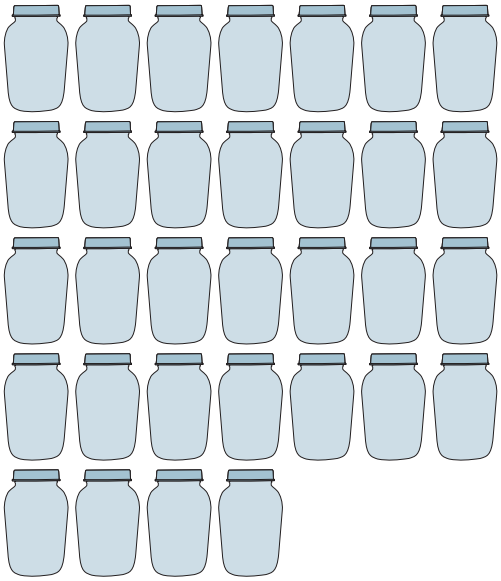

1 bushel = 32 quarts

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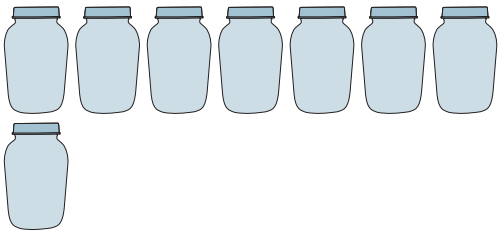
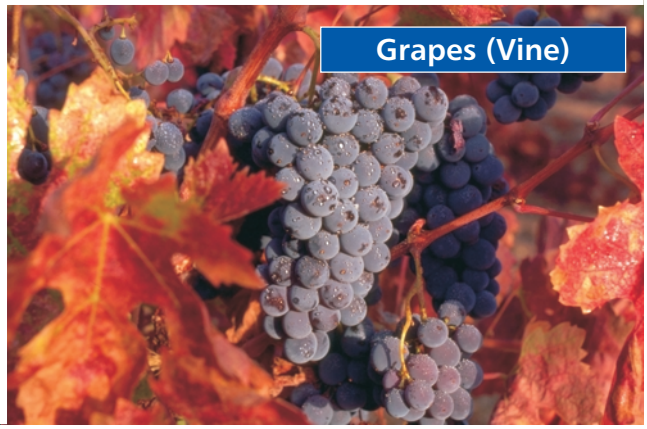


1 peck = ¼ bushel = 8 quarts

FRUIT CATEGORIES



NUT-BEARING TREES

Name _____

FRUIT SALAD TREE

Directions

This crazy tree is bearing fruit, but who knows what kind? Unscramble the letters in each of the words below and write the name of the fruit it spells in the blank.

_____ 1. p a p e l

_____ 2. a n b a n a

_____ 3. h e c r y r

_____ 4. e a p r g

_____ 5. h a c e p

_____ 6. r e a p

_____ 7. r e b r w y r s a t

_____ 8. r n a g o e

_____ 9. s a r r y b e p r

_____ 10. r u b b l e r y e

FRUIT SALAD TREE KEY

1. apple
2. banana
3. cherry
4. grape
5. peach
6. pear
7. strawberry
8. orange
9. raspberry
10. blueberry

WS: D–5B

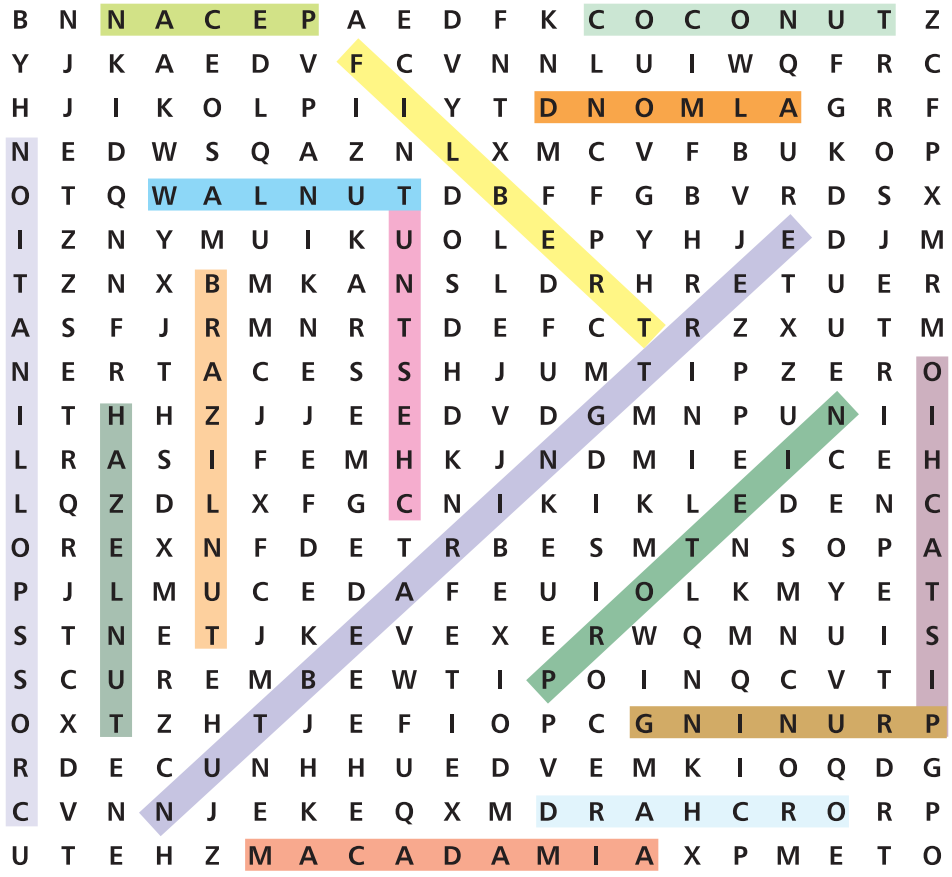
Name _____

NUTTY WORD SEARCH

B N N A C E P A E D F K C O C O N U T Z
Y J K A E D V F C V N N L U I W Q F R C
H J I K O L P I I Y T D N O M L A G R F
N E D W S Q A Z N L X M C V F B U K O P
O T Q W A L N U T D B F F G B V R D S X
I Z N Y M U I K U O L E P Y H J E D J M
T Z N X B M K A N S L D R H R E T U E R
A S F J R M N R T D E F C T R Z X U T M
N E R T A C E S S H J U M T I P Z E R O
I T H H Z J J E E D V D G M N P U N I I
L R A S I F E M H K J N D M I E I C E H
L Q Z D L X F G C N I K I K L E D E N C
O R E X N F D E T R B E S M T N S O P A
P J L M U C E D A F E U I O L K M Y E T
S T N E T J K E V E X E R W Q M N U I S
S C U R E M B E W T I P O I N Q C V T I
O X T Z H T J E F I O P C G N I N U R P
R D E C U N H H U E D V E M K I O Q D G
C V N N J E K E Q X M D R A H C R O R P
U T E H Z M A C A D A M I A X P M E T O

WALNUT	NUT-BEARING TREE	PECAN
CHESTNUT	ALMOND	FILBERT
PROTEIN	MACADAMIA	CROSS-POLLINATION
ORCHARD	PISTACHIO	BRAZIL NUT
HAZELNUT	PRUNING	COCONUT

NUTTY WORD SEARCH KEY



Name _____

ARE YOU IN FOR A BUSHEL OR A PECK?

Directions

Use the conversion chart to solve the problems.

Conversion Chart

1 pint = 2 cups
1 quart = 2 pints
1 peck = 8 quarts
1 bushel = 4 pecks

Problems

1. _____ cups = 1 peck
2. _____ quarts = 1 bushel
3. _____ pints = 1 peck
4. _____ pecks = 3 bushels
5. _____ pints = 2 bushels
6. _____ quarts = 2 pecks
7. _____ cups = 1 bushel
8. _____ pecks = 10 bushels
9. _____ cups = 4 bushels
10. _____ quarts = 6 bushels
11. The chef of a restaurant wants to buy blueberries for a special dessert for a private dinner party. The recipe calls for 1 cup of blueberries. The recipes makes 4 servings. Approximately 88 guests will be attending the dinner party. The chef calls the local berry farm to order the fresh berries. How many pecks should the chef order, and how many cups will he have left over?

WS KEY: D–5C

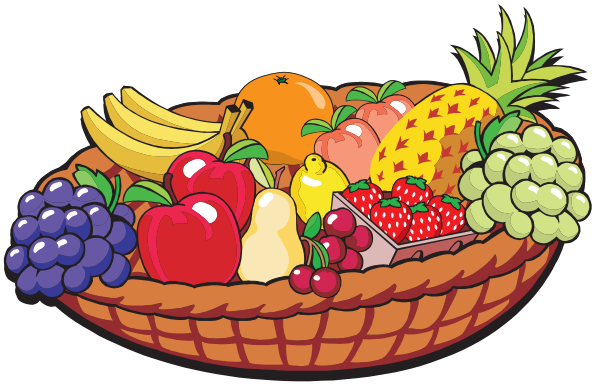
ARE YOU IN FOR A BUSHEL OR A PECK KEY

1. 32
2. 32
3. 16
4. 12
5. 64
6. 16
7. 128
8. 40
9. 512
10. 192
11. The chef should order 1 peck of blueberries. Only 22 cups are needed for the dinner party. Since a peck is 32 cups, 10 cups will be left over.

Name _____

FRUIT-TASTIC DISPLAY

Materials



- ✓ Nursery catalogs or other references with information about fruits
- ✓ Colored construction paper
- ✓ Scissors
- ✓ Glue
- ✓ Writing utensil

Procedure

1. Using the nursery catalogs, find information about your favorite fruit.
2. Cut out the shape of your fruit from the colored construction paper.
3. On the fruit shape, list information about your fruit. Be sure to include what type of plant it grows on, where it is grown, whether it contains seeds, what you like about it, and how you like to eat it (in pie, on ice cream, fresh, etc.).
4. Cut out pictures of your fruit from the catalogs and glue them to your fruit shape to decorate it.
5. Create a fruit basket bulletin board to display all of the fruits.

Name _____

NAME THAT NUT

Directions

Identify the nuts by writing the correct name under each picture.

1. _____

2. _____

3. _____

4. _____

5. _____

NAME THAT NUT KEY

1. Walnuts
2. Almonds
3. Brazil nuts
4. Hazelnuts
5. Pecans

Lesson E–1

PERSONAL FINANCES

Indiana Agricultural Literacy Lesson Plan Library

Unit E. Agribusiness

Lesson 1. Personal Finances

Indiana's Academic Standard. **Social Studies:** 4.4.6 — List the functions of money and compare and contrast things that have been used as money in the past in Indiana, the United States, and the world. 4.4.10 — Explain how money helps people to save and develop a savings plan in order to make a future purchase.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the purpose of money and describe various ways to use money.
2. Demonstrate the budgeting of money.
3. Discuss the differences between checking and savings accounts.
4. Identify the components of a check, and recognize a deposit slip, a withdrawal slip, a check register, and a bank statement.
5. Correctly fill out and record a check.
6. Distinguish differences in credit cards and proper use of credit.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Checkbook Math. Scottsdale, Arizona: Remedia Publications, 2001.

Elliot, Jack. *Agribusiness: Decisions & Dollars.* Albany, New York: Delmar Publishers, 1999.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

www.moneyinstructor.com

www.practicalmoneyskills.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Play money (bills and coins)
- ✓ Small items or candy for students to buy

Terms. The following terms are presented in this lesson (shown in bold italics):

- Allowance
- Bank
- Bank statement
- Barter
- Budget
- Check
- Checking account
- Check register
- Credit
- Credit card
- Currency
- Deposit
- Deposit slip
- Donation
- Income
- Interest
- Money
- Receipt

- Salary
- Saving
- Savings account
- Wage
- Withdrawal
- Withdrawal slip

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Set up a storefront in the classroom. Have small items (candy, stickers, toys, books, etc.) available for students to purchase. Give each student the same amount of play money. Tell them that they can spend their money on anything they want, but at the end of the week a larger item will be available for purchase. Some students will probably spend their money immediately and others will hold onto it. This activity will compel them to think about their spending choices and make them consider the consequences of their actions.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain the purpose of money and describe various ways to use money.

Anticipated Problem: Why do we need money?

I. Money is our main method of purchasing things that we need and want. Money carries a value. We use money's value to exchange for merchandise and services.

A. ***Barter*** is the trading of a good or service for another good or service without using money.
   1. A long time ago, people did not even use money. They used the barter system.
   2. Barter was the main form of exchange between neighbors, tribes, and countries.
   3. Most everyone has bartered at sometime or another.
   4. Trading baseball cards for a bag of potato chips is an example of bartering.

B. ***Money*** is a form of exchange and a measure of value.
   1. Money can be anything that is commonly accepted by a group of people.
   2. Money can be used to pay for goods and services.
      a. Goods are tangible materials like food, clothing, bicycles, cars, and houses.

b. Services are intangible things like doctor's visits, house cleaning service, and telephone and electrical service. We are actually paying for the service and not the merchandise.

3. At one time, shells were used as money.
4. Silver and gold nuggets were used before coins were produced.
5. A uniform system of money makes it more convenient to obtain goods and services.

C. ***Currency*** is the money in circulation in a country.

1. The United States uses a uniform system of coins and paper currency.
2. Currency lets people purchase goods and services in a convenient way.
3. Our currency system is less than 100 years old.

D. ***Income*** is the money received for labor, services, property, or investments.

1. Most people have some type of income from employment.
2. Some people may be paid a certain amount of money per hour, and their income depends on how many hours they actually work. The money they are paid for each hour is referred to as their ***wage***.
3. Other people may receive a ***salary***, which is a fixed payment for a period of work.
4. An ***allowance*** is an amount of money given to a person. Many children get allowances from their parents. They may have to do certain tasks like household chores (washing dishes, dusting, or vacuuming), mowing the lawn, running errands, keeping their room clean, or taking care of pets to receive their allowance.

Use TM: E–1A to cover the content of the objective. This would be a good time to review currency identification and value. Use WS: E–1A to help students identify the faces on various coins and bills. It would be interesting to have a coin collector visit the classroom to show a variety of coins as well as foreign currency.

Objective 2: Demonstrate the budgeting of money.

Anticipated Problem: How should I spend or save my money?

II. It is important to make wise money choices. The money choices you make today can make a big difference in your future. A ***budget*** is a written plan that outlines how money should be used.

A. It is a good idea to make a budget that details how money will be spent, saved, donated, and/or invested.

B. If you are saving for a large item, such as a bicycle or a computer, you may want to make a budget to help save for the item.

C. Most of us find it easy to spend money! A budget can help us decide how much money we have to spend and what we want to spend it on.

1. People spend money on things that they need and things that they want. Money is spent on food, clothing, cars, houses, and other items that are considered necessities.

Money is also spent on luxury items, such as televisions, computers, boats, and toys, or on entertainment.

2. ***Saving*** means putting away money for use in the future. Sometimes, it may seem more difficult to save money than it is to spend it! If you spend all of your income, you will have no money left over to save.
   a. Saving is the best way to ensure that money will be available for future wants and needs.
   b. A responsible person might save a certain amount or percentage of his or her income before spending any of it.
   c. Some people save for emergencies, such as sickness, loss of job, or vehicle breakdowns.
3. People invest money to make more money. Money can be invested in property, stocks, bonds, etc. Stocks and bonds gain value by earning interest. People can also lose money in investments.
4. People can make a ***donation***, or give money, to individuals or organizations, such as churches, community groups, and youth clubs. Girl Scouts, March of Dimes, the American Red Cross, and the Cancer Society are all examples of organizations people donate money to. Donations are very important in helping others.

Use TM: E–1B to cover the content of the objective. Use WS: E–1B to give students a chance to budget their money. Have them think about how they will use their money. Will they spend it, save it, or donate it? Allow some discussion on what students might buy or how they could save for a larger purchase. Encourage them to distinguish between wants and needs. Instruct students to think about their choices and how their decisions will affect their money. Promote saving and donating along with wise spending.

Objective 3: Discuss the differences between checking and savings accounts.

Anticipated Problem: What is the difference between a checking account and a savings account?

III. Most people put their money in banks for safe keeping.

A. A ***bank*** is a business or institution for receiving, keeping, and lending money. The main purpose of a bank is to make money.

B. A ***checking account*** is a bank account that allows a person to write checks from his or her account to pay for goods and services. Checking accounts are a convenient way to pay bills because checks, unlike cash, are safe to send in the mail. Some checking accounts can earn interest but not normally as much as savings accounts.

C. A ***savings account*** is a bank account that offers a convenient way to save money. It can provide a reserve of money to be used in the future. Savings accounts gain interest on the money deposited.

D. A ***deposit*** is the placing of money into an account.

E. A ***withdrawal*** is the removal of money from an account. Writing a check withdraws money from a checking account.

F. ***Interest*** is money paid to the account holder for keeping money in the bank. Interest can also be charged to someone borrowing money from a bank.

Use TM: E–1C to cover the content of the objective. Use WS: E–1C as a fun activity that will help students further their understanding of the terms presented in this objective.

Objective 4:

Identify the components of a check and recognize a deposit slip, a withdrawal slip, a check register, and a bank statement.

Anticipated Problem: What are the various parts of a check, a deposit slip, a check register, and a bank statement?

IV. In order to properly manage money, it is important to know about checks, deposit slips, withdrawal slips, check registers, and bank statements.

A. A ***check*** is a legal financial document written by an account holder that requests the bank to withdraw money from the checking account and pay it to the business or individual to whom the check is written.

1. Checks can be used as payment instead of cash.
2. Most businesses and individuals accept checks as payment.
3. You generally must show proper identification when writing or cashing a check.
4. A check is a safe way to send money in the mail.

B. A ***check register*** or ledger is a form used to keep a record of the checks that have been written. Deposits are also recorded in a check register.

C. A ***deposit slip*** is a bank form used to show the amount of money deposited into an account.

D. A ***receipt*** or ***withdrawal slip*** is a bank form used to show the amount of money that is taken out of an account.

E. A monthly ***bank statement*** is a bank form that shows all the transactions in an account.

1. Each deposit and withdrawal is included on the statement and the balance is calculated.
2. Any interest or fees are also included on the bank statement.
3. You should review your monthly bank statement to make sure all checks, deposits, fees, and interest are listed correctly. You should also use it to balance your checkbook each month.

Use TM: E–1D to cover the content of the objective. Use TM: E–1E to help students identify the basic components of a check. Use TM: E–1F, TM: E–1G, and TM: E–1H to show students an example of what a deposit slip, withdrawal slip, and checkbook

register look like. Use WS: E–1D as an activity to help students learn the different parts of a check.

Objective 5: Correctly fill out and record a check.

Anticipated Problem: How do you properly write a check and record it in your check register?

V. In order to properly manage your checking account, you must know how to correctly fill out a check and record it in your check register.

A. A check is a legal document and should be treated as such.
   1. Always use a permanent ink pen to write a check.
   2. Write neatly on checks so that the bank and the receiver of the check can read it.
   3. If a mistake is made on a check, it should be voided (destroyed) or corrected and initialed.
   4. Be careful to fill out the check completely and accurately.
   5. Record the information from the check in your check register to insure proper record keeping. The check number, date, name of payee, amount of check, and the purpose of the check should be recorded in the check register.

B. Some information is printed on checks. Always examine new checks to verify that all the information is correctly printed.
   1. Most people have their name, address, and phone number printed on the top of their checks.
   2. The name of the bank or institution is also printed on the check, usually under the dollar amount line.
   3. The check number is printed at the upper right corner of the check for identification purposes.

C. Information must be filled out by the person writing the check.
   1. Write the date of the check on the date line (example: June 1, 2005).
   2. Write the name of the business or person to whom the check is being written on the "Pay to the order of" line. This must be completely filled in. Do not leave a blank in this space because anyone could fill it in and cash it.
   3. Write the amount of the check in numeric form after the "$" sign.
   4. Also write the amount of the check in word form on the next line.
      a. Write the dollar amount as words.
      b. Write the cents amount as a fraction.
      c. It is important that the entire line is filled so that additional numbers cannot be added.
   5. Fill in the ledger or memo line to show the purpose of the check. This helps you remember why the check was written and makes record keeping easier.
   6. Sign your legal name to the check.

Use TM: E–1I to show students examples of how dollar and cents amounts are properly written in word form on a check. Use TM: E–1J as an example of how to fill out a check. Use TM: E–1K to show students how to correctly record a check in a check register. Have students complete WS: E–1E to help them learn how to properly write dollar and cent amounts as words. Use WS: E–1F to have students practice writing checks. WS: E–1G will help students learn how to enter information into a checkbook register.

Objective 6: Distinguish differences in credit cards and proper use of credit.

Anticipated Problem: How are credit cards different and how should they be used?

VI. ***Credit*** is money borrowed that must be paid back to the lender.

A. Credit can be used to buy something right away when you do not have enough money to pay for it at the time. Credit allows people to buy things and pay for them over a period of time.

B. Credit is available through credit cards or loans. The lender charges a fee for the use of the money.

C. Goods and services can be purchased with credit.

D. Credit can also be used to buy things without having to carry cash. Credit is a privilege and should not be abused.

E. There are two main types of credit: short-term credit and long-term credit.

1. Short-term credit is considered to be for one month to one year.
   a. Short-term credit can be used in our personal lives to buy items such as clothing, furniture, appliances, or services (like restaurant meals or vacations).
   b. Short-term credit can be used in a business to buy the things necessary for the operation of the business, such as fuel, fertilizer, or seed. This might be necessary when cash is not available during production.
   c. Credit cards are commonly used for short-term credit.
2. Long-term credit would be for 3 to 30 years.
   a. Long-term credit is commonly used by businesses or individuals for buying large items, such as automobiles, equipment, buildings, or real estate. Many people do not have enough money to pay cash for a car or house, so they must acquire credit. New businesses may need credit for initial start-up costs. Other businesses might need credit to buy additional land, buildings, or equipment.
   b. Long-term credit may require a down payment before credit is given.
   c. Loans are normally used for long-term credit.

F. A ***credit card*** is a plastic card issued by a bank or other financial institution that allows people to purchase goods and services now and pay for them later.
   1. Credit cards have many advantages.
      a. Credit cards make it possible to buy something you don't have the money for right away and pay for it later or over a period of time.
      b. Credit cards make it easier to buy things immediately by mail, Internet, or phone.
   2. There are also many disadvantages to credit cards.
      a. Overspending is the most common problem with credit cards. Because it is easy to buy things with a credit card, some people may not realize how much they are spending or how long it will take to pay the money back.
      b. Credit cards can be stolen or lost and purchases made on your account.
      c. Some credit cards charge a yearly fee to use them.
      d. Most credit cards have high interest rates. Because the interest continues to accumulate until the balance is paid in full, you may end up paying much more for an item than it actually costs.

Use TM: E–1L to discuss short-term and long-term credit with students. Use TM: E–1M to show students the advantages and disadvantages of credit cards. Arrange a visit to a local bank to let students see the safe/vault, how the bank operates, what forms are used for accounts and loans, etc.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they tour a local bank and as they complete WS: E–1A, WS: E–1B, WS: E–1C, WS: E–1D, WS: E–1E, WS: E–1F, and WS: E–1G.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. f
2. c
3. e
4. b

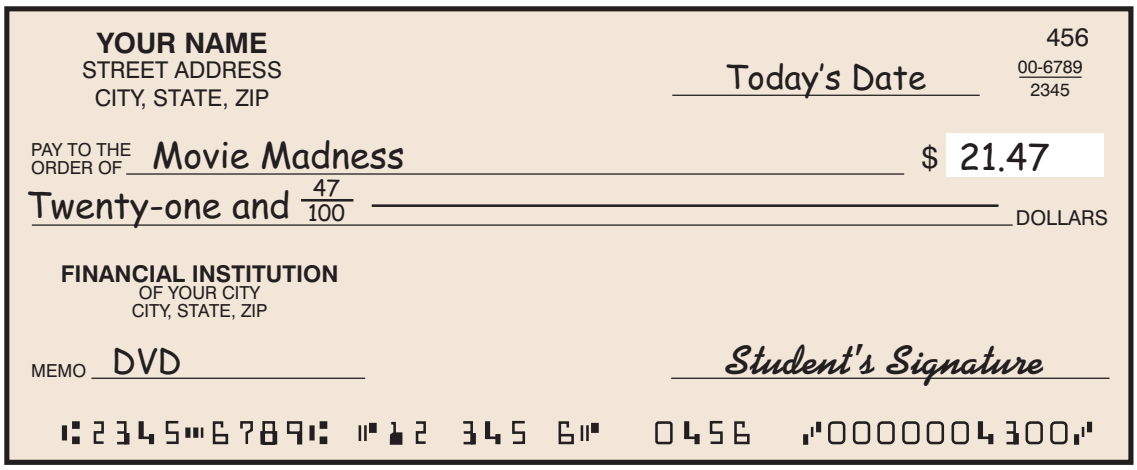
5. d
6. a

Fill-in-the-Blank

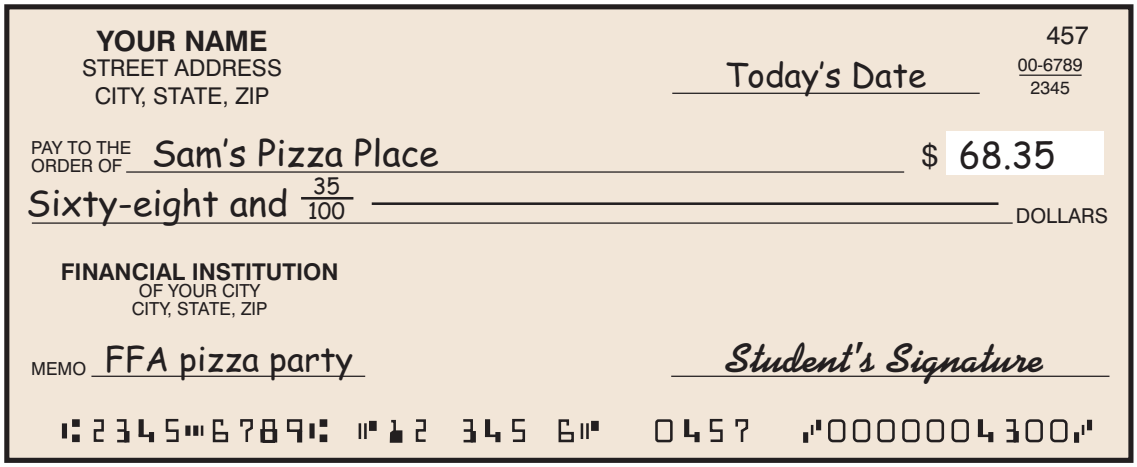
1. donation
2. interest
3. bank
4. checking account
5. savings account
6. withdraw
7. Barter

Short Answer

1.



2.



Test E–1

Name _____

PERSONAL FINANCES

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. currency
b. saving
c. budget
d. deposit
e. income
f. check

_____1. A legal financial document written by an account holder that requests the bank to withdraw money and pay it to a business or individual.

_____2. A written plan that outlines how money should be used.

_____3. The money received for labor, services, property, or investments.

_____4. Putting away money for use in the future.

_____5. The placing of money into an account.

_____6. The money in circulation in a country.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Giving money to a church or youth group is considered a(n) _____.
2. Savings accounts and some checking accounts earn money, or _____.
3. A business or institution for receiving, keeping, and lending money is called a(n) _____.
4. A bank account that checks are written from is called a(n) _____ _____.
5. An account that is used to save money is called a(n) _____ _____.
6. When you take money out of a bank you _____ the money.
7. _____ is the trading of a good or service for another good or service without using money.

Short Answer

***Instructions*. Answer the following questions.**

1. You bought a new DVD from Movie Madness for $21.47. Write the check to pay for the purchase. Use today's date.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

456
00-6789
2345

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____

⑆234567890⑆ ⑈12 345 6⑈ 0456 ⑈000000430⑈

2. You threw a pizza party for your fellow FFA members at Sam's Pizza Place. The total cost of the party was $68.35. Write the check to pay for the party. Use today's date.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

457
00-6789
2345

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____

⑆234567890⑆ ⑈12 345 6⑈ 0457 ⑈000000430⑈

MONEY

- Money is our main method of purchasing things that we need and want. It carries a value.
- Barter is the trading of a good or service for another good or service without using money.
- Currency is the money in circulation in a country.
- Income is the money received for labor, services, property, or investments.

BUDGETING

- A budget is a written plan that outlines how money should be used.
- A budget can help us decide how much money we have to spend and what we want to spend it on.
  - ➔ People spend money on things that they need and things that they want.
  - ➔ Saving means putting away money for use in the future.
  - ➔ People can invest money with the goal to make more money.
  - ➔ People can make a donation, or give money, to individuals or organizations.

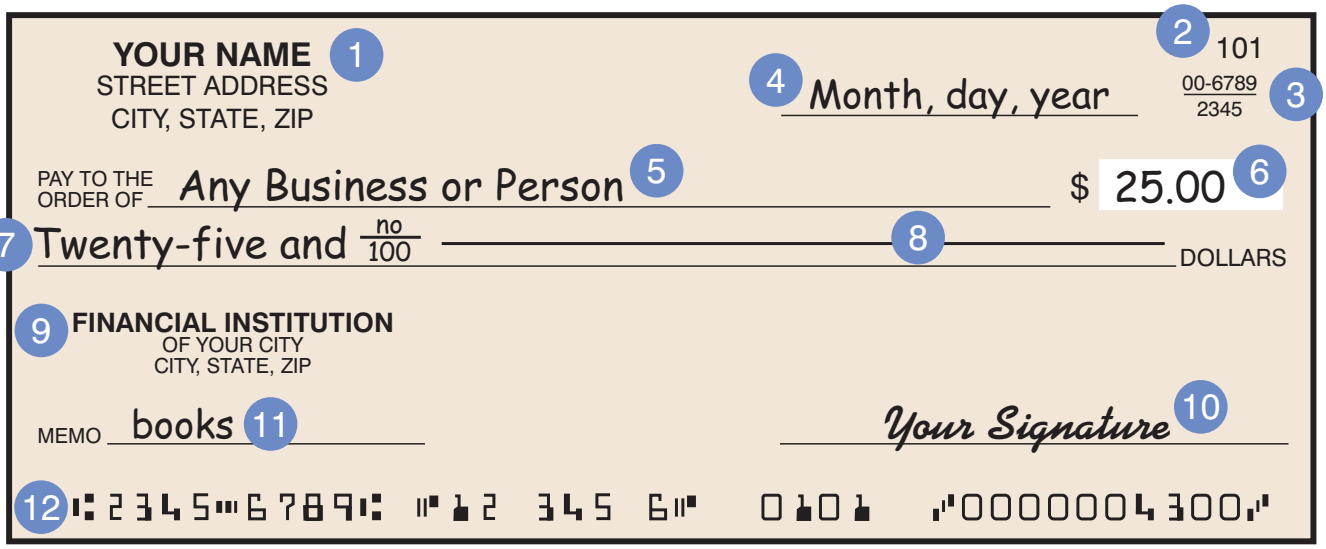
CHECKING AND SAVINGS ACCOUNTS

- A bank is a business or institution for receiving, keeping, and lending money.
- A checking account is a bank account that allows a person to write checks from his or her account to pay for goods and services.
- A savings account is a bank account that offers a convenient way to save money.
- A deposit is the placing of money into an account.
- A withdrawal is the removal of money from an account.
- Interest is money paid to the account holder for keeping money in the bank. Interest can also be charged to someone borrowing money from a bank.

BANK FORMS

- A check is a legal financial document written by an account holder that requests the bank to withdraw money from the checking account and pay it to the business or individual to whom the check is written.
- A check register or ledger is a form used to keep a record of the checks that have been written. Deposits are also recorded in a check register.
- A deposit slip is a bank form used to show the amount of money deposited into an account.
- A receipt or withdrawal slip is a bank form used to show the amount of money that is taken out of an account.
- A monthly bank statement is a bank form that shows all the transactions in an account.

IMPORTANT PARTS OF A CHECK



1. Name and address of account holder.
2. Consecutive check number.
3. Financial institution's number.
4. Date.
5. Name of the payee.
6. The check amount in figures (numeric).
7. The check amount in words (alphabetic).
8. Line to fill the space between the amount and the word "DOLLARS."
9. Name and location of financial institution.
10. Signature of account holder.
11. Memo line to record what the check is in payment of.
12. Numbers used by the financial institution for sorting checks and listing the account's number.

DEPOSIT SLIP

CHECKING ACCOUNT DEPOSIT TICKET

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

DATE Month, day, year
DEPOSITS MAY NOT BE AVAILABLE FOR IMMEDIATE WITHDRAWAL

SIGN HERE FOR CASH RECEIVED (IF REQUIRED)

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

⑆12345⑈6789⑆ ⑈12 345 6⑈

CASH	CURRENCY	24	00
	COIN	5	00
LIST CHECKS SINGLY			
TOTAL FROM OTHER SIDE		85	00
TOTAL		114	00
LESS CASH RECEIVED			
NET DEPOSIT		114	00

75-305
919

USE OTHER SIDE FOR ADDITIONAL LISTING

BE SURE EACH ITEM IS PROPERLY ENDORSED

CHECKS AND OTHER ITEMS ARE RECEIVED FOR DEPOSIT SUBJECT TO THE PROVISIONS OF THE UNIFORM COMMERCIAL CODE OR ANY APPLICABLE COLLECTION AGREEMENT.

WITHDRAWAL SLIP

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

SAVINGS WITHDRAWAL

012-34567-8
ACCOUNT NUMBER

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

DATE _____

RECEIVED
DOLLARS _____
(AMOUNT IN WORDS)

TO BE CHARGED TO MY ACCOUNT $ _____
(AMOUNT WITHDRAWN)

NEW BALANCE $ _____ SIGNATURE _____

CHECKBOOK REGISTER

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT

CHECK NUMBER	DATE	DESCRIPTION OF TRANSACTION	(–) PAYMENT/DEBIT		✓ T	(–) CHECK FEE (IF ANY)	(–) DEPOSIT/CREDIT		BALANCE 310	40
321	1/18	ABC Hardware	58	20					58	20
		lawnmower repair parts							252	20
322	1/18	John Doe	14	85					14	85
		hockey tickets							237	35
323	1/21	XYZ Grocery	39	42					39	42
		groceries							197	93
	1/24	Deposit					160	00	160	00
									357	93
324	1/26	ABC Video	46	30					46	30
		video games							311	63

REMEMBER TO RECORD AUTOMATIC PAYMENTS / DEPOSITS ON DATE AUTHORIZED

WRITING AMOUNTS IN WORD FORM

Dollar Amounts

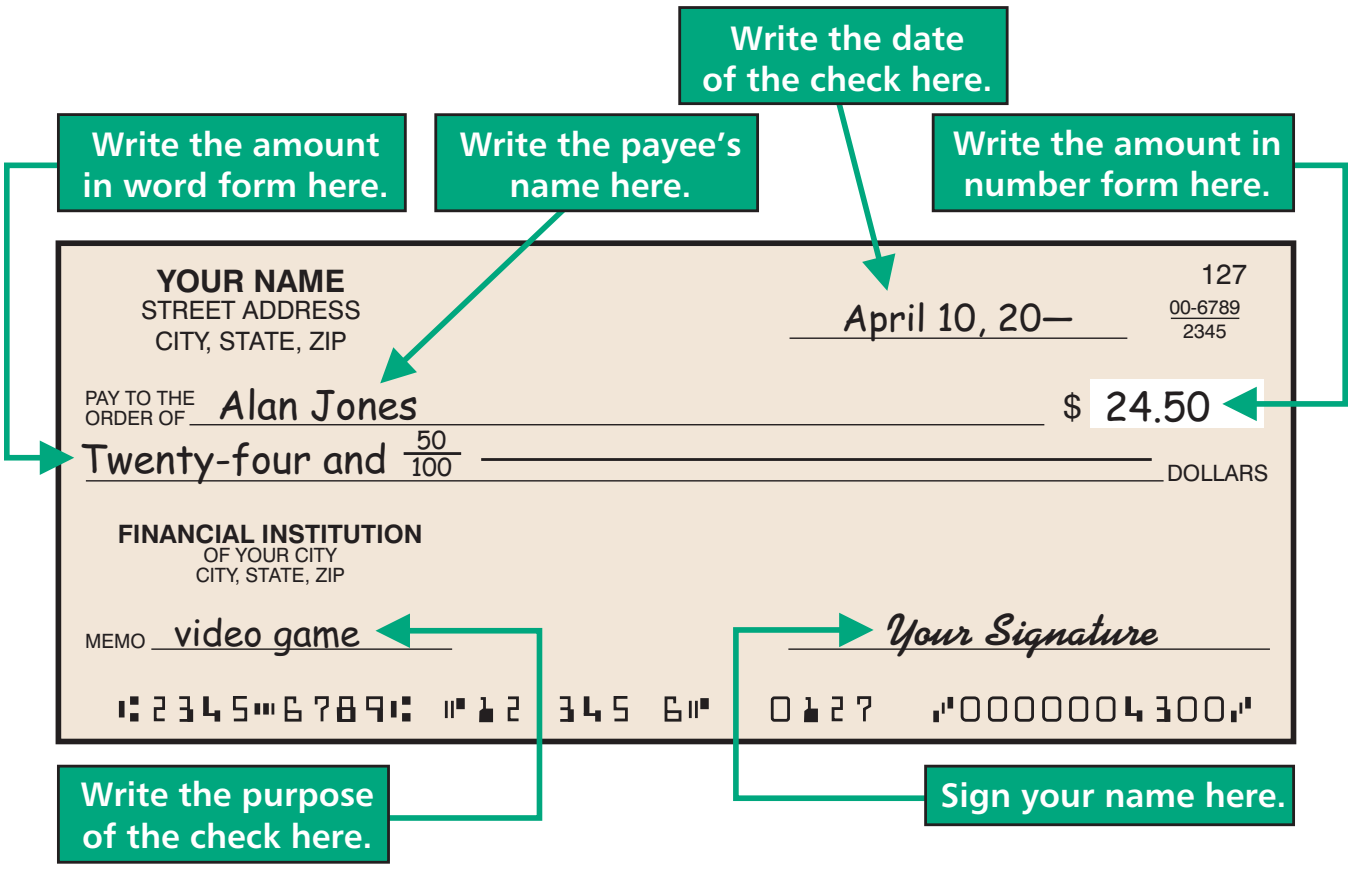
1 — one
2 — two
3 — three
4 — four
5 — five
6 — six
7 — seven
8 — eight
9 — nine
10 — ten
11 — eleven
12 — twelve
13 — thirteen
14 — fourteen
15 — fifteen
16 — sixteen
17 — seventeen
18 — eighteen
19 — nineteen
20 — twenty
21 — twenty-one
30 — thirty
40 — forty
50 — fifty
60 — sixty
70 — seventy
80 — eighty
90 — ninety
100 — one hundred
101 — one hundred one
190 — one hundred ninety

Cents Amounts

0 — 00/100 or no/100
1 — 01/100
2 — 02/100
3 — 03/100
4 — 04/100
5 — 05/100
6 — 06/100
7 — 07/100
8 — 08/100
9 — 09/100
10 — 10/100
15 — 15/100
20 — 20/100
25 — 25/100
50 — 50/100
99 — 99/100

HOW TO WRITE A CHECK

You owe Alan Jones $24.50 for a video game you bought on April 10.



HOW TO RECORD A CHECK IN A CHECK REGISTER

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT

CHECK NUMBER	DATE	DESCRIPTION OF TRANSACTION	(–) PAYMENT/DEBIT		✓ T	(–) CHECK FEE (IF ANY)	(–) DEPOSIT/CREDIT		BALANCE	
									270	20
124	3/24	Read-A-Lot Book Store	32	72					32	72
		books							237	48
125	3/28	Melissa Smith	25	30					25	30
		concert ticket							212	18
126	4/4	ABC Computers	14	85					14	85
		mouse							197	33
	4/7	Deposit					80	00	80	00
									277	33
127	4/10	Alan Jones	24	50					24	50
		video game							252	83

REMEMBER TO RECORD AUTOMATIC PAYMENTS / DEPOSITS ON DATE AUTHORIZED

Subtract amount of check from balance and record new balance.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

127
00-6789
2345

April 10, 20—

PAY TO THE ORDER OF Alan Jones $ 24.50

Twenty-four and 50/100 DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO video game

Your Signature

⑆234567891⑆ ⑈12 345 6⑈ 0127 ⑈000004300⑈

SHORT-TERM CREDIT AND LONG-TERM CREDIT

- Short-term credit is considered to be for one month to one year.
- Long-term credit would be for 3 to 30 years.

ADVANTAGES AND DISADVANTAGES OF CREDIT CARDS

Advantages:

- Credit cards make it possible to buy something you don't have the money for right away and pay for it later or over a period of time.
- Credit cards make it easier to buy things immediately by mail, Internet, or phone.

Disadvantages:

- Overspending is the most common problem with credit cards.
- Credit cards can be stolen or lost and purchases made on your account.
- Some credit cards charge a yearly fee to use them.
- Most credit cards have high interest rates.

Name _____

FACE VALUE

Directions

Match the coins and bills with the faces that appear on them. Write the letter of the person next to the coin or bill that he or she appears on. (Hint: Some people will be used more than once.)

_____1. Penny

_____2. Nickel

_____3. Dime

_____4. Quarter

_____5. Fifty cent piece

_____6. Silver dollar

_____7. $1 bill

_____8. $2 bill

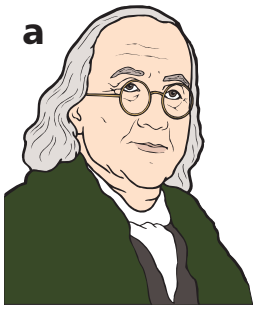
_____9. $5 bill

_____10. $10 bill

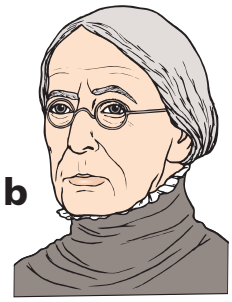
_____11. $20 bill

_____12. $50 bill

_____13. $100 bill

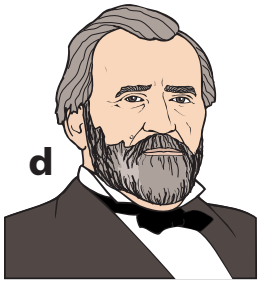


Benjamin Franklin

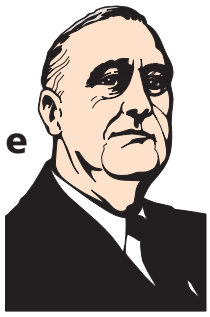


Susan B. Anthony

Abraham Lincoln

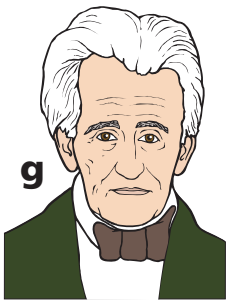


Ulysses S. Grant

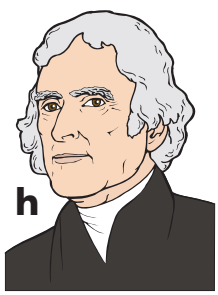


Franklin D. Roosevelt

George Washington



Andrew Jackson



Thomas Jefferson

John F. Kennedy

Alexander Hamilton

FACE VALUE KEY

1. c
2. h
3. e
4. f
5. i
6. b
7. f
8. h
9. c
10. j
11. g
12. d
13. a

WS: E–1B

Name _____

HOW WILL YOU USE YOUR MONEY?

You have $200 and you can do whatever you want with the money. How are you going to use it?

▶ Save

1. Is there something that I want to buy later that I do not have enough money for now? I will save this amount: _____
2. Am I thinking about a car in the future? I will save this amount: _____
3. Am I thinking about college in the future? I will save this amount: _____
4. Do I want to have money in savings just for safe keeping? I will save this amount: _____

▶ Spend

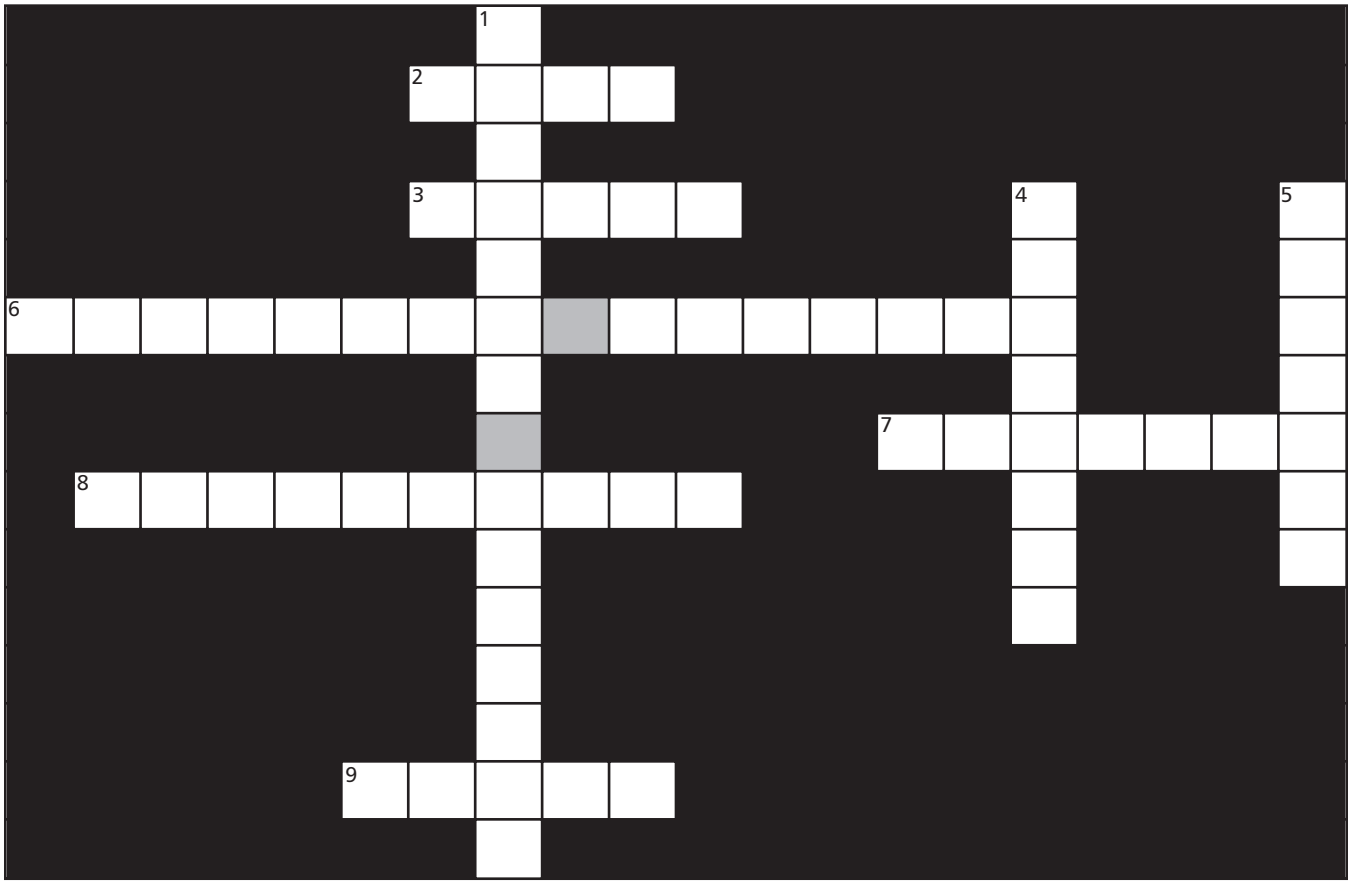
1. Do I need new shoes? I will save this amount: _____
2. Do I need pencils for school? I will save this amount: _____
3. Do I want a new CD to listen to? I will save this amount: _____
4. Do I want to buy a gift for a relative? I will save this amount: _____

▶ Donate

1. Should I give to my local church? I will save this amount: _____
2. Should I give to my local youth organization? I will save this amount: _____
3. Should I donate to my local community group? I will save this amount: _____

Name _____

CHECKING AND SAVINGS ACCOUNTS CROSSWORD



▶ Across

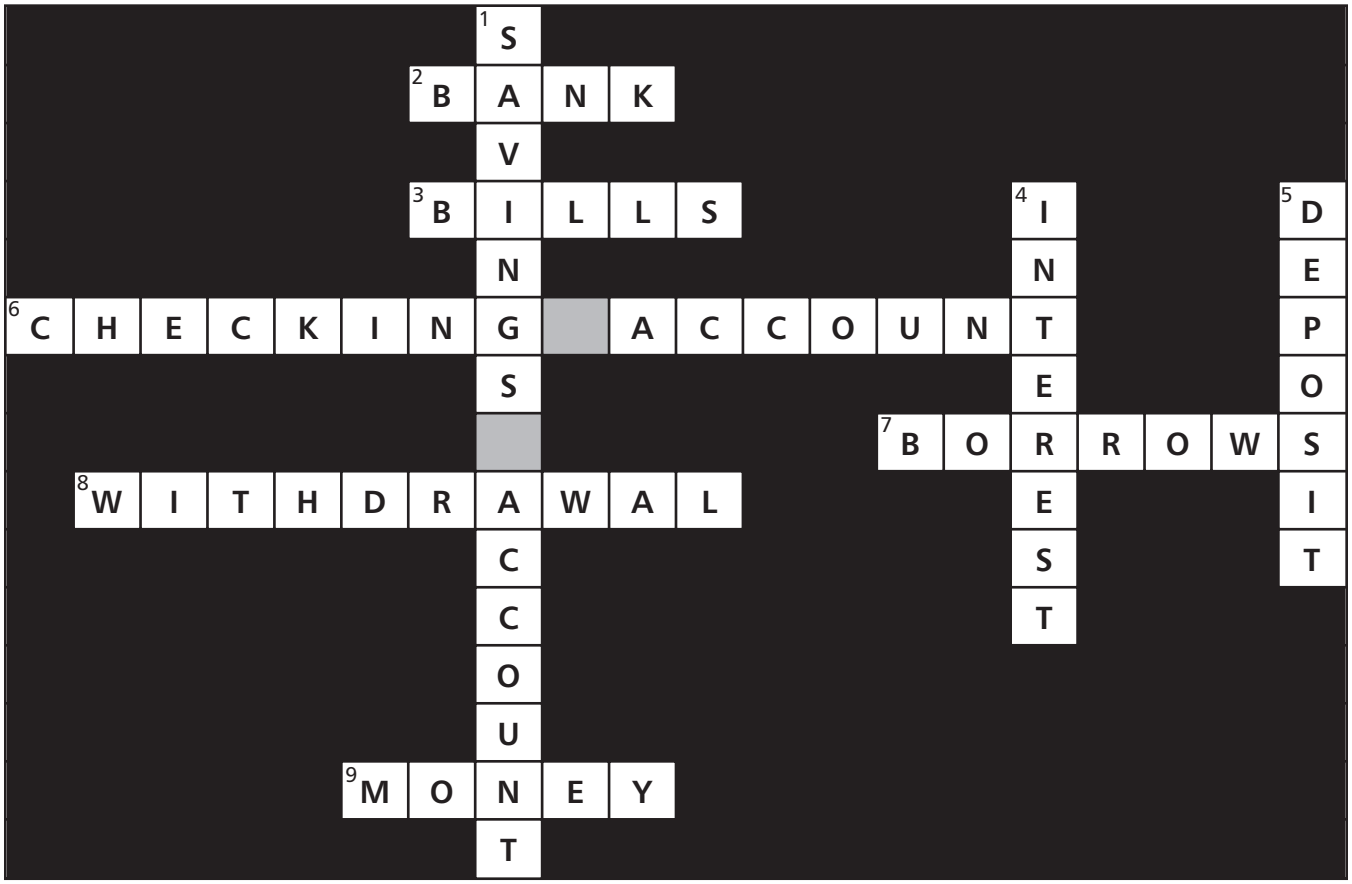
2. A business or institution for receiving, keeping, and lending money.
3. Checking accounts are a convenient way to pay ____.
6. A bank account that allows a person to write checks from his or her account to pay for goods or services.
7. Interest is charged when someone ____ money from a bank.
8. The removal of money from an account.
9. The main purpose of a bank is to make ___.

▶ Down

1. A bank account that offers a convenient way to save money.
4. Money paid to the account holder for keeping money in the bank.
5. The placing of money into an account.

WS KEY: E–1C

CHECKING AND SAVINGS ACCOUNTS CROSSWORD KEY



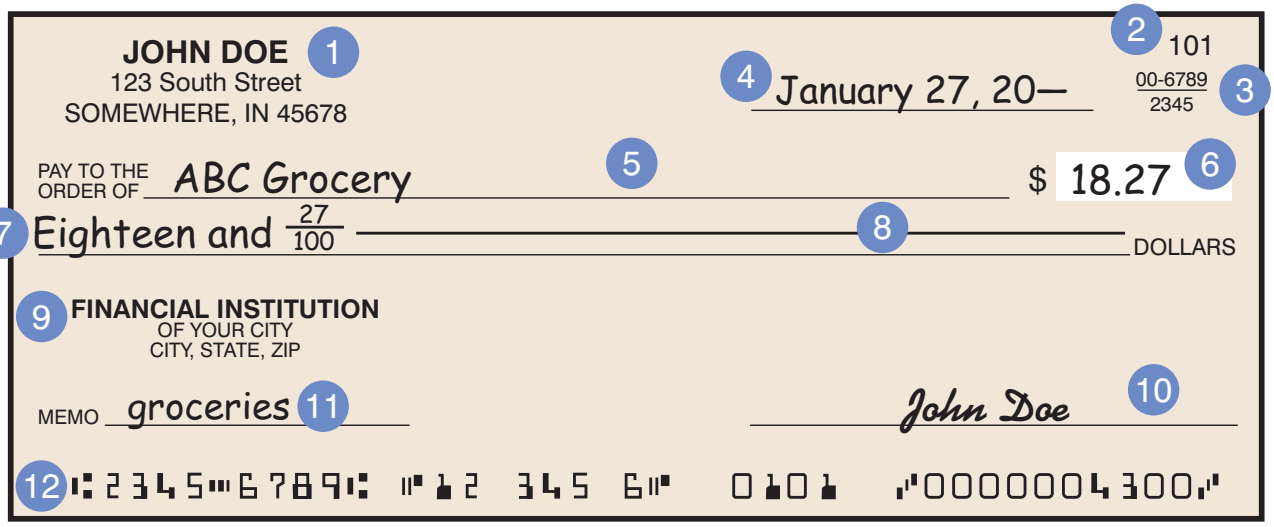
WS: E–1D

Name _____

PARTS OF A CHECK

Directions

Identify the parts of the check shown below.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

PARTS OF A CHECK KEY

1. Name and address of account holder.
2. Consecutive check number.
3. Financial institution's number.
4. Date.
5. Name of the payee.
6. The check amount in figures (numeric).
7. The check amount in words (alphabetic).
8. Line to fill the space between the amount and the "DOLLARS."
9. Name and location of financial institution.
10. Signature of account holder.
11. Memo line to record what the check is in payment of.
12. Numbers used by the financial institution for sorting checks and listing the account's number.

WS: E–1E

Name _____

WRITING DOLLARS AND CENTS

Directions

Using the dollar and cents amounts below, write the amounts in words as they should appear on a check. (Don't forget to fill in the space with a line.)

1. $38.00 _____ DOLLARS
2. $14.25 _____ DOLLARS
3. $142.00 _____ DOLLARS
4. $92.37 _____ DOLLARS
5. $27.42 _____ DOLLARS
6. $115.00 _____ DOLLARS
7. $77.77 _____ DOLLARS
8. $60.00 _____ DOLLARS
9. $58.22 _____ DOLLARS
10. $152.50 _____ DOLLARS

WRITING DOLLARS AND CENTS KEY

1. Thirty-eight and no/100 ——— DOLLARS
2. Fourteen and 25/100 ——— DOLLARS
3. One hundred forty-two and no/100 ——— DOLLARS
4. Ninety-two and 37/100 ——— DOLLARS
5. Twenty-seven and 42/100 ——— DOLLARS
6. One hundred fifteen and no/100 ——— DOLLARS
7. Seventy-seven and 77/100 ——— DOLLARS
8. Sixty and no/100 ——— DOLLARS
9. Fifty-eight and 22/100 ——— DOLLARS
10. One hundred fifty-two and 50/100 ——— DOLLARS

Name _____

WRITING CHECKS

Directions

Use the information to fill in the checks correctly. Use today's date for all your checks.

1. You bought some new clothes at D's Clothing Store today. The total was $128.67. Write your check to pay for the purchase.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

231
00-6789
2345

_____

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____ _____

⑆234567891⑆ ⑈12 345 6⑈ 0231 ⑇0000004300⑇

2. You picked up a used jacket from your friend Jenny Williams for just $25.00. Write Jenny a check to pay for the jacket.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

232
00-6789
2345

_____

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____ _____

⑆234567891⑆ ⑈1 345 6⑈ 0232 ⑇0000004300⑇

3. You decided to donate $35.00 to the Girl Scouts of America. Write them a check.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

233
00-6789
2345

PAY TO THE
ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____

⑆234567890⑆ ⑈12 345 6⑈ 0233 ⑈000000430⑈

4. There's a great sale at the Riverdale Music Shop. Write a check to pay for the $17.26 worth of CDs you bought.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

234
00-6789
2345

PAY TO THE
ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____

⑆234567890⑆ ⑈12 345 6⑈ 0234 ⑈000000430⑈

5. You bought some plants, seeds, and fertilizer from Valley Nursery for your vegetable garden. Write a check to pay for the $43.57.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

235
00-6789
2345

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____ _____

⑆234567890⑆ ⑈12 345 6⑈ 0235 ⑇0000004300⑇

6. Your Aunt Susan's birthday is next week. Write a check to R and R Florist for $23.18 to pay for the flower arrangement you're sending.

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP

236
00-6789
2345

PAY TO THE ORDER OF _____ $ _____

_____ DOLLARS

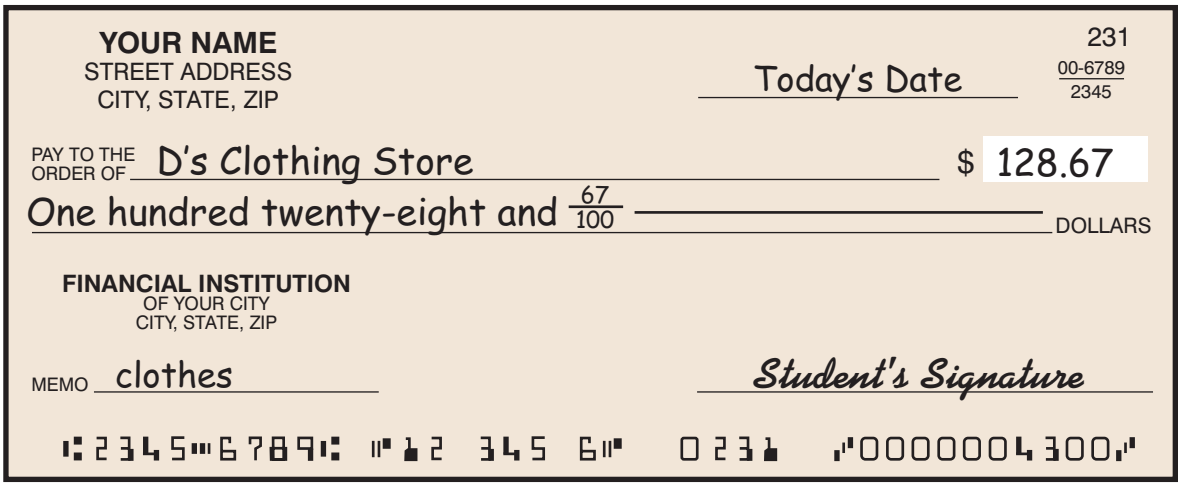
FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP

MEMO _____ _____

⑆234567890⑆ ⑈12 345 6⑈ 0236 ⑇0000004300⑇

WRITING CHECKS KEY

1.



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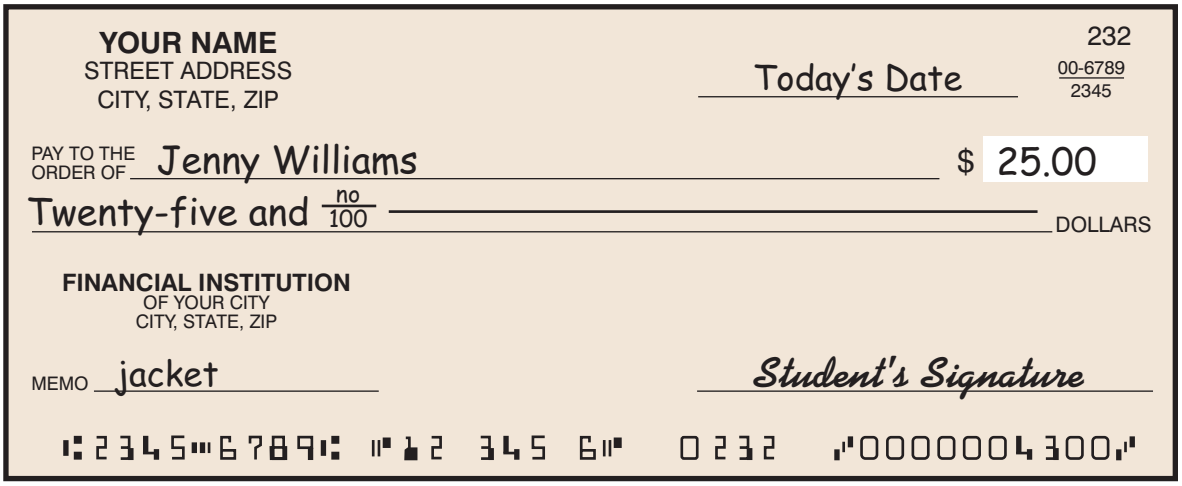

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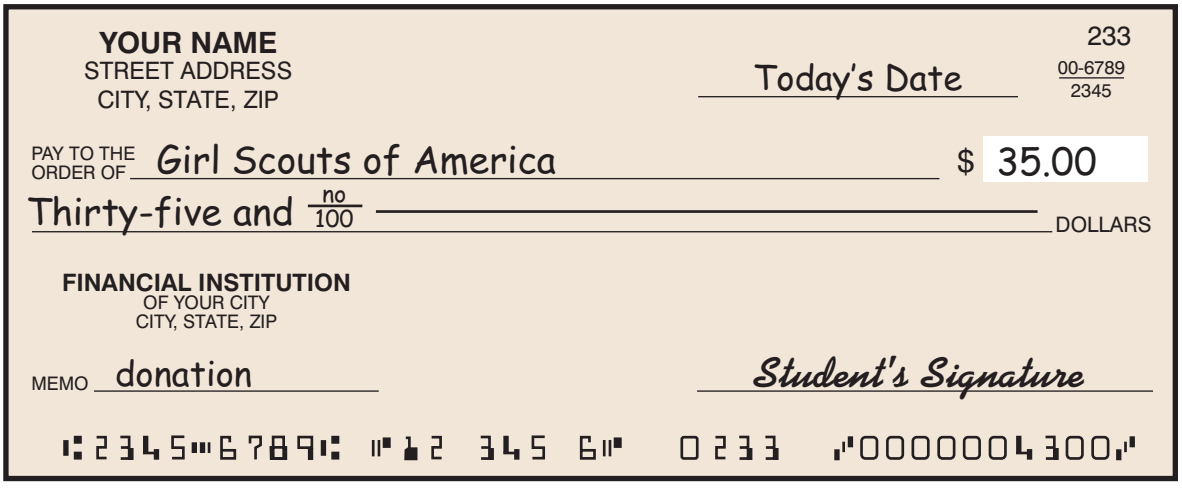

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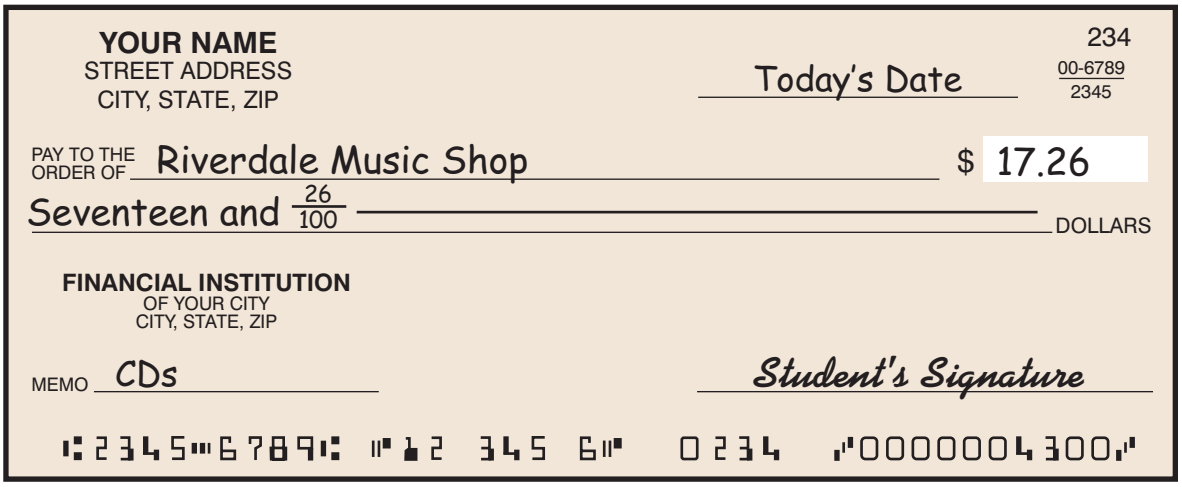
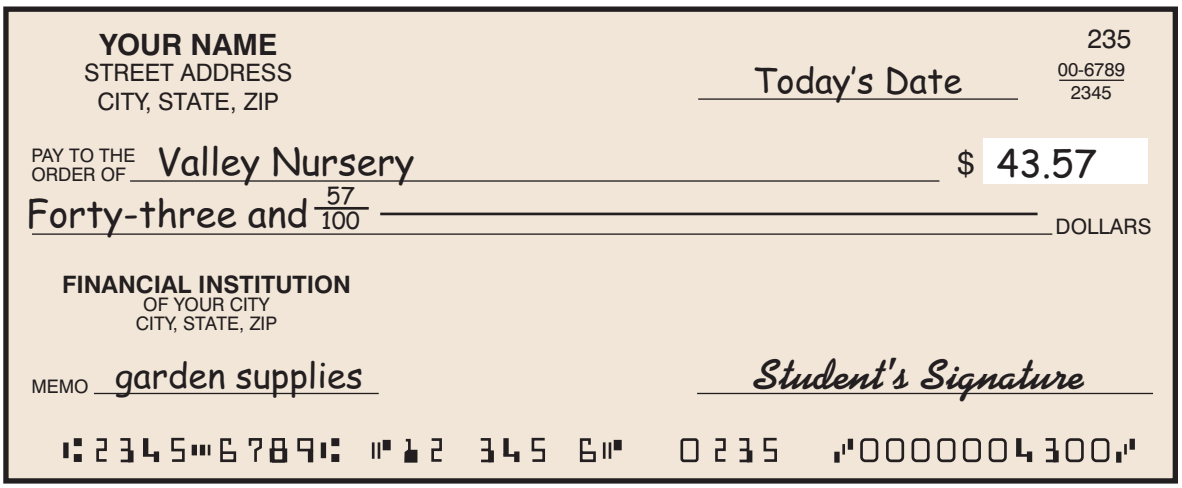
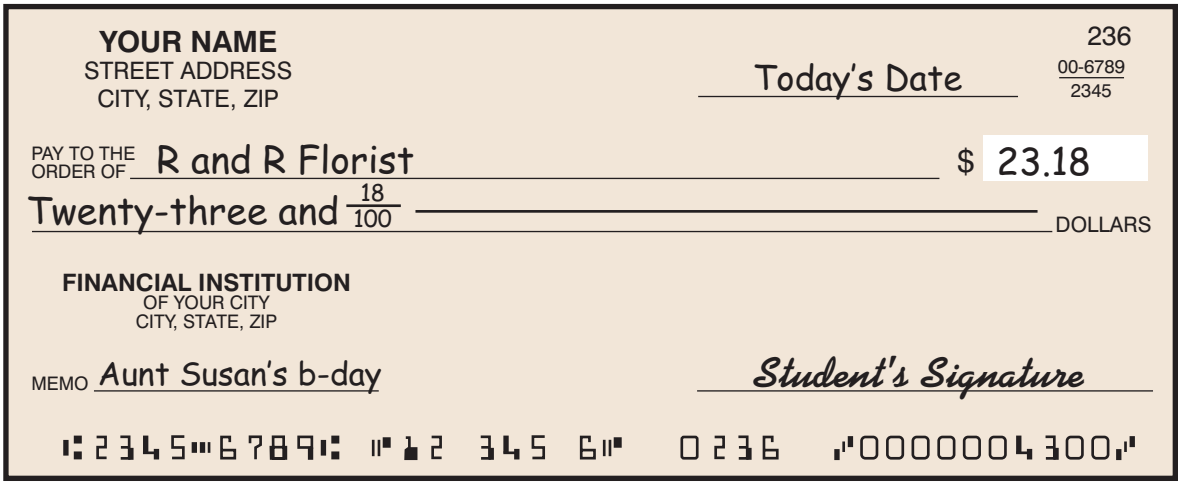

YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP
234
Today's Date
00-6789
2345
PAY TO THE ORDER OF Riverdale Music Shop
$ 17.26
Seventeen and 26/100
DOLLARS
FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP
MEMO CDs
Student's Signature
⑆234567891⑆ ⑈12 345 6⑈ 0234 ⑈0000004300⑈

5.


YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP
235
Today's Date
00-6789
2345
PAY TO THE ORDER OF Valley Nursery
$ 43.57
Forty-three and 57/100
DOLLARS
FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP
MEMO garden supplies
Student's Signature
⑆234567891⑆ ⑈12 345 6⑈ 0235 ⑈0000004300⑈

6.


YOUR NAME
STREET ADDRESS
CITY, STATE, ZIP
236
Today's Date
00-6789
2345
PAY TO THE ORDER OF R and R Florist
$ 23.18
Twenty-three and 18/100
DOLLARS
FINANCIAL INSTITUTION
OF YOUR CITY
CITY, STATE, ZIP
MEMO Aunt Susan's b-day
Student's Signature
⑆234567891⑆ ⑈12 345 6⑈ 0236 ⑈0000004300⑈

WS: E–1G

Name _____

RECORDING YOUR CHECKS

▶ Directions

Using the check register below, record each of the checks you wrote in the last activity and calculate the balance.

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT

CHECK NUMBER	DATE	DESCRIPTION OF TRANSACTION	(–) PAYMENT/DEBIT		✓ T	(–) CHECK FEE (IF ANY)	(–) DEPOSIT/CREDIT		BALANCE	
									295	50

REMEMBER TO RECORD AUTOMATIC PAYMENTS / DEPOSITS ON DATE AUTHORIZED

WS KEY: E–1G

RECORDING YOUR CHECKS KEY

RECORD ALL CHARGES OR CREDITS THAT AFFECT YOUR ACCOUNT

CHECK NUMBER	DATE	DESCRIPTION OF TRANSACTION	(–) PAYMENT/DEBIT		✓ T	(–) CHECK FEE (IF ANY)	(–) DEPOSIT/CREDIT		BALANCE 295	50
231	Today	D's Clothing Store	128	67					128	67
		clothes							166	83
232	Today	Jenny Williams	25	00					25	00
		jacket							141	83
233	Today	Girl Scouts of America	35	00					35	00
		donation							106	83
234	Today	Riverdale Music Shop	17	26					17	26
		CDs							89	57
235	Today	Valley Nursery	43	57					43	57
		garden supplies							46	00
236	Today	R and R Florist	23	18					23	18
		Aunt Susan's birthday							22	82

REMEMBER TO RECORD AUTOMATIC PAYMENTS / DEPOSITS ON DATE AUTHORIZED

Lesson E–2

ACCOUNTING: RECORD KEEPING

Indiana Agricultural Literacy Lesson Plan Library

Unit E. Agribusiness

Lesson 2. Accounting: Record Keeping

Indiana's Academic Standards. **Social Studies:** 4.4.10 — Explain how money helps people to save and develop a savings plan in order to make a future purchase.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe borrowing and loans.
2. Discuss simple and compound interest.
3. Explain why financial records are kept.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Elliot, Jack. *Agribusiness: Decisions & Dollars.* Albany, New York: Delmar Publishers, 1999.

Illinois Core Curriculum: Agribusiness Management Cluster, 2002.

www.practicalmoneyskills.com

www.state.il.us/treas/Education

www.n4hccs.org (Financial Champions)

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Items for borrowing (1 for each student)

Terms. The following terms are presented in this lesson (shown in bold italics):

- APR (annual percentage rate)
- Asset
- Borrow
- Borrower
- Capital
- Collateral
- Compound interest
- Expense
- Interest
- Inventory
- Investment
- Lender
- Liability
- Loan
- Net worth
- Principal
- Profit
- Revenue
- Simple interest

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Tell the students that they will need a purple pen (or any item that most students would not normally have) for today's activity. Be sure to have pens (or another item) available for each student to borrow. In return for borrowing the pen from you, the students must give something as collateral. Explain that the collateral must be of equal value and that it will be returned when they return the pen. This exercise will make students think about buying items on loan, having collateral, and repayment of debts. Have students complete WS: E–2A in order to borrow the pen.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe borrowing and loans.

Anticipated Problem: What is a loan and how can I borrow money?

I. People may need to borrow money for a variety of reasons: buy a vehicle, buy a house, buy farm equipment, buy or expand a business, pay for a vacation, pay for college, operate a business, etc. ***Borrow*** means to receive something with the intention of returning it. A ***loan*** is money borrowed from a lender.

A. People may use credit cards to buy some things, but for larger items, such as vehicles, houses, businesses, or farm equipment, they may need to get a loan.

B. Money can be borrowed from banks or credit unions. Other institutions, such as insurance companies, may also loan money.

C. The main purpose of institutions that provide loans is to make money by charging interest. ***Interest*** is the price that the borrower pays the lender for the use of the money borrowed.

1. Interest is based on a percentage, and the amount depends on the size of the loan and the type of interest rate.
2. The ***borrower*** must pay the ***lender*** back the amount of money originally borrowed plus the interest on that amount.

D. Individuals, families, small businesses, large companies, and even our government can borrow money.

1. Borrowers must prove that they are of good character and are financially able to repay the money.

2. Good credit must be established before taking out a loan. A good credit history shows that you are capable of repaying the money and you are not a risk to the lender.
3. Borrowers must show records of their financial history and may be required to put up collateral to secure the loan.
    a. ***Collateral*** is property or other assets promised to the lender to insure the repayment of a loan.
    b. If the loan is not repaid on time, the lender may take the asset from the borrower as loan repayment.
4. Not all loans require collateral. Signature or unsecured loans, for example, are based on credit history and need no collateral.

E. When borrowing money, a contract is usually signed and the borrower is legally obligated to repay the money to the lender.

F. There are many factors to consider when applying for a loan. Depending on the length of the loan, type of loan, lender, and repayment schedule, the interest and payments may vary a great deal. It is a good idea to shop around for the best loan that fits your specific needs.

G. Loans can be categorized by the length of term.
1. A short-term loan is paid back in one year.
2. An intermediate loan is paid back over a period of one to five years.
3. A long-term loan is paid back over a period of 5 to 30 years.

H. Loans can also be categorized by their use.
1. Auto loans are made for the sole purpose of buying a vehicle. They are normally intermediate loans, with repayment within three to five years.
2. Real estate or mortgage loans are used to purchase land or buildings. These are usually long-term loans.
3. Commercial loans are made to businesses. These are normally long-term loans.
4. Student or college loans are used to pay for college. Students generally do not pay them back until they are out of school and working.
5. Personal loans can vary greatly and can be used for things such as furniture, home improvements, or vacations. These can be short-term or intermediate loans.

Use TM: E–2A to discuss with students ways to establish good credit so that a loan request will not be denied. Use TM: E–2B and TM: E–2C to discuss the different types of loans. Invite a representative from your local bank to come to the class and discuss the methods they use to determine whether to give a loan or not. Show students sample loan applications so they can see the type of information that is requested.

Objective 2: Discuss simple and compound interest.

Anticipated Problem: How is interest calculated?

II. Interest can vary depending on the type of loan, length of loan, lender, and repayment schedule. Research your options to get the best deal.

A. The ***principal*** is the amount of money borrowed. This is the amount that is used to calculate the interest.

B. The ***APR (annual percentage rate)***, also called effective rate, is the actual annual interest rate to be paid on the loan.

C. Interest is based on a percent, which is multiplied by the principal.

D. ***Simple interest***, also called add-on interest, is interest that is paid only on the original principal. Simple interest is calculated by using this equation:

$P \times R \times T = \text{Interest}$ (where, P = principal, R = percentage rate, and T = time).

Example: If $1,000 is borrowed for 2 years at a rate of 5%, then the interest would be $1,000 \times 0.05 \times 2 = \$100$ and the total repayment of the loan would be $1,100.

E. ***Compound interest*** is interest that is paid on the principal balance, which changes over the length of the loan. This method results in a larger amount of interest and higher payments. A special chart or table is normally used to calculate this type of interest.

Use TM: E–2D to cover the content of the objective. Use WS: E–2B to have students do some sample calculations of simple interest. From the activity, students should realize that varying loan rates and terms will affect the total amount of the loan repayment.

Objective 3: Explain why financial records are kept.

Anticipated Problem: Why are financial records kept?

III. Both businesses and individuals need to keep accurate records.

A. Record keeping is useful for many purposes. For example:

1. Filing taxes
2. Applying for a loan or refinancing a loan
3. Keeping track of inventories
4. Planning a budget and making changes in spending
5. Marketing a product
6. Monitoring animal feed consumption
7. Showing profits and losses

8. Calculating operating expenses and investments
9. Listing inventory for insurance policies
10. Planning an estate

B. People need to keep records for their assets, liabilities, net worth, capital, investments, revenue, expenses, profit, and inventory.

1. An ***asset*** is something of value that an individual or business has. Money, livestock, equipment, tractors, and crops are all assets.
2. A ***liability*** is a financial obligation an individual or business owes. Any debt is considered a liability.
3. ***Net worth*** is how much a business or individual is actually worth. (Net Worth = Assets – Liabilities)
4. ***Capital*** is cash, savings, or other assets (machinery, livestock, buildings) that a business or individual has.
5. An ***investment*** is money that is used with the purpose of making more money.
6. ***Revenue*** is money made from products sold or services offered. For example, money received from selling grain at the elevator or selling livestock at an auction is considered revenue.
7. An ***expense***, also called an expenditure, is money paid for items or services. Money spent on animal feed, veterinary service, and machinery repair are examples of expenses.
8. ***Profit*** is the money an individual or business actually makes for its products or services. (Profit = Income or revenue – Expenses)
9. An ***inventory*** is a list of all the assets, including their value, that an individual or business has. An inventory helps in calculating net worth and is often necessary for insurance purposes.

Use TM: E–2E and TM: E–2F to cover the content of the objective. Use WS: E–2C to aid the students in distinguishing between assets/liabilities and revenues/expenses. Use WS: E–2D to have students take an inventory and understand that they possess assets such as jackets, bookbags, books, pens, calculators, gym shoes, etc. Allow them to take inventory of their locker or desk contents. Discuss why it is important to take an inventory and keep a record of what they have.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: E–2A, WS: E–2B, WS: E–2C, and WS: E–2D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. f
2. d
3. a
4. e
5. g
6. h
7. c
8. b

Fill-in-the-Blank

1. compound interest
2. asset
3. profit
4. Revenue
5. liability
6. inventory
7. expense
8. Net Worth

Short Answer

1. $60,000 × 4% × 10 years = 60,000 × 0.04 × 10 = $24,000 interest from bank loan
2. $60,000 + $24,000 = $84,000 total bank loan
3. $60,000 × 5% × 5 = 60,000 × 0.05 × 5 = $15,000 interest from insurance company loan
4. $60,000 + $15,000 = $75,000 total insurance company loan
5. The loan from the insurance company is a better deal. ($9,000 less)

Test E–2

Name_____

ACCOUNTING: RECORD KEEPING

▶ Matching

***Instructions*. Match the correct word with the definition.**

a. APR	d. interest	g. collateral
b. investment	e. capital	h. loan
c. borrow	f. principal	

_____1. The amount of money borrowed on which interest is calculated.

_____2. The price that the borrower pays the lender for the use of the money borrowed.

_____3. The actual annual interest rate to be paid on the loan.

_____4. Cash, savings, or other assets that a business or individual has.

_____5. An asset promised to the lender to insure the repayment of a loan.

_____6. The money borrowed from a lender.

_____7. To receive something with the intention of returning it.

_____8. Money that is used with the purpose of making more money.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Using the _____ _____ method results in a larger amount of interest than with the simple interest method.
2. A(n) _____ is something of value that an individual or business owns or possesses.
3. The money that an individual or business actually makes is called a(n) _____.
4. _____ is the money made from products sold or services offered.
5. A financial obligation or debt which a person or business owes is called a(n) _____.
6. A(n) _____ is a list of all the assets, including their value, that an individual or business has.
7. A(n) _____, also called an expenditure, is money paid for items or services.
8. Assets – Liabilities = _____ _____.

Short Answer

***Instructions*. Read the following scenario and answer the questions using the simple interest method.**

Mr. Brown needed to build a new machine shed to house his tractors and other farm equipment. The cost of the shed will be $60,000. He can borrow the money from the local bank for 10 years at 4 percent interest, or he can borrow from his insurance company for 5 years at 5 percent interest.

1. Calculate the interest from the bank loan.

2. Calculate the total loan from the bank.

3. Calculate the interest from the insurance company loan.

4. Calculate the total loan from the insurance company.

5. Which loan is the better deal (less interest)?

WAYS TO ESTABLISH GOOD CREDIT

- Open a checking and savings account.
- Buy an item on lay-away and pay it off fully.
- Obtain a credit card, purchase a small item, and then pay it off.
- Pay all bills on time.

TYPES OF LOANS BY LENGTH

- Short-term loan—paid back in one year.
- Intermediate loan—paid back over a period of one to five years.
- Long-term loan—paid back over a period of 5 to 30 years.

TYPES OF LOANS BY USE

- Auto loans—used for buying a vehicle; normally intermediate loans (repayment in three to five years).
- Real estate or mortgage loans—used to purchase land or buildings; usually long-term loans.
- Commercial loans—made to businesses; normally long-term loans.
- Student or college loans—used to pay for college; generally not paid back until student is out of school and working.
- Personal loans—vary greatly; can be used for things such as furniture, home improvements, or vacations; can be short-term or intermediate loans.

INTEREST

- Principal—the amount of money borrowed and the amount that is used to calculate the interest.
- APR (annual percentage rate)—the actual annual interest rate to be paid on the loan.
- Simple interest—interest that is paid only on the original principal. Calculated by using this equation:

  $P \times R \times T = \text{Interest}$ (where, P = principal, R = percentage rate, and T = time).
- Compound interest—interest that is paid on the principal balance, which changes over the length of the loan. This method results in a larger amount of interest and higher payments. A special chart or table is normally used to calculate this type of interest.

REASONS FOR KEEPING RECORDS

- Filing taxes
- Applying for a loan or refinancing a loan
- Keeping track of inventories
- Planning a budget and making changes in spending
- Marketing a product
- Monitoring animal feed consumption
- Showing profits and losses
- Calculating operating expenses and investments
- Listing inventory for insurance policies
- Planning an estate

DEFINITIONS

- Asset—something of value that an individual or business has.
- Liability—a financial obligation an individual or business owes.
- Net worth—how much a business or individual is actually worth.
- Capital—cash, savings, or other assets that a business or individual has.
- Investment—money that is used with the purpose of making more money.
- Revenue—money made from products sold or services offered.
- Expense—money paid for items or services.
- Profit—the money an individual or business actually makes after all expenses have been paid.
- Inventory—a list of all the assets, including their value, that an individual or business has.

Name _____

CONTRACT FOR LOAN

I, _____, am borrowing _____
(name of borrower) (item borrowed)

from _____ for the period of _____.
(name of lender) (time borrowed for)

I will offer _____ as collateral,
(item for collateral)

which will be returned to me upon the full repayment of said loan.

Name of Borrower _____ Date _____

Signature of Borrower _____

Name of Lender _____ Date _____

Signature of Lender _____

WS: E–2B

Name _____

CALCULATING INTEREST

Directions

Calculate the following problems using simple interest and answer the questions.

Simple interest:	Principal	×	Percentage Rate	×	Time	=	Interest
	P	×	R	×	T	=	Interest

1. Mr. Jones borrowed $10,000 to expand his greenhouse nursery business. The bank will loan the money to him for five years at 8 percent interest.

   a. What will be the interest on the loan?

   b. What will be the total amount of the loan that Mr. Jones will have to repay?

   c. What would his monthly payment be?

2. Miss Black wanted to buy 40 acres of land to start an apple orchard. The land costs $2,000 an acre. She could borrow the amount from a credit union at 5 percent interest for 10 years.

   a. What will be the total cost of the land?

   b. How much will the interest on the loan be?

   c. What will be the total amount of repayment of the loan?

3. The Smith family needs to buy a new pick up truck for their grain farm. The cost of the truck is $20,000. Would it be better to borrow the money from the bank at 5 percent interest for three years, or borrow the money from the truck dealership at 4 percent interest for five years?

   a. What would the interest be from the bank loan?

   b. What would the interest be from the dealer loan?

   c. What would be the total loan amount from the bank?

   d. What would be the total loan amount from the dealer?

   e. What would the monthly payments be to the bank?

   f. What would the monthly payments be to the dealer?

   g. Which is the better deal?

CALCULATING INTEREST KEY

1. a. $10,000 × 8% × 5 years = 10,000 × 0.08 × 5 = $4,000 interest
   b. $10,000 + $4,000 = $14,000 total loan
   c. $14,000 ÷ 60 (5 years × 12 months per year) = $233.34 per month
2. a. 40 acres × $2,000 per acre = $80,000 total cost of land
   b. $80,000 × 5% × 10 years = 80,000 × 0.05 × 10 = $40,000 interest
   c. $80,000 + $40,000 = $120,000 total loan amount
3. a. $20,000 × 5% × 3 years = 20,000 × 0.05 × 3 = $3,000 interest from bank
   b. $20,000 × 4% × 5 = 20,000 × .04 × 5 = $4,000 interest from dealer
   c. $20,000 + $3,000 = $23,000 total loan from bank
   d. $20,000 + $4,000 = $24,000 total loan from dealer
   e. $23,000 ÷ 36 = $638.89 monthly payment to bank
   f. $24,000 ÷ 60 = $400 monthly payment to dealer
   g. The loan from the bank would result in a higher monthly payment but a savings of $1,000 on the total loan amount.

   Discussion: Discuss the answers with the students. Point out that even though the interest rate may be lower, if the term is longer they may end up paying more interest. As in this case, the interest rate and monthly payment is lower from the dealer, but the total cost of the truck ends up being $1,000 more. Even with the higher interest rate, the loan from the bank is a better deal. The idea of the payments fitting into their budget may also play a role in which loan they would choose. If they are not able to afford the higher monthly payment, they may have to choose the loan from the dealer.

Name _____

ASSETS/LIABILITIES AND REVENUES/EXPENSES

▶ Asset or Liability?

Decide if these are assets or liabilities. On each line, write an "A" for asset or an "L" for liability.

_____1. Savings account

_____2. Mortgage payment

_____3. Car loan

_____4. Beef cows

_____5. 1,000 acres of farm land

_____6. Combine

_____7. Loan for tractor

_____8. Corn crop

_____9. Seed/fertilizer bill

_____10. Barn/machine shed

▶ Revenue or Expense?

Decide if these are revenues or expenses. On each line, write either "R" for revenue or "E" for expense.

_____1. Sale of corn crop

_____2. Chemical cost

_____3. Fertilizer cost

_____4. Purchase of 40 lambs

_____5. Sale of soybean crop

_____6. Purchase of sheep feed

_____7. Sale of fat lambs

_____8. Veterinary bills

_____9. Equipment repair

_____10. Purchase of tractor

ASSETS/LIABILITIES AND REVENUES/EXPENSES KEY

▶ Asset or Liability?

1. A
2. L
3. L
4. A
5. A
6. A
7. L
8. A
9. L
10. A

▶ Revenue or Expense?

1. R
2. E
3. E
4. E
5. R
6. E
7. R
8. E
9. E
10. E

Name _____

INVENTORY

Directions

Take inventory of your locker or desk. List every item and its value. You can keep a copy of this inventory for your records.

Item	Value
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	

Lesson E–3

ECONOMICS

Indiana Agricultural Literacy Lesson Plan Library

Unit E. Agribusiness

Lesson 3. Economics

Indiana's Academic Standards. **Social Studies:** 4.4.4 — Explain that prices change as a result of changes in supply and demand for specific products.

Student Learning Objectives. Instructions in this lesson should result in students achieving the following objectives:

1. Explain supply and demand.
2. Identify agricultural supplies and services.
3. Describe ways businesses are organized.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Elliot, Jack. *Agribusiness: Decisions & Dollars.* Albany, New York: Delmar Publishers, 1999.

Farm Facts. Park Ridge, Illinois: American Farm Bureau Federation, 2002.

Innovations in Agriculture. Bloomington, Illinois: Illinois Farm Bureau, 2002.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Play money ($5.00 per student)
- ✓ Miniature candy bars (one for each student)

Terms. The following terms are presented in this lesson (shown in bold italics):

- Capital resource
- Consumer
- Cooperative
- Corporation
- Cost
- Demand
- Fixed cost
- Human resource
- Input
- Market clearing price
- Natural resource
- Output
- Pricetaker
- Producer
- Productivity
- Profit
- Share
- Stockholder
- Supply
- Variable cost

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

(Adapted from "Supply and Demand" from Innovations in Agriculture.)

Demonstrate supply and demand to the students by using candy bars and play money. Give each student $5.00 in play money. Explain that you only have five candy bars to sell. Describe that the demand is great because everyone is hungry. Ask the students how much they would be willing to pay for the candy bars. Write the prices on the writing surface or on the overhead projector. After all the students have offered their price, tell them that you will sell each of them a candy bar for $5.00. Ask how many would pay that amount for a candy bar and record the number. Next, change the situation by telling the students that you have enough candy bars for everyone to each buy one. Ask the students if they would buy one now. What price would they pay? Write the prices on the board or overhead. Tell the students that you will sell each of them a candy bar for $1.00. How many students want to buy one now? Explain to students that the price for the candy bars depended on the amount of demand and the supply available. When the supply was small (only five candy bars), the demand was large and the price was high. The price went down when the supply increased (enough candy bars for each student). This made it possible to sell most or all of the candy bars.

Other discussion: *Have students think of popular items that are low in supply. Discuss objects like new electronic items. There are few produced so the price remains high. When the item becomes more popular, the demand increases and more are produced. The price then decreases. The personal computer is a good example. Decades ago computers were very expensive, costing thousands of dollars. When the demand increased and more were produced, the price decreased. Today computers are affordable and many can be purchased for just a few hundred dollars.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain supply and demand.

Anticipated Problem: What is supply and demand?

I. The price of a good or service is determined by the supply available and the amount of demand.

A. A ***producer*** is an individual or business responsible for producing goods and products for purchase. Farmers are important producers, supplying us with our food, clothing, housing, and other essentials.

B. A ***consumer*** is an individual or business who buys and uses the goods and products produced by producers.

C. ***Supply*** is the amount of a good or service available for purchase at a particular price. Supply is what farmers or producers are able and willing to produce for a certain price. Producers are able and willing to produce more of a product when it has a higher price. The supply that a farmer is able to produce depends on many factors, such as weather or rainfall.

D. ***Demand*** is the amount of a good or service that consumers want and are willing to pay for at a certain price. Consumers are willing to buy more of a good or service at a lower price.

E. The "Law of Supply" states that when the price of a product increases, the amount of the product that producers are able and willing to produce also increases. There are many factors that affect supply.

1. Costs of production affects supply. If the price of inputs increases, then production may decrease because it costs more to produce the products. If the price of inputs decreases, then production may increase.
2. Technology affects supply. Generally, new and improved technology decreases the cost of production, making it cheaper to produce the product.
3. The price of other products affects supply. If a business can produce a different product that is priced higher, it may change production to take advantage of the higher profit.
4. Seasonal and cyclical production affects supply. Some cycles of production are uncontrollable. For example, we have no control over the time required for livestock to reproduce or the time needed to grow fruits and vegetables.

F. The "Law of Demand" states that when the price of a product decreases, the amount of the product that consumers are able and willing to buy increases. There are many factors that affect demand.

1. Factors that we cannot control, like the weather, affect demand. There is definitely an increase in demand for coats and winter supplies in the winter. Pool supplies and barbecue items would be in greater demand in the summer.

2. Consumer preferences affect demand of a product. The demand of products may change over time. Clothing styles, for example, come and go, causing demand for specific items.
3. Population affects demand. As population increases, demand would naturally increase, especially for necessities like food, clothing, and housing.
4. Wealth affects demand. When the income of people increases, their spending increases, causing more demand for products. People tend to spend more money as they receive more income.
5. Prices of other goods and services affect demand. People only have a limited amount of money to spend and must make choices about what products to buy. When the price of a substitute item decreases, people will buy more of the cheaper substitute.

G. The ***market clearing price*** is the point where the supply equals the demand. At this point, all the products the producers make will be sold and consumers will get what they want.

H. Farmers or agricultural producers depend on the laws of supply and demand.
   1. What and how much a farmer will plant, produce, or market is affected by supply and demand.
   2. Supply and demand often creates prices that are below the farmer's costs of production. That means that farmers may not receive enough money for their product to cover what it cost them to actually produce it.

I. Changes in the market affect the supply, demand, and prices of other markets.
   1. Prices reflect changes in supply and demand.
   2. The amount of corn produced in other countries affects the amount of corn that the U.S. can export and sell to other countries. If other countries have a short supply of corn, they may need to buy more from the United States. If other countries grow an abundant supply of corn, we would not be able to export as much corn.

TM: E–3A, TM: E–3B, and TM: E–3C to cover the content of the objective. Use WS: E–3A to have students write about a fad they have witnessed. Relate what they saw to supply and demand. (When everyone wants an item, the demand is high. Because everyone buys the item, the supply goes down and the price may go up. Producers may try to make more of the item so that they can make a profit. When the fad ends, there may be a lot of the item left over for sale. The demand for the items would then be down, and the supply would be high. This may cause producers to lower the price.)

Objective 2: Identify agricultural supplies and services.

Anticipated Problem: What supplies and services are needed for agricultural production?

II. Farmers and producers need supplies and services to operate their business.

A. An ***input*** is a resource used to produce a product or service. There are three types of inputs: natural resources, capital resources, and human resources.

1. A ***natural resource*** is something found in nature (water, soil, trees, minerals, plants, and animals).
2. A ***capital resource*** is an item used to produce the products or provide services. Capital resources are the major inputs of production, such as equipment, machinery, buildings, and supplies. These resources have made a large impact on farming. Until the 1930s, farming was very labor intensive, requiring long hours of work. Farming is now more capital intensive with improved technology and equipment. Farmers still work very hard, but it also takes a large amount of money (capital) to operate a farm.
3. A ***human resource*** includes the labor and services that are necessary for production. There are two main types of human resources: laborers and entrepreneurs.
   a. The laborer actually produces the product or provides the service.
   b. The entrepreneur manages the business and may be the laborer's boss.

B. An ***output*** is the finished good or service.

C. ***Productivity*** is the amount of goods or services (outputs) produced using a specific amount of inputs. When outputs increase with the same amount or fewer inputs, then there is an increase of productivity.

D. A ***cost*** is an expense that is involved in the production of a product.

E. A ***profit*** is the amount of money a business makes after all expenses have been paid.

F. A ***fixed cost***, also called overhead, is a production cost that remains the same no matter how much is produced. Fixed costs must be paid regardless of the production, even if nothing is produced. Fixed costs for farmers include tractors, combines, land, buildings, and taxes.

G. A ***variable cost*** is a production cost that increases as production increases. The more product that is produced, the more variable costs increase. A grain farmer will purchase more seeds, fuel, and fertilizers when growing more crops. A farmer will pay for more feed, medicines, and veterinary services when more animals are raised.

Use TM: E–3D to cover the content of the objective. Use TM: E–3E to show students the difference between fixed and variable costs. Use WS: E–3B as an activity to help students differentiate between fixed and variable costs. Invite a local agricultural producer to visit the class and discuss his or her work with the students. Have the producer describe some of the supplies and services necessary for the operation of his or her business. Before the visit, have students prepare a list of questions they would like to have answered.

Objective 3: Describe ways businesses are organized.

Anticipated Problem: How are businesses organized?

III. There are many ways to operate a business. Common ways include corporations, cooperatives, sole proprietorships, and partnerships.

A. A ***corporation*** is a business owned by stockholders. The stockholders may or may not have any direct control of the business.

1. A ***stockholder***, also called a shareholder, is an individual who owns stocks or shares of a corporation.
2. A ***share*** is a piece of a corporation owned by shareholders. All of the shares together form the ownership of the corporation.

B. A ***cooperative*** is a business that produces and markets the products owned by the members. The members share in the benefits.

1. Farmers and producers try to keep their costs low so that they can make a profit. The less money they spend on inputs, the more money they can keep as a profit. Cooperatives allow producers to share their expenses with other producers. This results in lower input costs and higher profits.
2. A ***pricetaker*** is a seller who must take whatever price the market dictates. Individual farmers are pricetakers. They have little control over the price they get for their product.
3. All of the members of the cooperative share the control, risks, and profits.
4. Cooperatives are operated on a non-profit basis.
5. Membership in a cooperative is voluntary.
6. Most cooperatives operate on one-member, one-vote basis.
7. Cooperative members elect the board of directors. The board is composed of cooperative members.
8. Cooperative stock does not increase or decrease in value.
9. The most common agricultural cooperatives are dairies, canneries, and fertilizer companies. Examples are Prairie Farms, FS, Ocean Spray, Riceland Foods, and Diamond Brand. These are all producer-owned cooperatives, owned by farmers who produce the product. There are also consumer owned cooperatives like Rural Electric Cooperatives, where each member owns a share of the company.

C. Sole proprietorships and partnerships are also commonly used in agriculture. Sole proprietorships involve ownership by a single person. Partnerships are owned by two or more individuals who share in the management of the business.

Use TM: E–3F and TM: E–3G to cover the content of the objective. Use WS: E–3C to allow students to work in small groups to organize and create their own cooperative. Have them present their cooperatives to the class. They could even make a poster or some type of advertisement for their cooperative.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: E–3A, WS: E–3B, and WS: E–3C.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. e
3. a
4. c
5. d
6. f

Fill-in-the-Blank

1. input
2. output
3. consumer
4. cost
5. Supply
6. Demand

Short Answer

1. The Law of Supply states that when the price of a product increases, the amount of the product that producers are able and willing to produce also increases.
2. The Law of Demand states that when the price of a product decreases, the amount of the product that consumers are able and willing to buy increases.

Test E–3

Name_____

ECONOMICS

▶ Matching

***Instructions*. Match the correct word with the definition.**

a. capital resource
b. cooperative
c. human resource
d. fixed cost
e. stockholder
f. variable cost

_____1. A business that produces and markets the products owned by the members.

_____2. An individual who owns stocks or shares of a corporation.

_____3. A major input used to produce products or provide services.

_____4. The labor and services that are necessary for producing a product.

_____5. A production cost that remains the same no matter how much is produced.

_____6. A production cost that increases as production increases.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A(n) _____ is a resource used to produce a product or service.
2. A(n) _____ is the finished good or service.
3. A(n) _____ is an individual or business who buys and uses the goods and products produced by producers.
4. A(n) _____ is an expense that is involved in the production of a product.
5. _____ is the amount of a good or service available for purchase at a particular price.
6. _____ is the amount of a good or service that consumers want and are willing to pay for at a certain price.

Short Answer

***Instructions*. Answer the following questions.**

1. What does the Law of Supply state?

2. What does the Law of Demand state?

DEFINITIONS

- Producer—individual or business responsible for producing goods and products for purchase.
- Consumer—individual or business who buys and uses the goods and products produced by producers.
- Supply—amount of a good or service available for purchase at a particular price.
- Demand—amount of a good or service that consumers want and are willing to pay for at a certain price.
- Market clearing price—the point where the supply equals the demand.

LAW OF SUPPLY

The "Law of Supply" states that when the price of a product increases, the amount of the product that producers are able and willing to produce also increases.

Factors that affect supply:

- Costs of production
- Technology
- Price of other products
- Seasonal and cyclical production

LAW OF DEMAND

The "Law of Demand" states that when the price of a product decreases, the amount of the product that consumers are able and willing to buy increases.

Factors that affect demand:

- Things that cannot be controlled, like the weather
- Consumer preferences
- Population
- Wealth
- Prices of other goods and services

SUPPLIES AND SERVICES

- Input—a resource used to produce a product or service.
- Natural resource—something found in nature.
- Capital resource—an item used to produce the products or provide services.
- Human resource—the labor and services that are necessary for production.
- Output—the finished good or service.
- Productivity—the amount of goods or services (outputs) produced using a specific amount of inputs.
- Cost—an expense that is involved in the production of a product.
- Profit—the amount of money a business makes after all expenses have been paid.
- Fixed cost—a production cost that remains the same no matter how much is produced.
- Variable cost—a production cost that increases as production increases.

FIXED AND VARIABLE FARMING COSTS

FIXED COSTS

- Land
- Tractor
- Combine
- Plow
- Sprayer
- Computer
- Internet service
- Cultivator
- Vehicle
- Real estate tax

VARIABLE COSTS

- Seed
- Herbicide
- Fertilizer
- Gasoline, oil
- Diesel fuel
- Electricity
- Income tax
- Livestock feed
- Vet services
- Labor

CORPORATIONS

A corporation is a business owned by stockholders. The stockholders may or may not have any direct control of the business.

- A stockholder, also called a shareholder, is an individual who owns stocks or shares of a corporation.
- A share is a piece of a corporation owned by shareholders. All of the shares together form the ownership of the corporation.

COOPERATIVES

A cooperative is a business that produces and markets the products owned by the members. The members share in the benefits.

- Cooperatives allow producers to share their expenses with other producers.
- A pricetaker is a seller who must take whatever price the market dictates.
- All of the members of the cooperative share the control, risks, and profits.
- Cooperatives are operated on a non-profit basis.
- Membership in a cooperative is voluntary.
- Most cooperatives operate on one-member, one-vote basis.
- Cooperative members elect the board of directors. The board is composed of cooperative members.
- Cooperative stock does not increase or decrease in value.

Name _____

FADS

Background

Most of us have seen a "fad" or two at some time in our lives. A fad is something that is very popular and a lot of people want. A fad can be a certain toy, video game, concert ticket, music CD, clothing, or anything else.

Directions

Write a short description about a fad you have seen. Explain what happened with the fad. Was there a supply shortage? Did the price of the item change when it became popular? What happened when the fad ended?

Name _____

FARMING COSTS— FIXED OR VARIABLE?

Directions

Label each cost with either an "F" for fixed cost or a "V" for variable cost.

_____1. Labor
_____2. Seed
_____3. Combine
_____4. Gasoline
_____5. Vehicle
_____6. Income tax
_____7. Internet service
_____8. Tractor
_____9. Plow
_____10. Fertilizer
_____11. Computer
_____12. Land
_____13. Diesel fuel
_____14. Electricity
_____15. Planter
_____16. Cultivator
_____17. Veterinary services
_____18. Sprayer
_____19. Real estate tax
_____20. Herbicide

FARMING COSTS— FIXED OR VARIABLE KEY

1. V
2. V
3. F
4. V
5. F
6. V
7. F
8. F
9. F
10. V
11. F
12. F
13. V
14. V
15. F
16. F
17. V
18. F
19. F
20. V

Name _____

YOUR OWN COOPERATIVE!

Objective

In this activity, you will work in groups of four to six students to develop a plan for your own cooperative.

Procedure

1. Decide what the purpose of your cooperative will be. Why do you need a cooperative? How will it help its members?
2. Name your cooperative. Does the name reflect the products being represented? The name should be catchy, but not too silly.
3. Elect your board members. Everyone in your group can be on the board, and a chairperson should be elected to be in charge.
4. List one main goal of your cooperative. Is it to help market your products or to help producers in production? How will you accomplish this?
5. Using the information you have developed, present your cooperative plan to the class.

Lesson E–4

MARKETING AGRICULTURAL PRODUCTS

Indiana Agricultural Literacy Lesson Plan Library

Unit E. Agribusiness

Lesson 4. Marketing Agricultural Products

Indiana's Academic Standard. **Social Studies:** 4.4.3 — Explain why both parties benefit from voluntary trade, and give examples of how people in Indiana engaged in trade in different time periods.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define the marketing process.
2. Outline the steps in the marketing process.
3. Explain research and development of a product.
4. Demonstrate the advertisement of a product.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Agribusiness Management Lesson Plan Library. Danville, Illinois: Center for Agricultural and Environmental Research and Training, Inc., 2002.

Innovations in Agriculture. Bloomington, Illinois: Illinois Farm Bureau, 2002.

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Magazines with advertisements

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Advertise
- ➤ Assembling
- ➤ Direct market
- ➤ Distributing
- ➤ Free enterprise
- ➤ Grading
- ➤ Marketing
- ➤ Marketing plan
- ➤ Market research
- ➤ Motive
- ➤ Patronage
- ➤ Processing
- ➤ Promoting
- ➤ Retail market
- ➤ Sales forecast
- ➤ Sales history
- ➤ Safety testing
- ➤ Target market
- ➤ Wholesale market

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Give each student a magazine. The magazines do not need to be recent issues. Have the students go through the magazines page by page and count the number of advertisements in their magazine. After all students have tabulated the number of ad pages, have them count the total number of pages in the magazine. You can have them calculate the percentage of ads, and you may also want to graph the results on the board. Discuss which advertisements were the most appealing and what attracted the students to those particular ads.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define the marketing process.

Anticipated Problem: What is involved in the marketing process?

I. Products must be marketed so that people will buy them and the producer will get paid for the products.

A. ***Free enterprise*** is doing business with minimum government control. In the United States, people do business as they wish as long as they obey the laws. We are free to buy property, own a business, choose what to produce, and buy and sell at prices agreed upon.

B. ***Marketing*** is the process of making goods or services available to consumers. Marketing involves making the product in the desired form that the consumer wants. It includes all functions that link the product to the consumers.

C. A ***marketing plan*** is a program designed to help a business achieve its estimated sales.

1. The marketing plan generally includes the four Ps of marketing: product (what to sell), place (where to sell the product), price (how much to charge for the product), and promotion (how to advertise the product to the public).
2. The marketing plan should be created before the product is produced. A product should not be produced if there is no market for it.

D. Marketing methods vary depending on the type of product, location to the market, and amount of processing required of the product. For example, perishable products like milk or fresh produce are marketed much differently than grains that can be stored in bins for months. Fresh fruits and vegetables are often marketed close to where they are grown. There are three main types of markets: direct, retail, and wholesale.

1. A ***direct market*** is a market in which a product is sold directly to the consumer. Farmer's markets and "you-pick" farms are direct markets.
2. A ***retail market*** is a market in which producers sell their products to an enterprise that then sells to the consumer. Department stores and grocery stores are retail markets.
3. A ***wholesale market*** is a market in which producers sell their products to an enterprise that resells the products to retailers or wholesalers. Distributing companies would be considered wholesale markets.

Use TM: E–4A to discuss the four Ps of marketing. Use TM: E–4B to cover the different types of markets. Use WS: E–4A to help students get an idea of what is involved in developing a marketing plan. Invite the marketing manager of a local business to visit the class and discuss with students some of the decisions involved in developing a marketing plan. Allow students to ask any questions they may want answered.

Objective 2: Outline the steps in the marketing process.

Anticipated Problem: What are the steps in the marketing process?

II. There are 10 main steps in the marketing process.

A. Planning—Decide what to produce, where to market it, the price to charge, and how to promote it.

B. Assembling—***Assembling*** is gathering a large quantity of the product from several sources so there is enough to ship and process. For example, it is more economical to have enough grain to fill a truck or train, but the grain may need to be assembled from several sources in order to have enough. A grain elevator can store the grain from many different farms until it has a large enough amount to fill a train car.

C. Grading—***Grading*** means sorting the product by size or quality. Meat, fruits, vegetables, eggs, and other products are graded by size and quality. For example, when you buy eggs at the store they are labeled as small, medium, large, extra-large, or jumbo. They are also quality graded (grade A).

D. Transporting—The product must be moved from the farm to storage, to the processing plant, or to the retail store. Products are transported in many ways—semi-trucks, rail cars, airplanes, cargo ships, and barges.

E. Storing—The product must be kept in good condition for later use. Foods like dairy products, meat, and fresh produce may need to be refrigerated or frozen. Corn, soybeans, and wheat can be stored at the elevator or farm in bins or silos. Processed foods like flour, cereal, or canned products are stored in warehouses.

F. Processing—***Processing*** is converting the raw products into a desirable form. Some foods like eggs, fruits, and vegetables may only need to be cleaned. Other products may need more processing, such as cutting, cooking, or preserving. Food is processed more now than it ever has been because many people want instant meals. Generally, the faster the meal is to prepare, the more processing it has gone through.

G. Packaging—The product must be packaged in containers to sell to stores or consumers. The purpose of packaging is to help preserve the product and to protect it from damage. Packaging is also used as advertisement to attract buyers.

H. Promoting—***Promoting*** is attempting to convince consumers to buy a product. A product can be promoted using advertisements, special promotions (buy one, get one free), or coupons. New items need to be promoted to make consumers aware that the product is available. If an item is not selling fast enough or too much of the product was ordered, promoting it may help to sell the amount on hand.

I. Distributing—***Distributing*** is delivering the product to where it is needed by using trucks, rail, planes, ships, barges, or other methods. For example, corn is hauled to the elevator using grain trucks, wagons, or semi-trucks. The elevators can then load the corn on rail cars and send it to processing plants. The processed product can be shipped by semi-truck or rail car to barges on the rivers. Products can also be transported by airplane and cargo ship to other parts of the United States or to other countries.

J. Selling—The product must be sold to the consumers. This is the last step of the marketing process. Selling the products differs depending on where the product is sold. It is much easier to buy fruit at a grocery store (retail), but it may be more fun to purchase it at a you-pick farm or a farmer's market. It may be cheaper to buy corn from the elevator to feed your livestock, but it takes time and you would need a truck or wagon to pick up the corn. A feed store would have the corn packaged or delivered in bulk, but it would be at a higher expense.

Use TM: E–4C to discuss the 10 steps involved in the marketing process. Use WS: E–4B as a fun activity to help students become more familiar with the terms involved in the marketing process.

Objective 3: Explain research and development of a product.

Anticipated Problem: How is a product researched and developed?

III. Much research is done before a new product is developed or an old product is improved.

A. Research uses scientific experimentation. Development utilizes the findings from the experimentation.

B. Research and development may be conducted by colleges, corporations, independent labs, or government agencies. These groups may work together or alone.

C. Technology is the combination of research and development. Technology does not occur quickly because products must be tested and retested to assure safety and efficiency.

1. Many new discoveries are made every day and are developed into products or used to improve certain methods.
2. Technology has helped farmers improve their crop and livestock production.
   a. Farmers use technology to provide better care for their livestock and keep their animals healthy. This improves the quality and quantity of the animal's offspring.

b. Technology has improved the production of corn and soybeans. Many uses have been found for corn and soybean products and byproducts. Corn and soybeans can now be used to make ink, fuels, plastics, crayons, and building materials.

D. ***Market research*** is the gathering, recording, and analyzing of information related to products and consumers. Market research helps to insure that consumers get what they want or need. It is done before a product is developed to see if there is a need for the product. Both sales history and sales forecasts are considered.

1. A ***sales history*** is information gathered by looking at past sales of a product or similar product. Businesses can use sales history to plan for future sales and develop a market plan.
2. A ***sales forecast*** is information gathered to help estimate the amount of sales expected for a product.

E. A ***target market*** is the group of people who are most likely to buy a certain product.

F. ***Safety testing*** is testing done on a product to make sure it is safe for people and the environment. Safety testing is required by the government. There are many laws in place to help maintain safe products in the United States.

G. Facts must not only be gathered during research, but must also be shared with consumers. Consumers can use the facts to make informed decisions. Consumers want information on the products that they purchase.

Use TM: E–4D to cover the content of the objective. Use WS: E–4C to allow students to be creative and develop a new product that will be beneficial to society. Remind them that their product must be safe for others and the environment.

Objective 4: Demonstrate the advertisement of a product.

Anticipated Problem: How is a product advertised?

IV. ***Advertise*** means to present the positive qualities of a product or service to the public. Advertisement is necessary to make consumers aware of the products and services a business provides. Some businesses may not be able to stay in business without advertising. Consumers can benefit from advertising because it informs them about products and services they may want.

A. ***Motive*** is the reason someone buys a product or service. Most people buy products with four basic motives: rational, emotional, product, or patronage.

1. A person who buys something with a rational motive knows all of the facts about the product and decides to buy it.
2. A person who buys something with an emotional motive probably doesn't know all the facts, but wants the product no matter what.
3. If a person has product motive, they have sufficient information about the product, and they are willing to buy it anywhere.
4. ***Patronage*** is showing loyalty to a specific brand or dealer. With patronage motive, a person would only buy from a specific dealer or only buy a certain brand of product.

a. Farmers are generally patronage motivated. They tend to buy one brand of equipment or one brand of seed. They also may only buy fertilizer and herbicide from one dealer.
b. Because of this motivation, agricultural products are very competitive. Selling and advertising is important in the agricultural industry.

B. The main reasons for advertising are to create awareness of the business, product, or service; give information about the product or service; educate consumers by telling the benefits of the product or service; and to sell more of the product or service.

C. There are many methods of advertising—television, radio, newspaper, direct mail, Internet, and word of mouth. The choice of advertisement method is usually based on the amount of money available and the audience to be reached.
1. Television is the most expensive method of advertising, but it has the largest audience. It has national or world coverage and is used mostly by large companies.
2. Radio is less expensive than television but still has a large audience.
3. Newspapers are even less expensive than radio, but they also have a smaller audience. Newspaper ads are normally targeted to a local audience.
4. Direct mail is the least expensive and most effective method of advertising. Advertisements can be sent only to the target market, so money is not wasted on those who are not interested in the product. An example would be a tractor company only sending advertisements to farmers.
5. The Internet is another method to advertise. Advertising on the Internet is generally very affordable and can reach a large number of people.
6. One of the most efficient forms of advertisement is word of mouth. Satisfied customers will tell others about the products they bought or the services they received. Word of mouth is also an important advertising method used by salespeople. In order for word of mouth advertising to be successful, salespeople must provide good service both before and after the sale.

D. A good print advertisement should include the following: an attractive headline, clear and simplistic wording, a proper background, illustrations that link ideas, a clearly stated price, and the name of the business.

Use TM: E–4E, TM: E–4F, TM: E–4G, and TM: E–4H to cover the content of the objective. Use WS: E–4D to allow the students to create their own advertisement for a product. You may have them create the ad for the product that they invented using WS: E–4C, or you may want them to do something different. This could be a group activity. After developing the advertisement, the groups could make sales presentations to the class using video, cassette recording, or print. Take a trip to a local advertising agency and let students see the design process used in the agency.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: E–4A, WS: E–4B, WS: E–4C, and WS: E–4D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. c
3. e
4. b
5. g
6. a
7. f

Fill-in-the-Blank

1. Grading
2. sales history
3. Safety testing
4. Processing
5. Distributing
6. Promoting
7. sales forecast

Short Answer

1. A direct market is a market in which a product is sold directly to the consumer. Farmer's markets and "you-pick" farms are direct markets.
2. A retail market is a market in which producers sell their products to an enterprise that then sells to the consumer. Department stores and grocery stores are retail markets.
3. A wholesale market is a market in which producers sell their products to an enterprise that resells the products to retailers or wholesalers. Distributing companies would be considered wholesale markets.

Test E–4

Name_____

MARKETING AGRICULTURAL PRODUCTS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. advertise
b. target market
c. free enterprise
d. marketing
e. market research
f. motive
g. patronage

_____1. The process of making goods or services available to consumers.
_____2. Doing business with minimum government control.
_____3. The gathering, recording, and analyzing of information related to products and consumers.
_____4. The group of people who are most likely to buy a certain product.
_____5. Showing loyalty to a specific brand or dealer.
_____6. Present the positive qualities of a product or service to the public.
_____7. The reason someone buys a product or service.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ means sorting the product by size or quality.
2. A(n) _____ _____ is information gathered by looking at past sales of a product or similar product.
3. _____ _____ is done on a product to make sure it is safe for people and the environment.
4. _____ is converting the raw products into a desirable form.
5. _____ is delivering the product to where it is needed.
6. _____ is attempting to convince consumers to buy a product.
7. A(n) _____ _____ is information gathered to help estimate the amount of sales expected for a product.

▶ Short Answer

***Instructions*. Define each word and give an example of each.**

1. Direct market—

2. Retail market—

3. Wholesale market—

FOUR P's OF MARKETING

- Product (What to sell)
- Place (Where to sell the product)
- Price (How much to charge for the product)
- Promotion (How to advertise the product)

TYPES OF MARKETS

- Direct market—product is sold directly to the consumer; example: farmer's market and "you-pick" farm.
- Retail market—producers sell their products to an enterprise that then sells to the consumer; example: department store and grocery store.
- Wholesale market—producers sell their products to an enterprise that resells the products to retailers or wholesalers; example: distributing company.

MARKETING PROCESS

- Planning
- Assembling
- Grading
- Transporting
- Storing
- Processing
- Packaging
- Promoting
- Distributing
- Selling

RESEARCH AND DEVELOPMENT

- Research uses scientific experimentation.
- Development utilizes the findings from the experimentation.
- Research and development may be conducted by colleges, corporations, independent labs, or government agencies. These groups may work together or alone.
- Technology is the combination of research and development.
- Market research is the gathering, recording, and analyzing of information related to products and consumers.
- A target market is the people who are most likely to buy a certain product.
- Safety testing is testing done on a product to make sure it is safe for people and the environment.

MOTIVES

Motive is the reason someone buys a product or service.

- Rational—buyer knows all of the facts about the product.
- Emotional—buyer probably doesn't know all the facts, but wants the product no matter what.
- Product—buyer has sufficient information about the product and is willing to buy it anywhere.
- Patronage—buyer will only buy from a specific dealer or only buy a certain brand of product.

REASONS FOR ADVERTISING

- Create awareness of the business, product, or service
- Give information about the product or service
- Educate consumers by telling the benefits of the product or service
- Sell more of the product or service

METHODS OF ADVERTISING

- Television
- Radio
- Newspaper
- Direct mail
- Internet
- Word of mouth

COMPONENTS OF A GOOD PRINT ADVERTISEMENT

- Attractive headline
- Clear and simplistic wording
- Proper background
- Illustrations that link ideas
- Clearly stated price
- Name of the business

Name _____

MARKETING PLAN

Directions

Choose a product that you would like to sell. Work on a marketing plan for the product by answering the four P's below.

Product

What are you going to sell? Why do you think people will want to buy this product?

Place

Where will you sell the product? Do you think a direct market, retail market, or wholesale market would be best?

Price

How much will you charge for the product? What did you base your price on? Are there similar products that sell for a lower or higher price?

Promotion

How will you advertise the product? Will your advertisement reach the people who will be buying the product?

WS: E–4B

Name _____

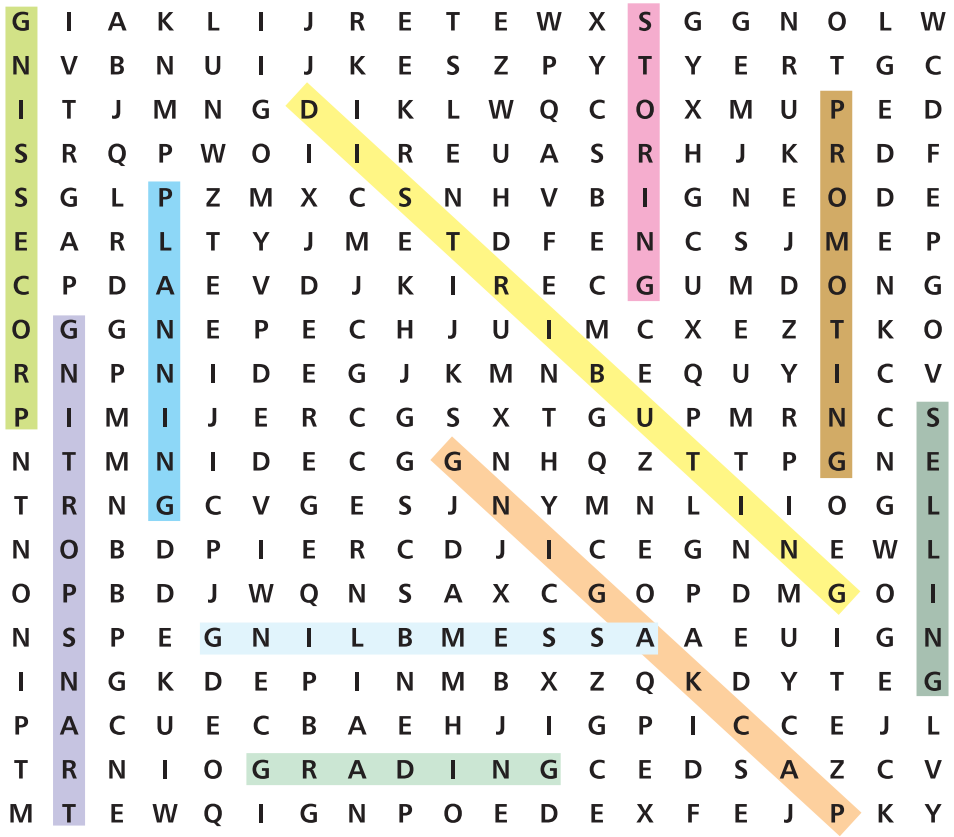
MARKETING PLAN WORD SEARCH

G I A K L I J R E T E W X S G G N O L W
N V B N U I J K E S Z P Y T Y E R T G C
I T J M N G D I K L W Q C O X M U P E D
S R Q P W O I I R E U A S R H J K R D F
S G L P Z M X C S N H V B I G N E O D E
E A R L T Y J M E T D F E N C S J M E P
C P D A E V D J K I R E C G U M D O N G
O G G N E P E C H J U I M C X E Z T K O
R N P N I D E G J K M N B E Q U Y I C V
P I M I J E R C G S X T G U P M R N C S
N T M N I D E C G G N H Q Z T T P G N E
T R N G C V G E S J N Y M N L I I O G L
N O B D P I E R C D J I C E G N N E W L
O P B D J W Q N S A X C G O P D M G O I
N S P E G N I L B M E S S A A E U I G N
I N G K D E P I N M B X Z Q K D Y T E G
P A C U E C B A E H J I G P I C C E J L
T R N I O G R A D I N G C E D S A Z C V
M T E W Q I G N P O E D E X F E J P K Y

PLANNING
ASSEMBLING
GRADING
TRANSPORTING
STORING
PROCESSING
PACKAGING
PROMOTING
DISTRIBUTING
SELLING

WS KEY: E–4B

MARKETING PLAN WORD SEARCH KEY



Name _____

DEVELOP A NEW PRODUCT

Directions

Develop a product that will be beneficial to society. Be creative and think of something that has not been developed before. Include a drawing of your product. The following questions may help you put together a plan.

1. What is your product?

2. What is the purpose of the product?

3. Who will use the product?

4. How will your product benefit society?

5. Will your product be easy to produce?

6. How will your product be marketed?

7. Is your product affordable?

8. Will there be an adequate supply of your product?

Name _____

DESIGN YOUR OWN ADVERTISEMENT

Directions

Make your own advertisement for an agricultural product.

1. What is the name of your product?

2. Who will be your target market?

3. What is the purpose of your product?

4. Make a clever slogan for your product.

5. On a separate sheet of paper or piece of posterboard, draw a print advertisement for your product. Remember to include an attractive headline, clear and simplistic wording, a proper background, illustrations that link ideas, a clearly stated price, and the name of the business.

Lesson E–5

WORLD TRADE: IMPORTS AND EXPORTS

Indiana Agricultural Literacy Lesson Plan Library

Unit E. Agribusiness

Lesson 5. World Trade: Imports and Exports

Indiana's Academic Standards. **Social Studies:** 4.4.3 — Explain why both parties benefit from voluntary trade, and give examples of how people in Indiana engaged in trade in different time periods.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define imports and exports.
2. Discuss U.S. agricultural imports and exports.
3. Describe various forms of transportation used for world trade.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Agribusiness Management Lesson Plan Library. Danville, Illinois: Center for Agricultural and Environmental Research and Training, Inc., 2002.

Farm Facts. Park Ridge, Illinois: American Farm Bureau Federation, 2002.

Innovation in Agriculture. Bloomington, Illinois: Illinois Farm Bureau, 2002.

Kids, Crops, & Critters in the Classroom. Bloomington, Illinois: Illinois Farm Bureau, 2002.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Cookies (one small package for each student or one package for the entire class to share and copies of the label)
- ✓ World maps

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Balance of trade
- ➤ Barge
- ➤ Cargo (freight)
- ➤ Cargo ship
- ➤ Exports
- ➤ Imports
- ➤ Intermodal rail
- ➤ Port
- ➤ Rail
- ➤ Tariff

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Begin by asking the students if they like cookies. Ask them what kind of cookies they like best. Allow all students to share the name of their favorite cookies and keep a

tally on the board. Chocolate chip cookies will probably be the most popular. Give each student chocolate chip cookies. Show them the label from the package. Ask the students to read the ingredients on the label. Tell them that some of the ingredients, like flour and butter, are grown and processed in the United States, but other ingredients come from other countries. Hand out WS: E–5A and have students complete the activity.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define imports and exports.

Anticipated Problem: What are imports and exports?

I. In addition to helping develop good relationships with other countries, imports and exports can increase the growth potential in the agricultural industry. Processing, distribution, handling, storage, and transportation jobs in the United States are created by imports and exports.

A. ***Imports*** are products bought from another country.

1. The U.S. imports many products including: cocoa, spices, vanilla, olive oil, wool, coffee, various tropical fruits, sugar, tea, seafood, machinery, electronics, timber, cars, and clothing. The U.S. produces some of these products, but it is necessary to import more to supply our country's needs. For example, the U.S. is the largest producer of beef, but we still are the largest importers of beef from Argentina and Australia.
2. Imports provide us with goods that we need or want that are not produced in the U.S.

B. ***Exports*** are products sold to other countries.

1. The United States is the world's largest agricultural exporter.
2. The U.S. exports wheat, corn, soybeans, soy products, beef, pork, and other feed grains.
3. The main countries that we export to are Japan, Canada, South Korea, Mexico, Taiwan, and the Netherlands.

C. ***Balance of trade*** is the balance between the amount of imports and the amount of exports. The United States has a favorable (positive) balance of agricultural trade, meaning that we export more than we import. Even though China is the largest and India is the second largest producer of rice, the U.S. exports more rice than both of them.

D. A ***tariff*** is a government tax imposed upon imports and exports.

Use TM: E–5A to cover the content of the objective. Use WS: E–5B to allow students to participate in a simulation of international trade. This activity should help students better understand the concept of imports, exports, balance of trade, and tariffs.

Objective 2: Discuss U.S. agricultural imports and exports.

Anticipated Problem: What agricultural products does the U.S. import and export?

II. The contributions of the U.S. agricultural industry are very important in the world market.

A. The United States exports about 18% of its agricultural products.

B. The United States provides 10.4% of the wheat, 11% of the eggs, 19.4% of the cotton, 20% of the milk, 24% of the beef and veal, 43% of the corn, and 43% of the soybeans in the world market.

C. Total U.S. agricultural exports equaled $53 billion in 2001. The top agricultural exports are beef, feed grains (corn, oats), soybeans, processed fruits and vegetables, wheat, hides and skins, cotton, fresh vegetables, poultry, tobacco, tree nuts, and fresh fruits.

D. Total U.S. agricultural imports equaled $39 billion in 2001. The top agricultural imports are bananas, coffee, tea, cocoa, spices, fresh and processed vegetables, grains and feeds, fresh and processed fruits, dairy products, live animals, and beef.

E. The regions and countries importing the most agricultural products from the United States in 2001 were Asia, Japan, Canada, Mexico, European Union, Latin America, Africa, China, Russia, and Germany.

Use TM: E–5B to discuss the U.S. share of word markets. Use TM: E–5C to show student a graphic of U.S. imports versus exports. Use TM: E–5D to show students our top foreign markets. Have students locate each country on a world map as you go through the list. Use WS: E–5C to familiarize the students with imports and exports of the United States and our share of the world market.

Objective 3: Describe various forms of transportation used for world trade.

Anticipated Problem: What types of transportation are used for world trade?

III. Most products must be transported to the place where they will bought or sold. Agricultural products are transported by many different methods.

A. ***Cargo***, or freight, is the load of commodities carried by a truck, plane, or ship.

B. ***Rail*** is the use of railroads and train cars in hauling freight.

C. A ***barge*** is a large, usually flat boat that is used for carrying freight on rivers and canals. One barge can carry as much cargo as 58 semi-trucks.

D. A ***cargo ship*** is a large ship that is used to transport cargo.

E. ***Intermodal rail*** is the movement of freight by rail and at least one other mode of transportation. For example, corn is usually hauled by truck and then loaded onto rail cars. It could also be shipped in rail cars and loaded onto barges.

F. A ***port*** is a harbor or town along a waterway where ships can unload cargo.

1. Indiana's border is more than 50 percent water, including the Great Lakes, St. Lawrence Seaway, Lake Michigan, Inland Waterway, and the Ohio River. The state of Indiana ships 75 million tons of cargo by water each year.
2. Indiana has three main ports: Burns Harbor in Portage, Clark Maritime Center in Jeffersonville (on the Inland Waterway System), and Southwind Maritime Center in Mount Vernon (on the Ohio River).
3. The major cargoes handled in the ports of Indiana are as follows:
   a. Burns Harbor—iron, steel, grain, chemicals, fertilizer, limestone, coal.
   b. Clark Maritime Center—steel, iron, grain, fertilizer, salt, asphalt.
   c. Southwind Maritime Center—grain, soybean products, coal, fertilizer, cement, minerals.

Use TM: E–5E and TM: E–5F to cover the content of the objective. Use WS: E–5D to help the students with the concept of transporting commodities and products from their origin to where they are needed. You might want to divide the class into small groups so students can work together to complete the activity. Try to make sure that each student or group of students chooses a different commodity or location so that you will have a variety of transportation routes. Visit a local grain elevator to allow students to watch them unload trucks or load rail cars.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: E–5A, WS: E–5B, WS: E–5C, and WS: E–5D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. c

3. e
4. a
5. b
6. f

Fill-in-the-Blank

1. Cargo
2. Rail
3. Intermodal rail
4. 18

Short Answer

Answers will vary. Students should list three of the following:

beef
feed grains (corn, oats)
soybeans
processed fruits and vegetables
wheat
hides and skins
cotton
fresh vegetables
poultry
tobacco
tree nuts
fresh fruits

Test E–5

Name_____

WORLD TRADE: IMPORTS AND EXPORTS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. balance of trade
b. barge
c. exports
d. imports
e. tariff
f. port

_____1. Products bought from another country.

_____2. Products sold to other countries.

_____3. A government tax imposed upon imports and exports.

_____4. The balance between the amount of imports and the amount of exports.

_____5. A large, usually flat boat that is used for carrying freight on rivers and canals.

_____6. A harbor or town along a waterway where ships can unload cargo.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ is the load of commodities carried by a truck, plane, or ship.
2. _____ is the use of railroads and train cars in hauling freight.
3. _____ _____ is the movement of freight by rail and at least one other mode of transportation.
4. The United States exports about _____ percent of its agricultural products.

▶ Short Answer

***Instructions*. Answer the following question.**

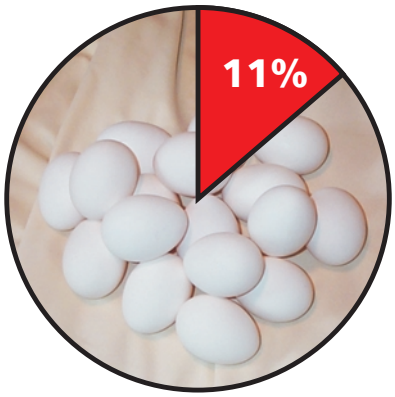
List three of the top U.S. agricultural exports.

IMPORTS AND EXPORTS

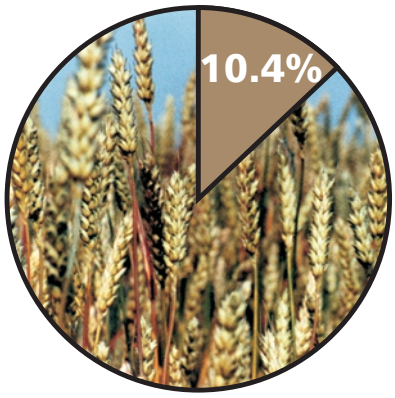
- Imports are products bought from another country.
- Exports are products sold to other countries.
- Balance of trade is the balance between the amount of imports and the amount of exports.
- A tariff is a government tax imposed upon imports and exports.

U.S. SHARE OF THE AGRICULTURAL WORLD MARKET

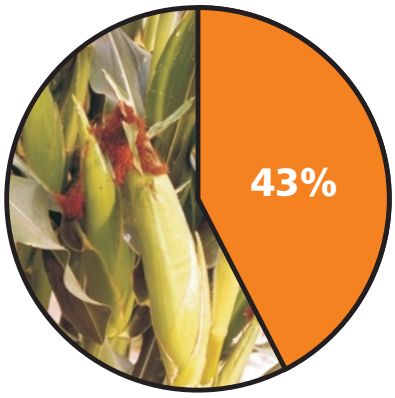
Milk



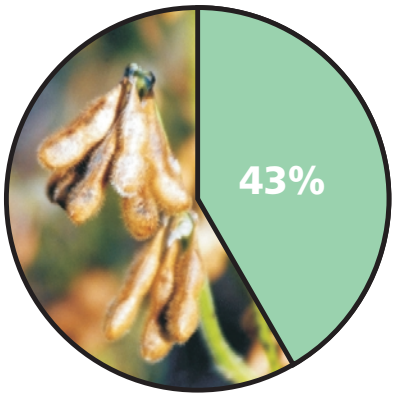
Eggs



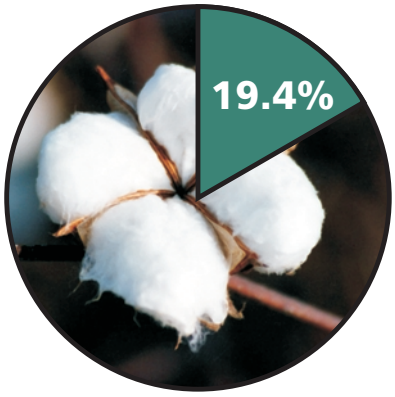
Wheat



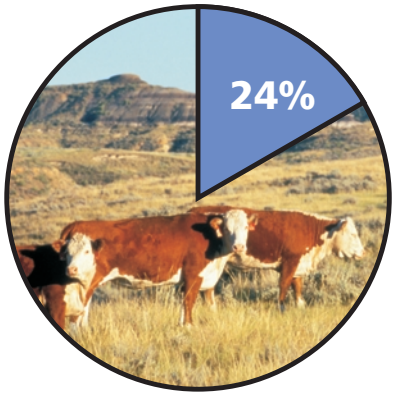
Corn



Soybeans

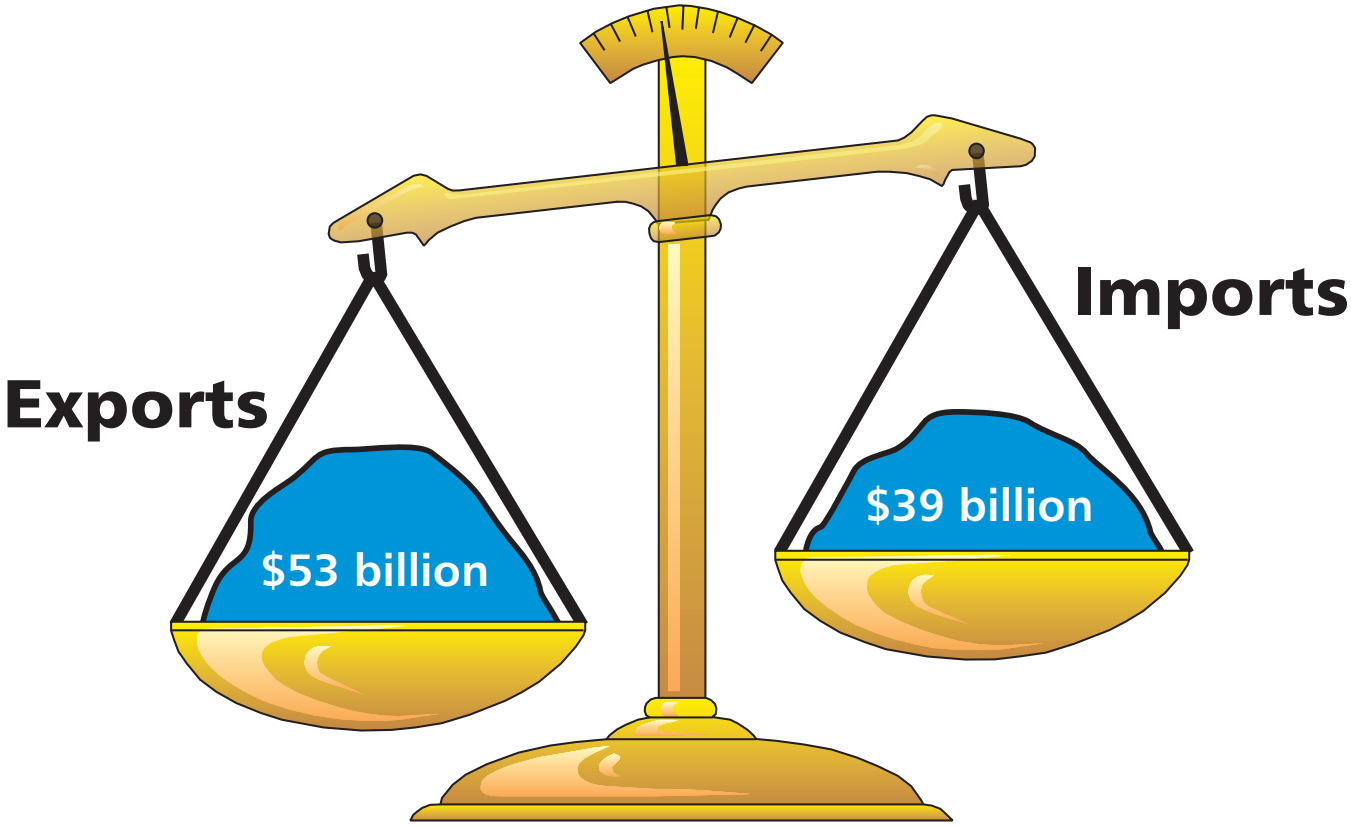


Cotton



Beef and Veal

U.S. EXPORTS AND IMPORTS



OUR TOP FOREIGN MARKETS

The countries and regions importing the most agricultural products from the United States in 2001:

- Asia — $11.5 billion
- Japan — $9.0 billion
- Canada — $8.0 billion
- Mexico — $7.3 billion
- European Union — $6.3 billion
- Latin America — $4.3 billion
- Africa —$2.1 billion
- China — $1.9 billion
- Russia — $1.0 billion
- Germany — $0.9 billion

TRANSPORTATION

- Cargo, or freight, is the load of commodities carried by a truck, plane, or ship.
- Rail is the use of railroads and train cars in hauling freight.
- A barge is a large, usually flat boat that is used for carrying freight on rivers and canals. One barge can carry as much cargo as 58 semi-trucks.
- A cargo ship is a large ship that is used to transport cargo.
- Intermodal rail is the movement of freight by rail and at least one other mode of transportation.
- A port is a harbor or town along a waterway where ships can unload cargo.

TRANSPORTATION

(Courtesy, U.S. Department of Agriculture)

Name _____

WHERE IN THE WORLD DO THOSE COOKIES COME FROM?

Directions

World trade and agriculture help make your cookies! Chocolate chip cookies are made from ingredients that are found all over the world. Some of the ingredients are only grown in other countries and must be imported to the United States. Use the world map below to label the countries the ingredients come from. Refer to an atlas or globe to help in locating the countries. Draw a line from each of the ingredients to the country it comes from.

Cacao (for chocolate chips) from Ivory Coast

Vanilla from Mexico

Nuts from Greece

Butter from the United States

Cinnamon from India

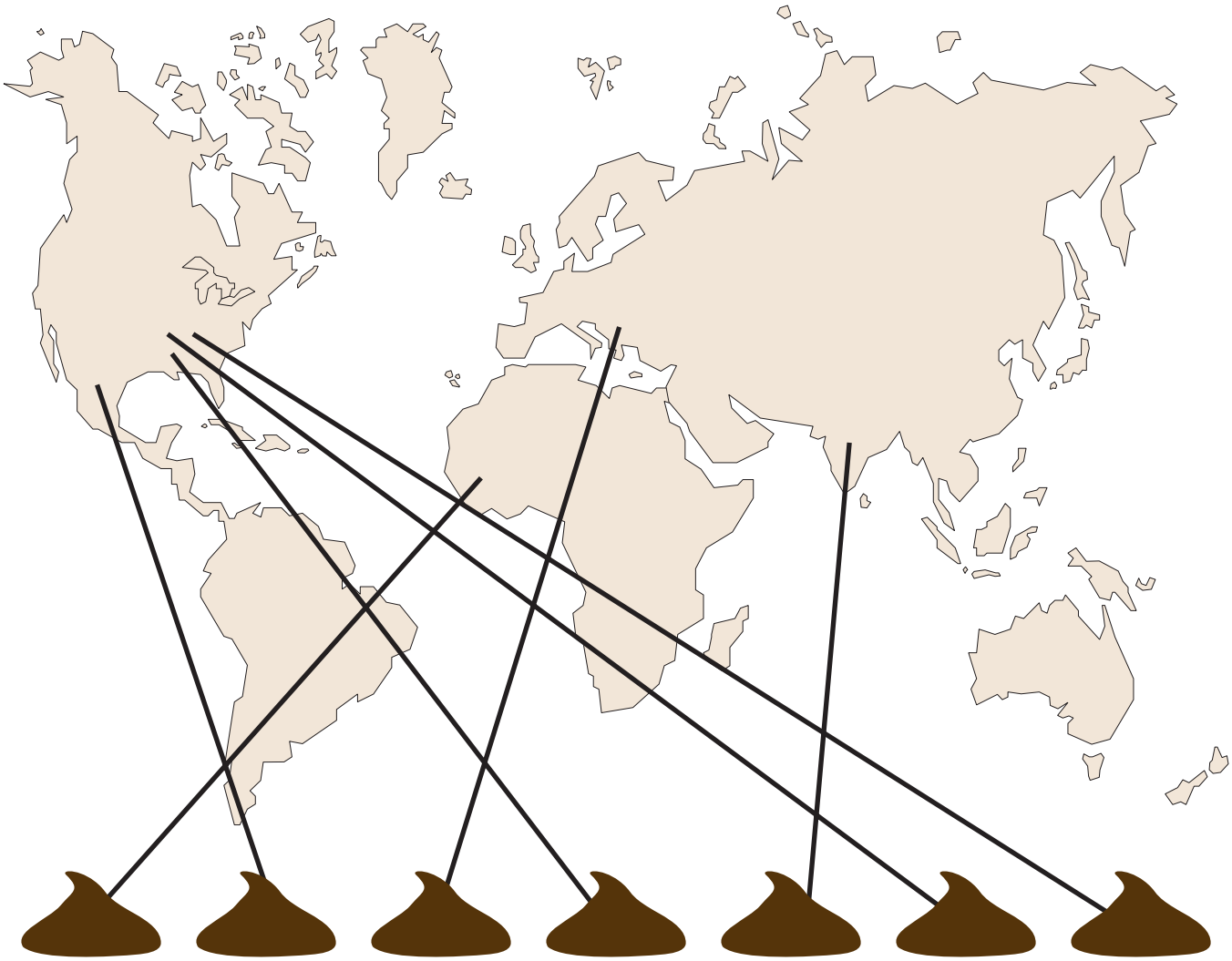
Eggs from the United States

Flour from the United States

(Adapted from Minnesota Agriculture in the Classroom, Ag Mag Volume 10, Issue 2.)

WS KEY: E–5A

WHERE IN THE WORLD DO THOSE COOKIES COME FROM? KEY



WS: E–5B

Name _____

WORLD TRADE

Materials

- ✓ Pair of dice
- ✓ Colored squares of construction paper (red, blue, green, yellow, black, and orange)
- ✓ Writing utensil

Procedure

1. You are in charge of your own country! Come up with a name for your country and write it in the Data Table.
2. Roll both dice. This number is the population of your country. Record this number in the table. Take one square of blue construction paper for each member of your population. Set these squares to the side.

DATA TABLE	
Name of country:	
Population of country:	
Crop grown (color):	
Number of units of the crop you produce:	
Number of crop units you have left over:	
Number of crops units you must get to provide for your people:	
Crop your population wants (color):	
Amount of money you have (roll of dice × 10) to buy crops:	
Amount of money you have or owe:	
Balance of trade (positive or negative):	

3. Roll one die. Use this chart to find what color your number is:

   1 = Red
   2 = Yellow
   3 = Orange
   4 = Red
   5 = Yellow
   6 = Orange

   This color represents the type of crop you grow in your country. Record this color in the table.

4. Roll both dice. This is the number of units of the crop your country produces. Record this number in the table and take one square of the correct color for each crop unit.
5. Before exporting any of your crop units, you must first provide for the people of your country. Take one square of your crop units for each member of your population and set them aside. You must keep these squares for your own people. Record how many crop units you have left over in the table. If you do not have enough crop units for your population, you will have to import them from another country. Record the number of units you will need.
6. Roll one die. Use the color chart to find what color your number is. This color represents the type of crop your population wants. Record this color in the table. You will need to get one unit of the crop for each member of your population. If your people want the same crop that you already produce, you can use the crop units you have to provide another square to your people.
7. Roll both dice. Multiply this number by 10. This is the number of dollars you have to provide food for your country. Record this number in the table and take one square of green construction paper for each dollar.
8. One at a time, go around the room and take turns buying (importing) the crop units you need from other "countries" and selling (exporting) your extra crop units. All crop units buy and sell for $1 (one square of green paper) each. You can buy from any student who has the color you need. You can sell any of the extra crop units you have that your population did not need to whichever country wants them first.
9. If you run out of money to buy crops with, you will have to borrow money from your teacher's country. For each green square you must borrow from your teacher, you will also take one black square to indicate your debt to your teacher's country.
10. If you cannot get enough crop units for your people from the other students' countries, you will have to buy the rest of them from your teacher. Unfortunately, because of tariffs in place in your teacher's country, you will have to pay $2 (two squares of green paper) per crop unit.
11. Any crop units you have left over that no one else needs can be sold to your teacher for $2 per unit.
12. Count your green or black squares to see how much money you have or how much you owe and record the number in the table. Place a minus sign (–) by the number if you owe it.
13. Record whether your country has a positive balance of trade or a negative balance of trade.

▶ Conclusions

How did you do? Were you able to produce enough crops to provide for your people, or did you have to import some from another country? Did you have any crops to export? Did you make any money by exporting, or did you have to go into debt to provide for your country? We are lucky to live in the United States where our agricultural industry provides an abundance of products for us to use and export!

Name _____

OUR MARKET SHARE

Fill in the percent of the world markets that the United States provides in each commodity.

Milk

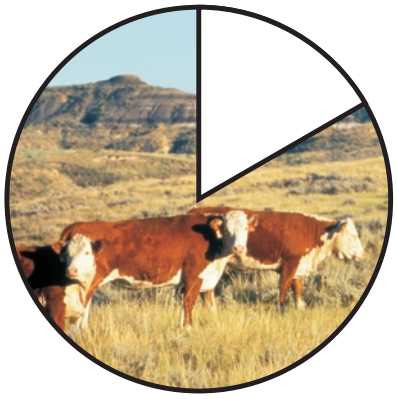
Eggs

Wheat

Corn

Soybeans

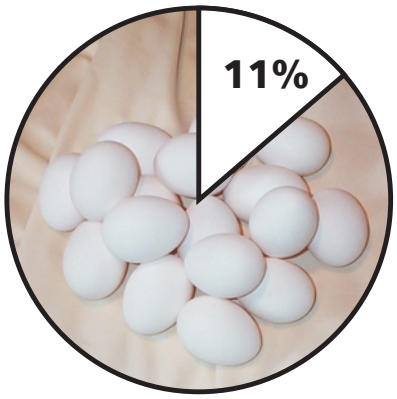
Cotton



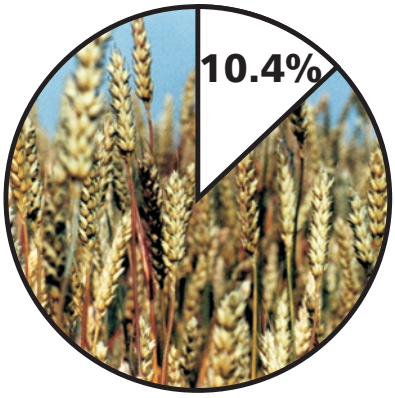
Beef and Veal

OUR MARKET SHARE KEY

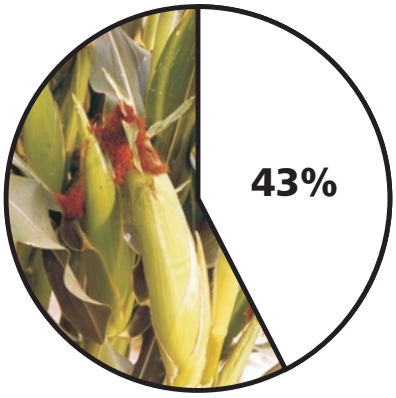
Milk



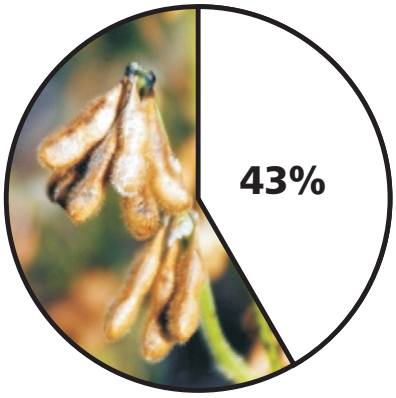
Eggs



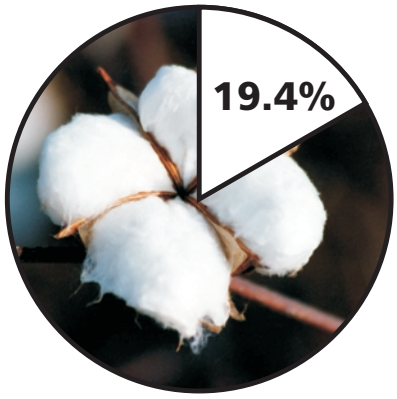
Wheat



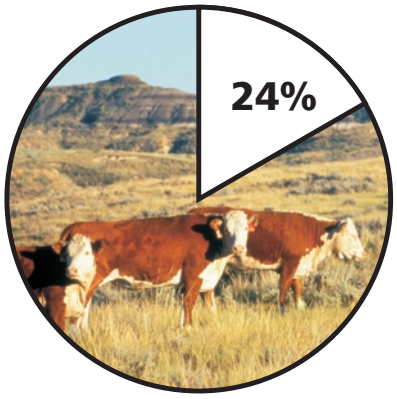
Corn



Soybeans



Cotton



Beef and Veal

Name _____

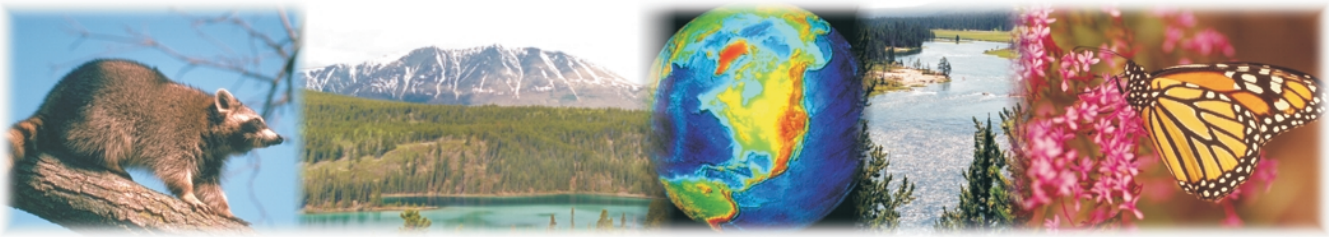
TRANSPORTING COMMODITIES

Materials

- ✓ Posterboard
- ✓ Markers
- ✓ Map

Directions

1. Choose a crop or other agricultural commodity produced in your state that you would like to transport.
2. Draw the outline of your state on the posterboard.
3. Choose a location in the state where your commodity is produced and label it.
4. Next label all of the railways, waterways, highways, and major cities. Use different colored markers for the different elements. Add a key to the posterboard that shows what each color stands for.
5. Find the major city that is located the furthest from where your commodity is produced.
6. Outline three routes that you would use to get your commodity to the city. Describe the types of transportation you would use to get your product to the major city.



Lesson F–1

SOILS

Indiana Agricultural Literacy Lesson Plan Library

Unit F. Environmental Science

Lesson 1. Soils

Indiana's Academic Standard. **Science:** 4.3.7 — Explain that smaller rocks come from the breakage and weathering of bedrock and larger rocks and that soil is made partly from weathered rock, partly from plant remains, and also contains many living organisms.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the difference between soil and dirt.
2. Describe how soil is formed.
3. Identify the layers of soil.
4. Recognize different soil textures.
5. Describe the role of earthworms in soil.
6. Explain what soil erosion is and methods to prevent it.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Dig In! Hands-On Soil Investigations. Arlington, Virginia: National Science Teachers Association Press, 2001.

Indiana Association of Soil and Water Conservation District—www.iaswcd.org/

Indiana State Soil Information—http://soils.usda.gov/gallery/state/html_docs/in_soil.htm

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Loynachan, T., et al. *Sustaining our Soils and Society.* Alexandria, Virginia: American Geological Institute, 1999.

Soil Erosion Hands-on Science Kit. Urbana-Champaign, Illinois: University of Illinois Information Technology and Communication Services, 2000.

Soils of Indiana—www.agry.purdue.edu/overview/content/state_soils.html

Soil: Who Needs It? (Video). Las Cruces, New Mexico: NMSU Board of Regents College of Agriculture & Home Economics, 1996.

The USDA Natural Resources Conservation Service Soils Education web site contains many good resources, lessons, information, links, songs, quotes and more—http://soils.usda.gov/education/main.htm

USDA NRCS—www.nrcs.usda.gov

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Bucket of soil from yard or field
- ✓ Old newspapers
- ✓ Magnifying lenses (one for each student)

Terms. The following terms are presented in this lesson (shown in bold italics):

- ► Clay
- ► Dirt
- ► Erosion
- ► Organic matter
- ► Parent material
- ► Sand
- ► Silt

- Soil
- Soil profile
- Soil texture
- Subsoil
- Topsoil

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Bring in a bucket of soil from the yard or a field. Spread some newspapers or plastic on a table. Pour the soil out on the newspaper. Please be sure to take a few minutes to check the soil for anything that might be harmful (broken glass, pieces of metal, etc.). Give each student a magnifying lens and allow him or her to explore the soil. Ask students to describe the soil. List their observations on the writing surface as they explore. If the soil has been recently dug, they may find some creatures living there. They may find some rocks, twigs, leaves, etc. While this is a very simple activity, it is a great opportunity for your students to enjoy their investigation and describe what they see and feel.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain the difference between soil and dirt.

Anticipated Problem: Are soil and dirt the same?

I. Many people use the words soil and dirt to mean the same thing. You have probably heard some of the following comments. "Oh, that's just dirt!" "We need to buy some potting soil." "Quit playing in the dirt." "Seeds need dirt to grow." "Who tracked the dirt in the house?" "To grow a good garden, you need some good, black dirt." "It must be old as dirt."

A. ***Soil*** is the outer portion of the earth's surface. Soil is the foundation of every living thing. Soil is a living, dynamic resource.

B. ***Dirt*** is simply soil that is out of place. When it is on your hands or clothes, it is dirt. It is not where we desire it to be. It is unable to serve its purpose.

C. Compare the difference of soil and dirt to that of a plant and a weed. A weed is merely a plant that is out of place. When a stalk of corn grows in a soybean field, it is called a weed.

If that same stalk of corn is moved to a cornfield, it is called a corn plant. While the difference may be considered subtle, it is important to distinguish between the two.

D. Dirt is a negative term. Soil is too important to be mistaken for dirt.
   1. Soil is where our fields and gardens grow.
   2. Soil provides the foundation for the roads and the structures we build.
   3. Soil provides a home to many plants and animals.
   4. Soil contains water that we depend upon.
   5. Soil also helps to filter water.
   6. Soil is used to help dispose of waste.
   7. Soil is the basis of many recreational areas, such as sports fields, camping grounds, playgrounds, parks, and golf courses.

E. Soil is a precious, natural resource that must be taken care of and protected. Soil is essential to our way of life.

Use TM: F–1A to show students the many uses for soil. Use WS: F–1A to demonstrate with an apple how much of the earth's surface is used for food production. Perform the demonstration using WS KEY: F–1A while students follow along and fill out their worksheet. Encourage students to think of the many things we use the soil for and why it is important to protect it for future use.

Objective 2: Describe how soil is formed.

Anticipated Problem: How is soil formed?

II. Soil is formed by the environment around it. Soil comes in many different colors, types, sizes, and textures.

A. Soil is made from rocks, minerals, and organic matter that slowly break down over time. Soil is 45 percent mineral matter, 25 percent water, 25 percent air, and 5 percent organic matter.
   1. As rocks weather, they break into smaller pieces.
   2. These smaller pieces of rock form the mineral matter in soil. This mineral portion consists of sand, silt, and clay in varying amounts.
   3. ***Organic matter*** is partially decomposed plant and animal matter. Organic matter gives soil its dark color and contributes to the soil's fertility.
   4. Air and water fill up the spaces between the pores in soil. The wetter the soil, the less air there will be. Water soaks into the soil and moves down through it.

B. Soils differ in different locations due to the factors by which they were formed. These factor include the following:
   1. Climate (kind of weather)
   2. Vegetative cover (plants)
   3. Parent material (bedrock)

4. Topography (sloping condition of the land)
5. Time that the soil has had to form

C. In looking at the soils of Indiana, three broad areas are recognized according to Purdue University's Agronomy Department: the steep, rolling, unglaciated area of southern Indiana; an older glaciated area in southern Indiana; and the surface left by more recent glaciation in the northern two-thirds of the state. The state soil of Indiana is Miami.

Use TM: F–1B to show students what soil is made of. Use TM: F–1C to discuss the factors that affect the formation of soil. Use WS: F–1B to have students create a recipe for soil. Visit http://soils.usda.gov/gallery for a fact sheet on your state soil and more information about soils. You may also want to contact your local soil and water conservation service.

Objective 3: Identify the layers of soil.

Anticipated Problem: What layers are found in soil?

III. Soil is composed of different layers.

A. A ***soil profile*** is a slice of earth several feet deep that shows the layers of soil—topsoil, subsoil, and parent material (sometimes called bedrock).

1. Some soil layers may be less than an inch thick, and some may be over 2 feet thick.
2. The layers are based on soil color, structure, texture, and the amount of gravel and organic matter present in the soil. These variations help distinguish between the layers.
3. The soil layers are also referred to as horizons. The O horizon is the very top layer of the soil. It is primarily made of organic materials (decaying plant and animal matter). This horizon is most commonly found in forests and swamps. It is not present in agricultural fields and deserts.

B. ***Topsoil*** is the upper soil layer. Also known as the A horizon, topsoil is the richest in nutrients.

1. Topsoil contains most of the soil's living organisms.
2. Plant roots, fungi, bacteria, and small animals are abundant in the topsoil.
3. Plants thrive in this layer.
4. Topsoil is usually gray-brown to black in color.
5. Wind and water erosion can wash away this valuable layer if it is not protected.
6. It takes nature over 500 years to replace 1 inch of topsoil.

C. ***Subsoil*** is the middle soil layer. Also known as the B horizon, subsoil is found beneath the topsoil.

1. Subsoil holds water and some plant nutrients.
2. Subsoil is less fertile than topsoil.
3. The subsoil is usually lighter in color than topsoil.

4. Subsoil often contains more clay, which makes it feel sticky and slick when you touch it. The clay makes the subsoil harder when dry and stickier when wet than the surrounding soil layers.
5. Deeper tree roots and earthworms live in the subsoil.

D. ***Parent material*** is the bottom soil layer. Also known as the C horizon, parent material is found beneath the subsoil.
1. The parent material layer is less altered and weathered than the layers above and has less living matter.
2. The parent material layer contains the material from which the topsoil and subsoil were created. It may be rock, material left after glaciers, materials deposited by water, or organic matter such as plants.
3. This layer is more compact and often has stones and rocks in it. Because of this, the parent material layer is sometimes called bedrock.

Show TM: F–1D to illustrate to students what a soil profile looks like. Contact your local Soil and Water Conservation District to see if an actual soil profile could be brought to class for the students to examine. Use WS: F–1C to have students make some edible soil which will illustrate the layers of soil.

Objective 4: Recognize different soil textures.

Anticipated Problem: What are the different textures of soil?

IV. The way a soil feels is called the ***soil texture***. The average soil contains three types of soil particles: sand, silt, and clay. A good mixture of soil would have 25 percent clay, 25 percent sand, and 50 percent silt. A soil that has about equal amounts of all three particle sizes is called loam.

A. ***Sand*** is the largest of the soil particles. It feels gritty. It is the heaviest. Sand allows water and air to move easily through it. To visualize the relative size of a sand particle, picture a basketball.

B. ***Silt*** is the soil particle that falls between sand and clay in texture. It is considered to be a medium size particle. Silt feels like flour—very smooth—when you rub it in your hands. Silt particles help keep the soil rich and loose. To visualize the relative size of a silt particle, picture a softball.

C. ***Clay*** is the smallest of the three soil particles. Clay has the tendency to become sticky or greasy to the touch when wet. When it is dry, clay becomes extremely hard and brick-like. To visualize the relative size of a clay particle, picture a marble.

Use TM: F–1E to show students the relative sizes of sand, silt, and clay particles. Use WS: F–1D to give students an opportunity to observe the different soil particles in soil samples. Use WS: F–1E to allow students to examine and feel the different soil textures.

Objective 5: Describe the role of earthworms in soil.

Anticipated Problem: What do earthworms do in the soil?

V. Below our feet lies an amazing world. Along with the sand, silt, and clay exists an incredible diversity of organisms that range in size from the tiniest one-celled bacteria, algae, fungi, and protozoa, to the more complex nematodes and micro-arthropods, to the visible earthworms, insects, and small vertebrates and plants. Organisms enhance the soil in many ways, such as by decomposing organic matter. The organism we recognize the most is the earthworm.

A. Earthworms live in warm, moist soil throughout the world.

B. Earthworms can range in size from 1 millimeter long to 11 feet long.

C. Earthworms are often called nature's recyclers. They eat organic matter and help break it down. They eat almost anything soft enough to chew. As organic matter passes through their body, it is ground up by tiny stones in the gizzard. The organic matter leaves the earthworm's body as waste in the form of dark, fertile casting containing partially digested material that enriches the soil. This enriched soil is full of nutrients that enable plants to grow.

D. Earthworms also tunnel through and aerate waste and the soil, which aids decomposition. They also help mix up the soil as they dig through.

E. Earthworms eventually die and become part of the compost.

Use TM: F–1F to discuss the importance of earthworms in the soil. Use WS: F–1F to demonstrate the activity of earthworms. Visit a local bait shop to see how they care for and raise worms used for fishing bait.

Objective 6: Explain what soil erosion is and methods to prevent it.

Anticipated Problem: What is soil erosion and what could be done to prevent it?

VI. ***Erosion*** is the wearing away of soil by water, wind, and other sources. Soil erosion is the greatest threat to our nation's soil productivity and one of the largest sources of pollution in our water. Topsoil, which is the most valuable layer of soil, is usually the first to disappear due to erosion.

A. In the United States, erosion causes us to lose 6.43 billion tons of soil per year. This would be the equivalent of 320 million dump trucks. If you were to park these trucks end to end, they would extend to the moon and three quarters of the way back!

B. Water erosion often begins with raindrops. To a soil particle, a raindrop is like a bomb falling from the sky. Raindrops can reach speeds of 20 miles per hour. When rain falls, millions of drops fall to the ground and splash soil particles as high as 3 feet into the air and splatter them as far as 5 feet away. As the water runs off the land, it often carries soil along

with it into other water sources. The steeper the slope, the faster the water will run, which in turn digs up and carries away more soil.

C. Wind is also responsible for soil erosion. Soil particles that are unsheltered can be picked up and carried away. Any exposed soil surface is vulnerable, especially in dry conditions and dry climates. Wind can carry soil over a greater distance than water in a short amount of time. When it is dry and windy, huge clouds of soil can blow across the land and cause dust storms. The size and severity of the soil erosion due to dust storms during the drought in the 1930s was referred to as the Dust Bowl.

D. Erosion can cause many problems.

1. Erosion carries away the most fertile, productive soil.
2. It breaks down the soil and reduces organic matter.
3. When water carries soil away into other water sources, the soil becomes a pollutant known as sediment. If you've ever seen a muddy lake or river, you've seen the effects of soil erosion.
4. Fertilizers and pesticides can be carried along with the soil into water sources.
5. As runoff increases, the soil is cut through, leaving rills (channels) that can become gullies.
6. Crops and vegetation of any kind can be damaged, covered with soil, and uprooted because of erosion. This results in crop loss, reduced productivity, and reduced yields.
7. Soil erosion can also damage structures by washing away roads and weakening building foundations.
8. On steep slopes, erosion can cause landslides to occur.

E. Soil is a very precious natural resource that takes a considerable amount of time to form. We must do what we can to conserve soil. While soil erosion can never be stopped, it can be controlled.

1. The Soil Conservation Service was permanently established in 1935 to provide assistance in controlling erosion. This happened just a year after dust storms carried an estimated 200 million tons of soil away. Soil conservationists, farmers, and others have learned how to minimize erosion through a variety of management practices.
2. One of the best ways to control soil erosion by water and wind is to protect the soil with healthy vegetation. Roadside ditches, waterways, and sloping areas are often planted with grass or other plants to help hold the soil in place. This vegetative area can also help hold back and filter out fertilizers and pesticides that could otherwise become water pollutants. Planting trees also provides a sheltered area for soil.
3. Construction sites often cover bare soil with straw until something more permanent is established to protect the soil. Straw bales are sometimes used in rows to form a small wall to slow water runoff. Once the construction is done, grass and other plants are usually put in place to control erosion.
4. In the past, farmers plowed their fields after harvest to mix the plant stems and leaves, known as crop residue, with the soil. This is called tilling. Today, many farmers leave the crop residue on the ground to help keep the soil in place. Farmers use a variety of

tillage methods based on the conditions of the land. Since they make their living from the land, farmers understand the importance of protecting the soil.

   a. No-till farming involves leaving crop residue on a field at all times. The soil is not turned over or worked when the new crop is planted.
   b. Minimum tillage involves working the soil but leaving some crop residue in place as the new crop is planted.

5. Terracing is a management practice used on sloping land such as hillsides. A terrace is a ridge that follows the contour of the land to slow runoff. Terraces serve the same purpose as speed bumps in parking lots.
6. Strip cropping is an erosion control method in which different kinds of crops are planted in strips across a hillside. These strips that are contoured with the slope of the land help slow runoff.
7. Streambank management practices are used to help prevent the soil from eroding along the banks of water. Rocks are often put strategically in place along rivers, streams, and lakes to control soil erosion. Planting willow trees can also help control erosion around water because the roots will hold the soil in place.

Use TM: F–1G and TM: F–1H to illustrate soil erosion and some soil conservation practices. Use WS: F–1G and WS: F–1H to demonstrate the concepts of the objective to students. Visit a nearby construction site or farm and allow students to examine the erosion control methods used at the location. Share the following quote with the students: "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." —Aldo Leopold from A Sand County Almanac, 1949. Ask students to write their personal reflection of this quote. They should describe what the quote means to them. Divide the students into small groups and have them share their reflections. Discuss the quote as a class. Hopefully, at some point students will realize that they play a role in caring for the land too.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: F–1A, WS: F–1B, WS: F–1C, WS: F–1D, WS: F–1E, WS: F–1F, and WS: F–1G.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

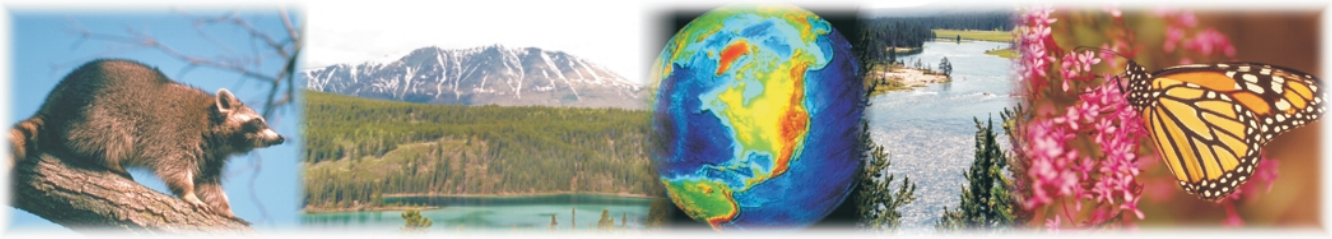
1. d
2. a
3. b
4. c

Fill-in-the-Blank

1. Clay
2. water and air
3. sand
4. Earthworms
5. silt

Short Answer

1. Answers will vary. Soil is the outer portion of the earth's surface. Soil is the foundation of every living thing. Soil is a living, dynamic resource. Dirt is simply soil that is out of place. When it is on your hands or clothes, it is dirt. It is not where we desire it to be. It is unable to serve its purpose.
2. Answers will vary. Students should list three of the soil erosion control methods discussed in Objective 6.



Test F–1

Name_____

SOILS

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. erosion
b. organic matter
c. soil profile
d. soil texture

_____1. The way a soil feels.

_____2. The wearing away of soil by water, wind, or other sources.

_____3. Partially decomposed plant and animal matter.

_____4. A slice of earth several feet deep that shows the layers of soil.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ is the smallest of the three soil particles and feels sticky when wet.
2. Soil is made up of organic matter, mineral matter, _____, and _____.
3. The gritty feeling, heaviest, and largest soil particle is called _____.
4. _____ are called nature's recyclers because they help break down organic matter and aerate the soil.
5. The medium size soil particle that feels like flour when you rub it in your hands is called _____.

Short Answer

***Instructions*. Answer the following questions.**

1. Explain the difference between soil and dirt.

2. Describe three methods that can be used to control soil erosion.

USES OF SOIL

Where our fields and gardens grow

Contains the water we depend on

Used to help dispose of waste

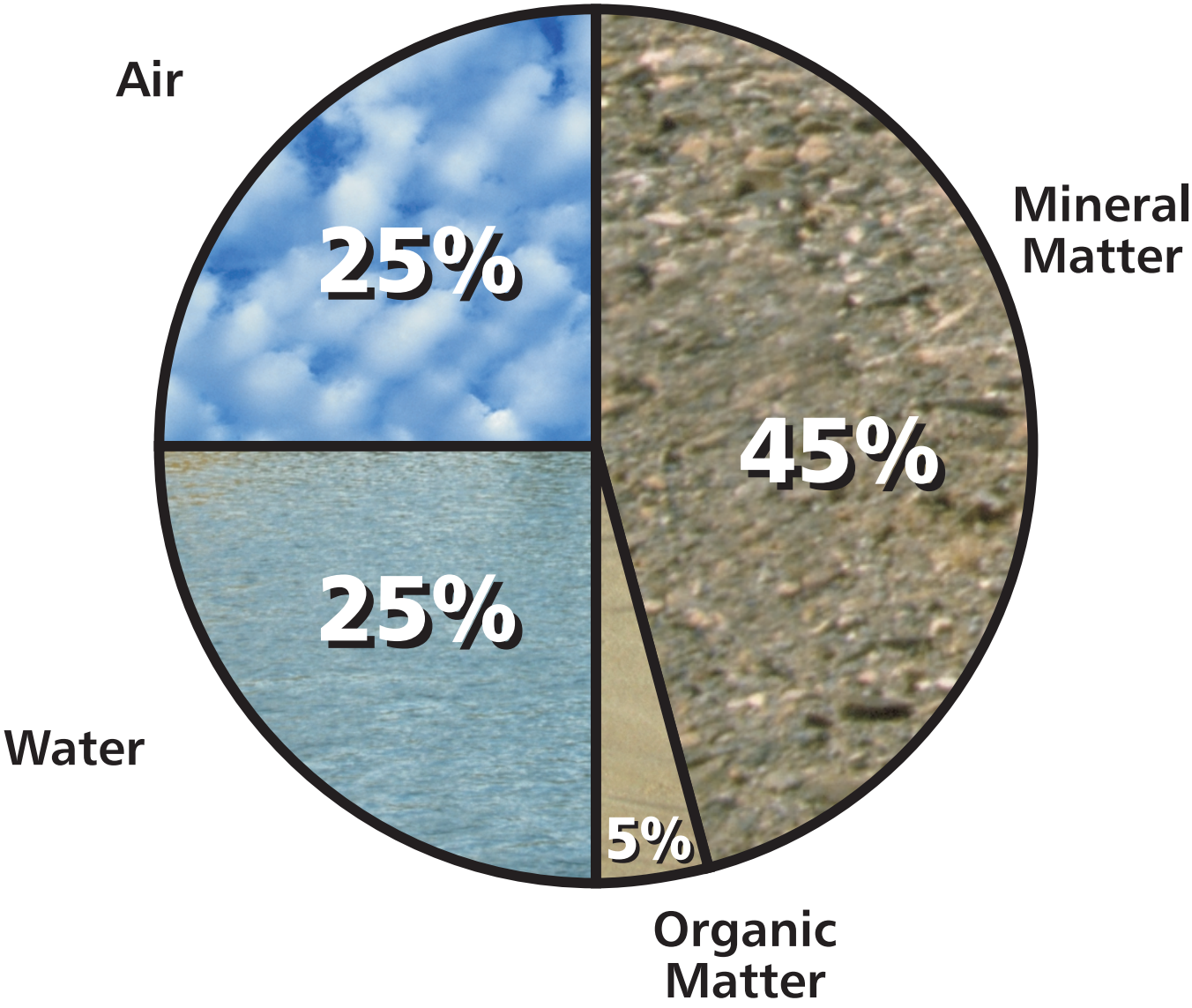
Basis of many recreational activities

A home to many plants and animals

Helps filter water

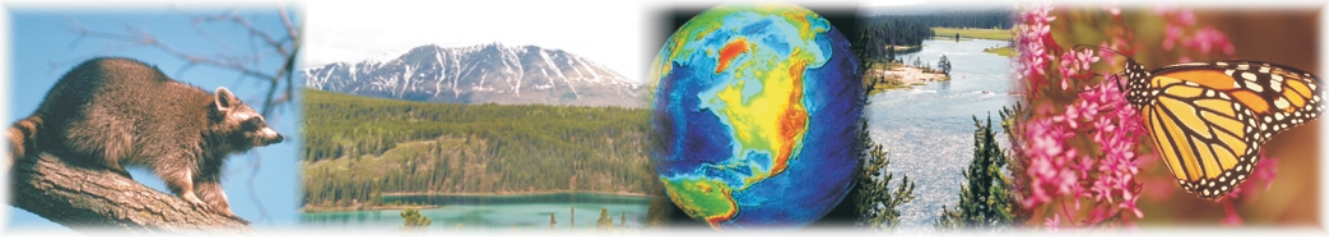
Foundation for the roads we drive and the structures we build

SOIL PARTS

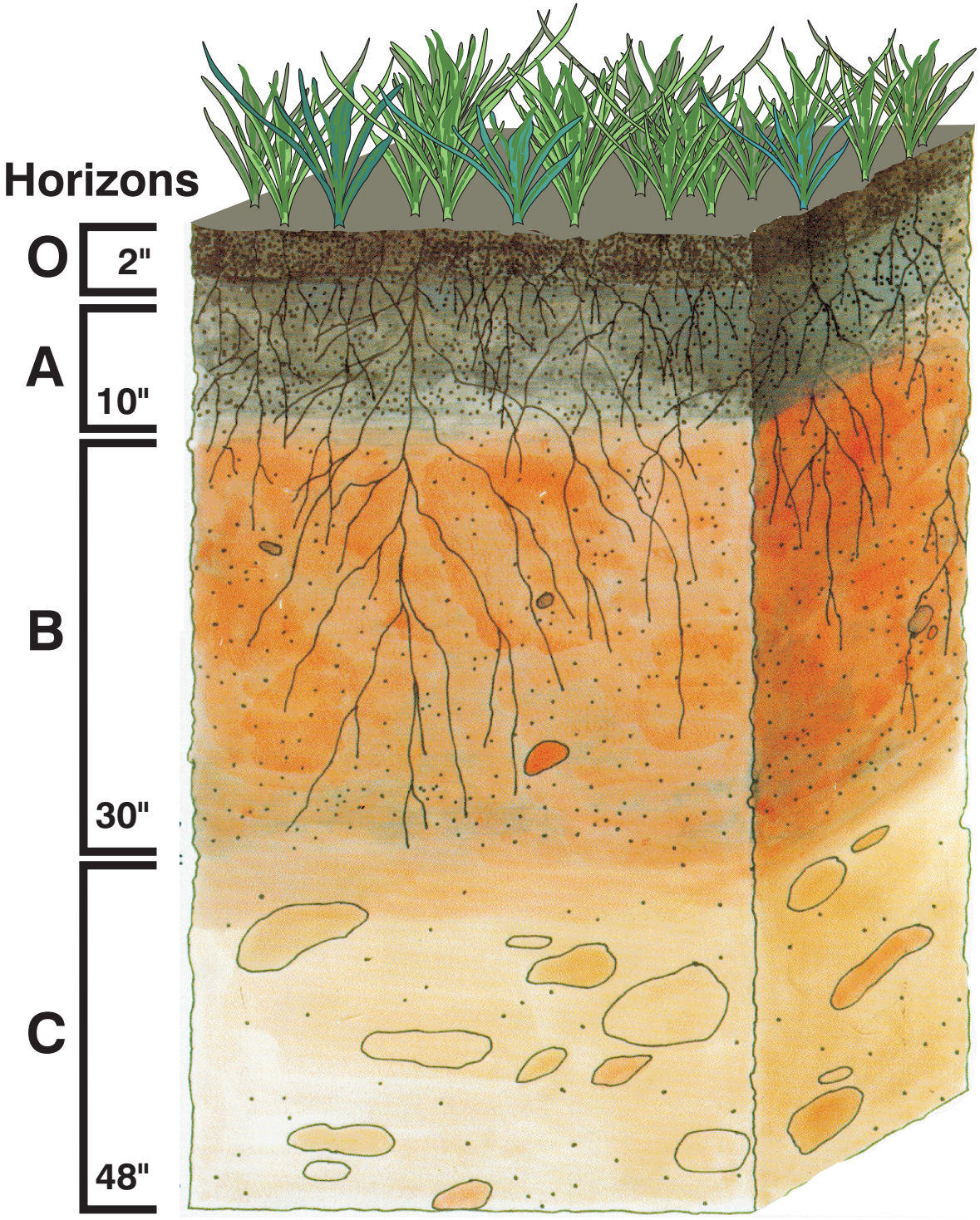


FACTORS THAT AFFECT SOIL FORMATION

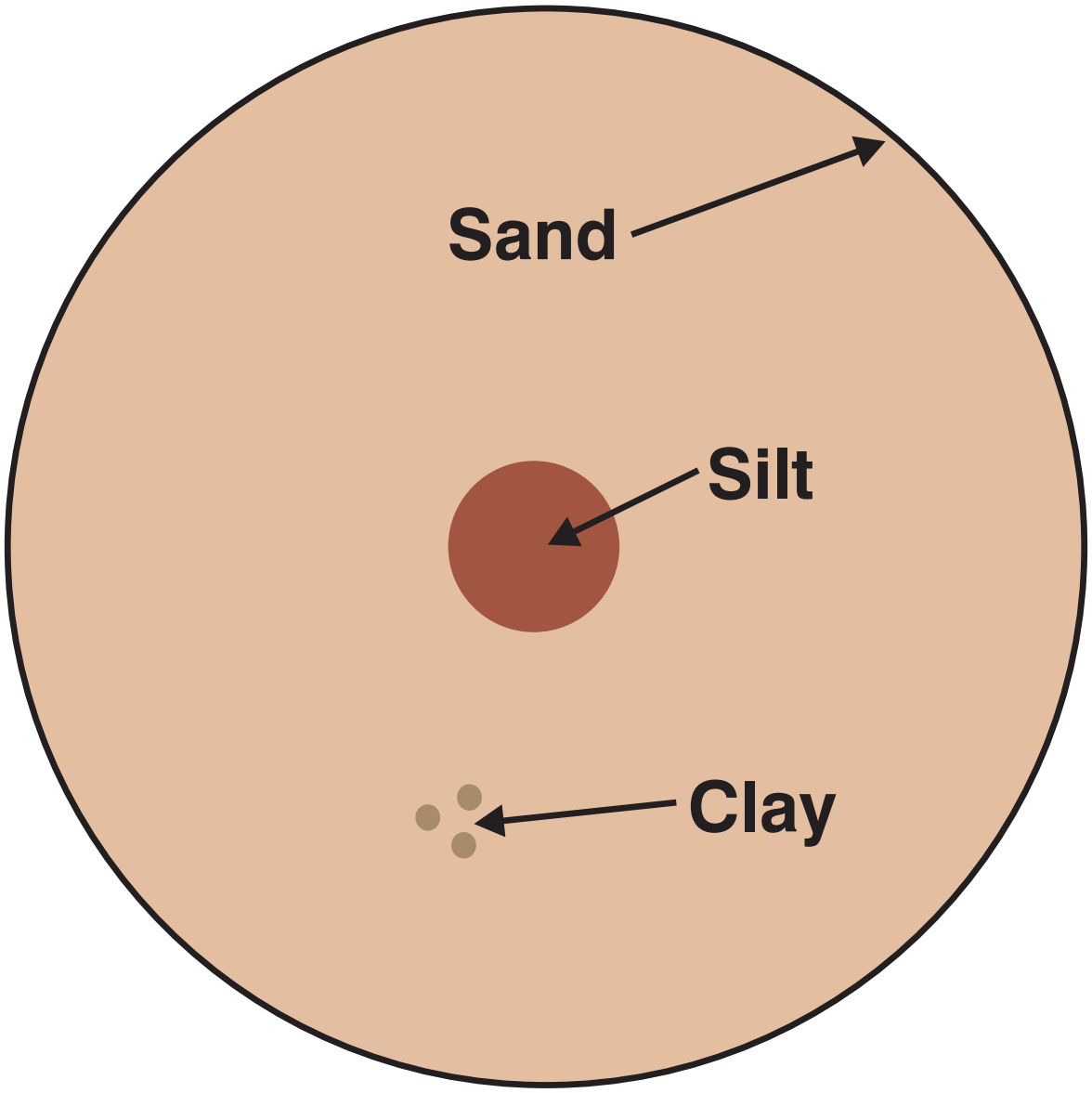
- Climate (kind of weather)
- Vegetative cover (plants)
- Parent material (bedrock)
- Topography (sloping condition of the land)
- Time that the soil has had to form



SOIL PROFILE



RELATIVE SIZE OF SOIL PARTICLES



EARTHWORMS

- Live in warm, moist soil throughout the world
- Range in size from 1 millimeter to 11 feet long
- Often called nature's recyclers because they eat organic matter and help break it down
- Aerate and mix up the soil
- Eventually die and become part of the compost

SOIL EROSION

SOIL CONSERVATION PRACTICES

Healthy vegetation along a road to control erosion.

A newly installed terrace to slow water runoff.

No-till soybeans growing through corn crop residue.
(Courtesy, U.S. Department of Agriculture)

Covering newly prepared lawn with straw to control erosion.

Strip cropping.
(Courtesy, U.S. Department of Agriculture)

Rocks placed along a streambank to control soil erosion.

WS: F–1A

Name _____

WHERE'S THE SOIL?

▶ Directions

Follow along as your teacher does a demonstration. Answer the questions when your teacher tells you to.

▶ Questions

1. How much of the Earth's surface do you think we use for food production—a lot, about half, just a little?

2. The three sections represent _____

   _____.

   The remaining section represents _____

   _____.

3. One section represents _____

   _____.

   The remaining section represents _____

   _____.

4. The three sections represent _____

_____.

The remaining section represents_____

_____.

5. The skin of this last apple slice represents _____

_____.

6. Why is it important to protect our soil from erosion?

WHERE'S THE SOIL? DEMONSTRATION KEY

▶ Materials

- ✓ Large apple
- ✓ Paring knife
- ✓ Paper towels

▶ Procedure

1. Pass out a copy of WS: F–1A to each student. Instruct them to follow along as you do the demonstration. Tell them to answer the questions when you tell them to.
2. Tell students to answer Question 1.
3. Cut the apple into four equal parts. Three parts of the apple represent the oceans on Earth. The remaining part represents all the land on Earth. Set the three parts representing water aside.
4. Tell students to answer Question 2.
5. Cut the land portion of the apple in half lengthwise. One part represents land where we cannot grow food (deserts, mountains, arctic, and wetlands). The remaining part represents the eighth of the entire Earth where humans can live. Set aside the part representing places we cannot grow food.
6. Tell students to answer Question 3.
7. Cut the part representing the areas humans can live into four equal parts. Three of these parts represent areas that have developed property (houses, schools, offices, cities, roads) and/or that are too hot, cold, rocky, or wet for food to grow. Set those three parts aside. The remaining part represents the 1/32 of the Earth that we can use to grow food.
8. Tell students to answer Question 4.
9. Take the remaining 1/32 piece and peel off the skin. This sliver of skin represents all of the land that we depend on to grow all of our food. Compare this to all of the other parts that were set aside.
10. Tell students to answer Questions 5 and 6. Discuss why it is so important that we protect and make the best use of the soil we have.

WS: F–1B

Name _____

SOIL RECIPE

▶ Materials (for entire class)

- ✓ Large, clear glass mixing bowl
- ✓ Large spoons for stirring
- ✓ Five small paper bags
- ✓ Three small re-sealable plastic bags
- ✓ Three small containers
- ✓ Water
- ✓ Gummy worms
- ✓ Colored paper dots (green and yellow)
- ✓ Flashlight
- ✓ Watch or small clock
- ✓ Permanent marker

SOIL

INGREDIENTS

Rocks	Air
Twigs	Water
Leaves	Bacteria
Grass clippings	Nutrients
Soil	Sunshine
Worms	Time

▶ Procedure

1. Before preparing your soil, you should gather some of the ingredients you will need.
2. Go outside and gather the first five ingredients for the soil recipe. Collect the rocks, twigs, leaves, grass clippings, and soil in separate small paper bags. Label each bag with its contents.
3. For the worms, place some gummy worms in a small re-sealable plastic bag.
4. Blow some air into a small re-sealable plastic bag and seal it quickly.
5. In a small container, gather some green paper dots to represent bacteria.
6. In another container, place some yellow paper dots to represent nutrients.
7. Fill the last small container with water.
8. You can now begin mixing your soil!
9. In the large mixing bowl, add the rocks, twigs, leaves, grass clippings, and soil.
10. For good aeration and to help break down organic matter, dump in some worms.
11. Throw in the bag of air.
12. Pour the water into the mix.
13. Sprinkle the bacteria in.
14. Add the nutrients.
15. Stir your soil and mix it well.
16. Your soil needs sunlight. Shine the flashlight on the bowl to represent the sun.
17. The soil is still not complete because it takes time for the soil to form. Place the watch or small clock in a re-sealable plastic bag and seal it tightly. Add it to the soil mixture.
18. Your recipe for soil is now complete!

Name _____

EDIBLE SOIL

▶ Materials (for a class of 30)

- ✓ One package chocolate chips
- ✓ Two tubs (22 ounces each) ready-to-eat chocolate pudding
- ✓ Two packages (16 ounces each) chocolate sandwich cookies, crushed
- ✓ 30 gummy worms
- ✓ ½ cup sprinkles (multicolored)
- ✓ ½ cup coconut
- ✓ Green food coloring
- ✓ Six 3" × 5" index cards
- ✓ Permanent marker
- ✓ Six clear containers
- ✓ One re-sealable plastic bag
- ✓ Paper towels
- ✓ 36 plastic spoons
- ✓ 30 clear plastic portion cups
- ✓ 30 napkins

▶ Procedure

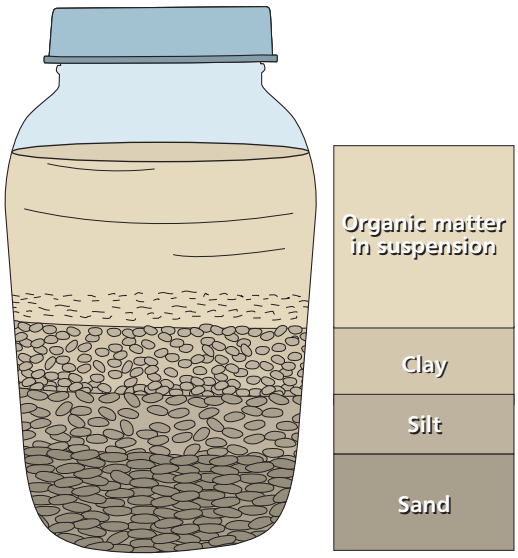
1. Create a 3" × 5" index card for each of the following: PARENT MATERIAL, SUBSOIL, TOPSOIL, ORGANISMS, EARTHWORMS, and GRASS.
2. Pour the chocolate chips into a clear container and place the container next to the "PARENT MATERIAL" card.
3. Pour the pudding into a clear container and place it next to the "SUBSOIL" card.
4. Place the crushed cookies into a clear container and set the container next to the "TOPSOIL" card.
5. Place the sprinkles in a clear container and set the container next to the "ORGANISMS" card.
6. Place the coconut in a re-sealable plastic bag. Add a couple drops of green food coloring. Shake the bag vigorously until the coconut is green. Dump the coconut onto paper towels to dry (about ½ hour). Put the coconut into a clear container and set it next to the "GRASS" card.
7. Place the gummy worms in a clear container and set the container next to the "EARTHWORMS" card.
8. Place a plastic spoon in each of the containers.
9. Line up to build your own soil! Start with a small layer of parent material (chocolate chips).
10. Next add some subsoil (chocolate pudding) with an earthworm (gummy worm).
11. Then add a small layer of topsoil (crushed cookies). Your earthworm could be poking up through the topsoil.
12. Add some more organisms (sprinkles) to the topsoil layer.
13. Top it off with some grass (coconut).
14. You now have your own edible soil! Enjoy!

Name _____

SOIL SEDIMENTATION SHAKE

Materials

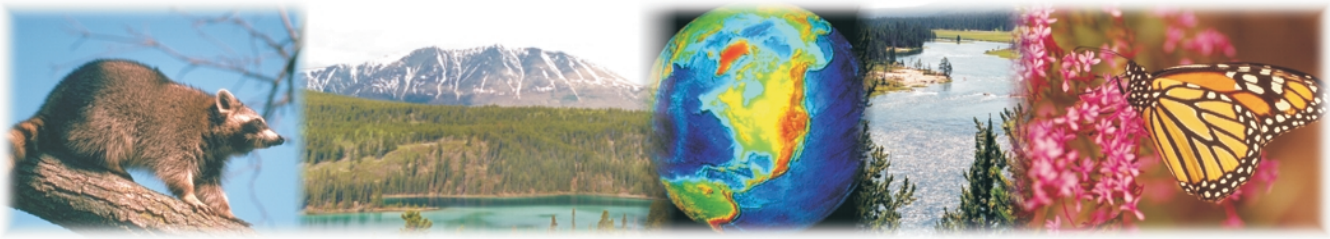
- ✓ Two soil samples (one from a garden, flower bed, or field and one from a yard, roadside, or housing development)
- ✓ Two quart jars with tightly fitting lids
- ✓ Dishwashing liquid
- ✓ Water
- ✓ Ruler
- ✓ Masking tape
- ✓ Permanent marker
- ✓ Colored markers, pencils, or crayons



Procedures

Day 1—

1. Collect two soil samples. One should come from a garden, flower bed, or field. The other one should come from a yard, roadside, or housing development. Remove any trash or rocks from the samples.
2. Using the masking tape and marker, create a label for each jar that lists where the soil sample came from and the date.
3. Place about ½ cup of each soil sample in the corresponding jar.
4. Add 3½ cups of water to each jar.
5. Add 1 teaspoon of dishwashing liquid to each jar.
6. Tighten the lids securely so that the jars do not leak.
7. Shake the jars vigorously until the particles separate from each other (about three to five minutes).
8. Place the jars in a safe location and allow the samples to settle.
9. After about 10 minutes, observe the jars and record your findings in the Data Table.



DATA TABLE			
	Day 1	Day 2	Day 3
Sample 1			
Sample 2			

Day 2—

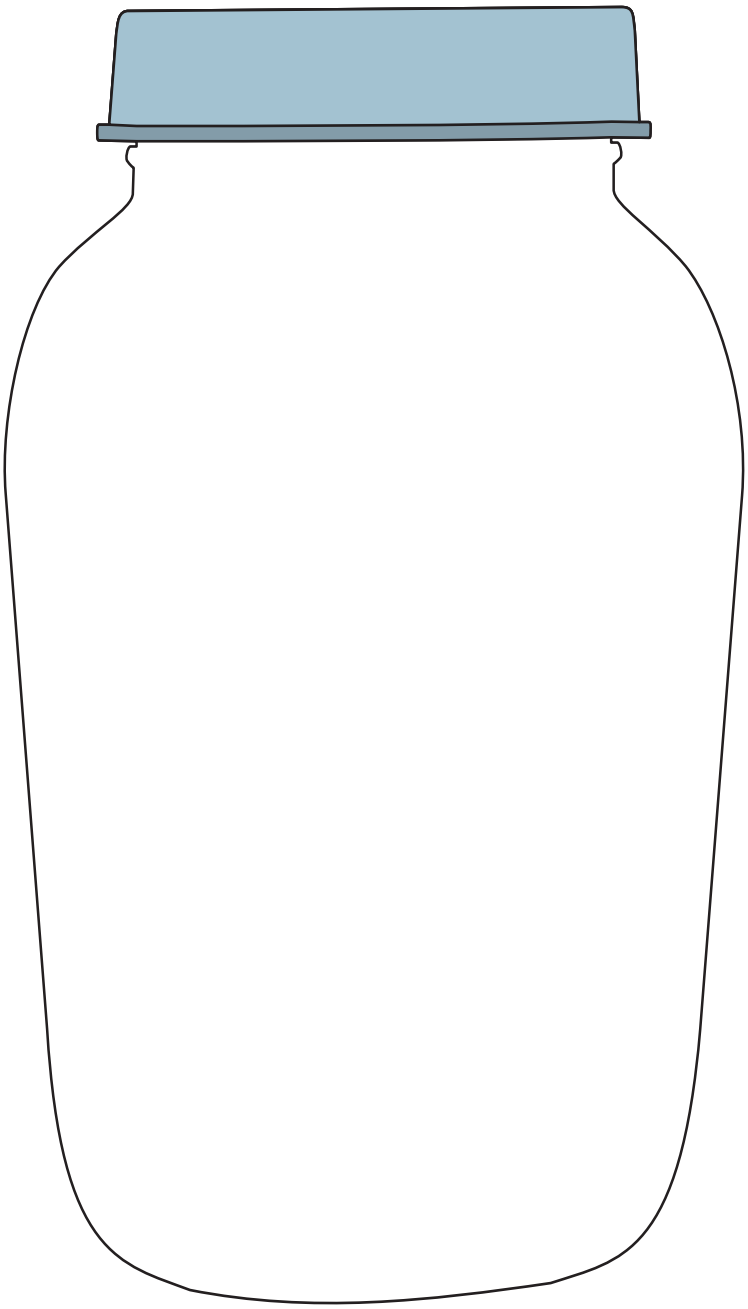
1. Observe your jars and record your findings.

Day 3—

1. Observe your jars and record your findings. By now, even the smallest particles should be completely settled. You should be able to see the different layers of sand, silt, and clay. Any material left floating in the water is considered organic matter.
2. Use the jar outlines provided to draw the layers that you see. You can use a ruler to measure the depths of the different layers. Use different colored pencils, markers, or crayons for each layer. Label the layers.

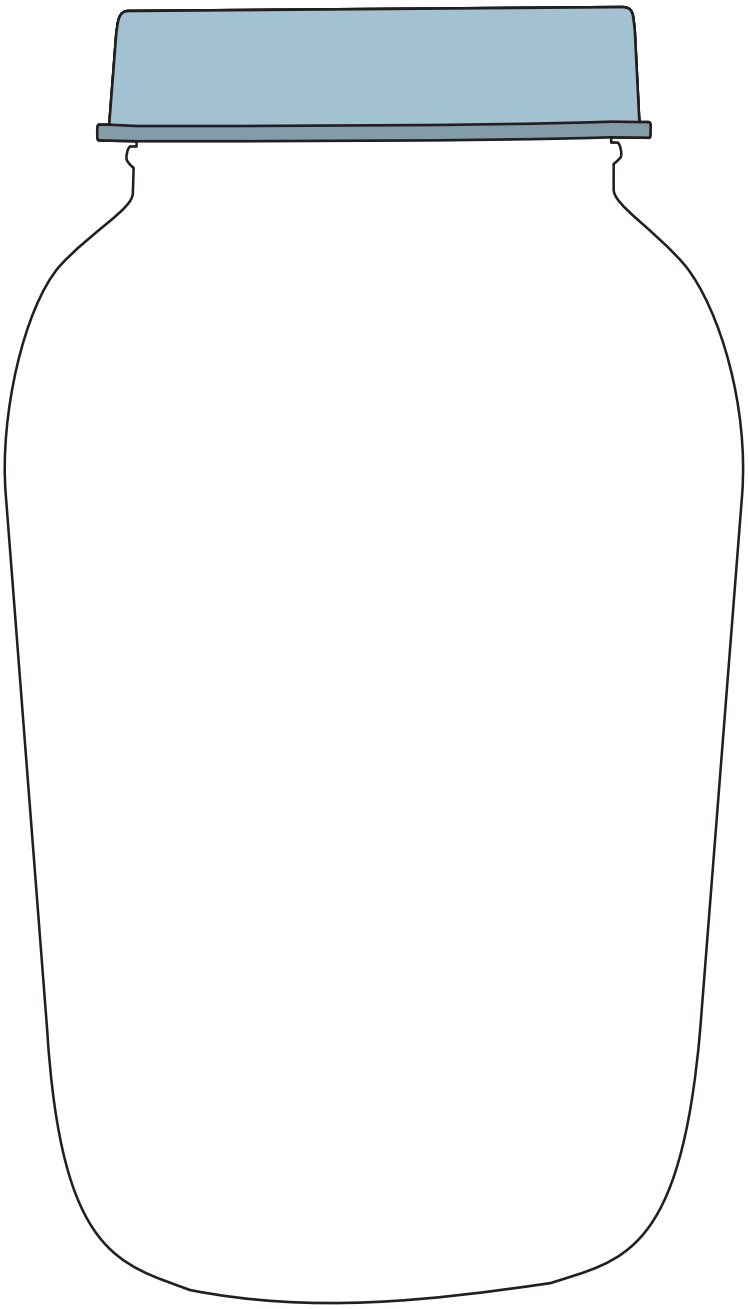
Name _____

SAMPLE 1



Name _____

SAMPLE 2



Name _____

SOIL TEXTURE

Materials

- ✓ Sand, silt, and clay sample
- ✓ Three small, plastic plates
- ✓ Water
- ✓ Eye dropper
- ✓ Magnifying lens
- ✓ Permanent marker
- ✓ Writing utensil

Procedure

1. Label the three plates as “sand,” “silt,” and “clay.”
2. Place each sample on its correct plate.
3. Look at the samples and record their appearance in the Data Table.
4. View the samples with a magnifying lens so you can see the particles. Record the size of the particles in the data table.
5. Place a pinch of the sand sample in the palm of your hand and rub it with your index finger. Record the texture of the sample in the Data Table. Repeat this step for the silt and clay samples. Rinse and dry your hand after each sample.
6. Place a pinch of the sand sample in the palm of your hand. Add two drops of water to the sample. Look at the wet sample and rub it with your index finger. Record your observations in the Data Table. Repeat this step for the silt and clay samples. Rinse and dry your hand after each sample.

DATA TABLE

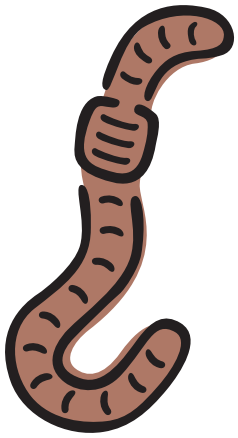
	Description (Dry)	Particle Size (Small, Medium, or Large)	Texture When Dry (Gritty, Smooth, or Very Smooth)	Description (Wet)
Sand				
Silt				
Clay				

Name _____

EARTHWORMS: WHAT DO THEY DO?

▶ Materials

- ✓ Two quart jars
- ✓ Lids for the jars (with several small holes punched in them)
- ✓ Dark soil
- ✓ Light sandy soil
- ✓ Water
- ✓ Two earthworms
- ✓ Carrot scraps
- ✓ Two pieces of dark paper
- ✓ Masking tape
- ✓ Permanent marker



▶ Procedures:

1. Put a 2-inch layer of dark soil in the bottom of each jar.
2. On top of the dark soil layer, place a 1-inch layer of light sandy soil.
3. Keep adding dark then light layers until the jar is half full.
4. Slightly moisten the soil in both jars.
5. Using the masking tape and marker, label one jar "EARTHWORMS," and label the other jar "NO EARTHWORMS."

6. Place two earthworms in the EARTHWORMS jar.
7. Add carrot scraps to both jars.
8. Put the lids on the jars.
9. Wrap each jar with dark paper and secure the paper with tape.
10. Put the jars in a safe location and leave them undisturbed for three days.
11. Write what you think will happen in each jar in the Data Table.
12. After three days, carefully unwrap the jars and record your observations in the Data Table. Were your predictions correct?

DATA TABLE		
	Predictions	**Observations After Three Days**
EARTHWORMS jar		
NO EARTHWORMS jar		

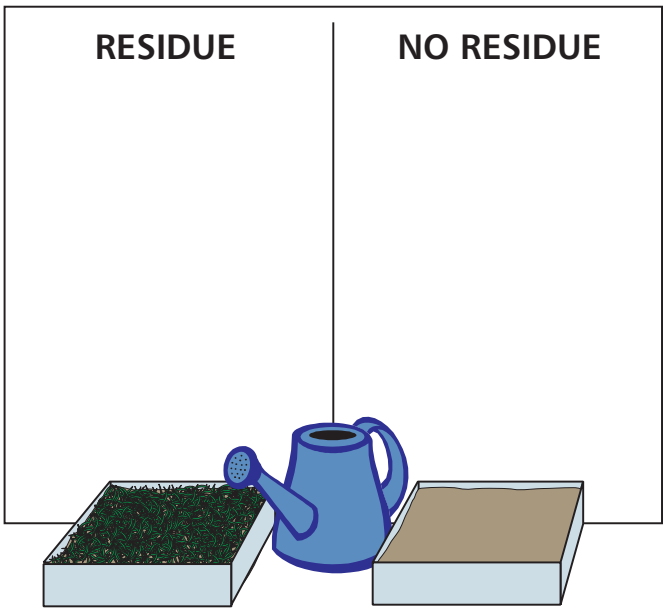
WS: F–1G

Name _____

RAINDROPS: HOW DO THEY AFFECT THE SOIL?

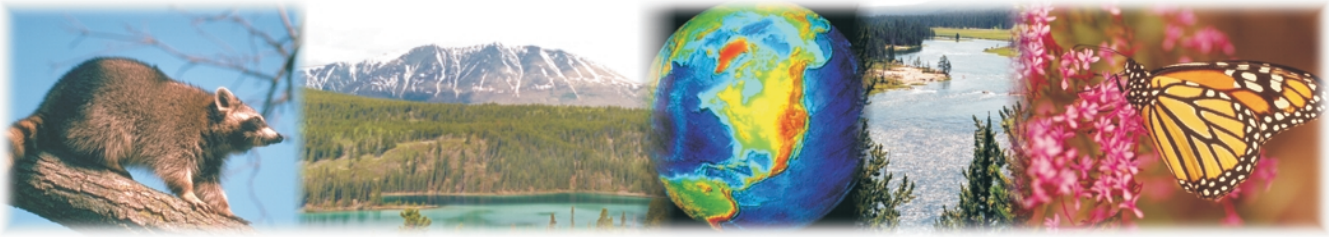
▶ Materials

- ✓ One piece of 22" × 28" posterboard
- ✓ Two disposable square cake pans (8" × 8" × 1¾")
- ✓ Soil
- ✓ Sprinkling container
- ✓ Water
- ✓ Residue (straw, dry grass clippings, wood chips, or leaves)
- ✓ Permanent marker
- ✓ Newspaper or plastic to cover table



▶ Procedure

1. Near the top of the long edge of the posterboard, label one half "RESIDUE" and the other half "NO RESIDUE."
2. Cover your table with newspaper or plastic.
3. Stand the posterboard up on the table. Use the wall to support the posterboard.
4. Fill the two cake pans with soil.
5. Place one cake pan directly in front of each half of the posterboard.
6. Cover the pan in front of the "RESIDUE" half of the posterboard with a large amount of residue (straw, dry grass clippings, wood chips, or leaves).
7. Sprinkle the same amount of water on each of the pans to simulate rain.
8. Remove the posterboard and observe how much soil splashed on each half. Which half of the posterboard had more soil splashed on it. What does this tell you about the importance of covering the soil to protect it from erosion?



Name _____

SOIL EROSION FROM THE WIND: BLOWN AWAY

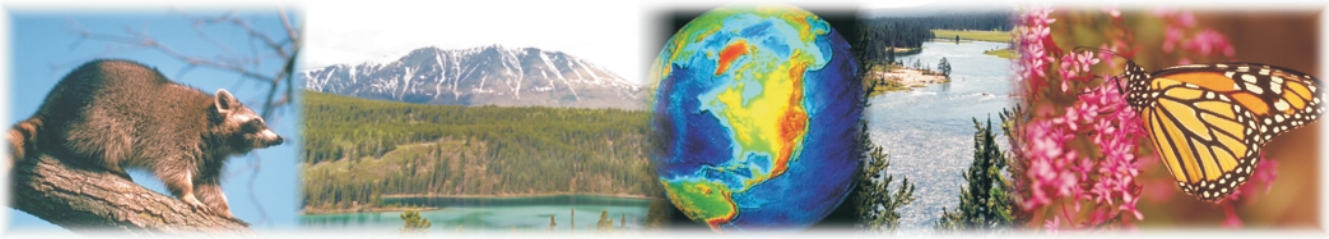
Materials

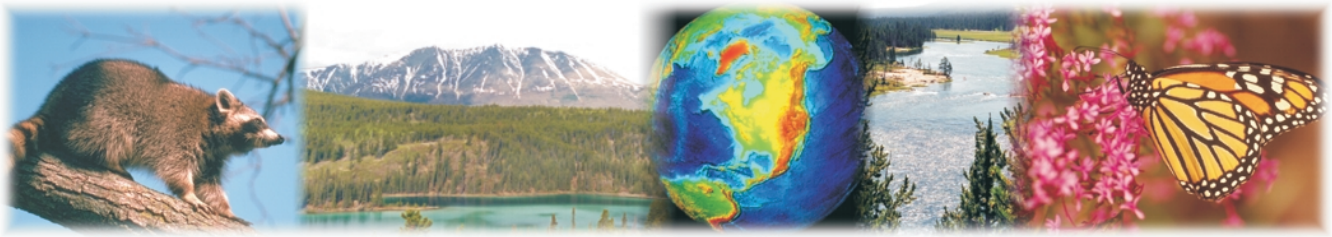
- ✓ Paper confetti
- ✓ Shallow cake pan
- ✓ Green flat marbles (medium to large size, enough to cover the pan)
- ✓ Blow dryer with two speed settings (set on no heat)

Procedure

1. Place several layers of paper confetti in the shallow cake pan. The confetti represents the soil.
2. Set the blow dryer on the low setting (no heat). Holding the blow dryer several inches from the pan, turn it on for about 10 seconds. This represents the wind. What happens to the "soil"? Record your observations in the Data Table.
3. Replace the soil in the cake pan.
4. Set the blow dryer to the high setting (no heat). Holding the blow dryer the same distance from the pan, turn it on for about 10 seconds. What happens to the soil with this stronger wind? Record your observations in the Data Table.
5. Replace the soil in the cake pan and cover it with a protective layer (flat green marbles).
6. Repeat the wind experiments (low and high settings). What happens to the soil now? Record your observations in the Data Table.
7. What does this experiment tell you about the effect of wind on our soil? Why would it be a good idea to use healthy vegetation, straw, crop residue, rocks, or other cover material on the soil?

DATA TABLE		
	Low Wind	High Wind
Bare soil		
Covered soil		





Lesson F–2

WATER RESOURCES

Indiana Agricultural Literacy Lesson Plan Library

Unit F. Environmental Science

Lesson 2. Water Resources

Indiana's Academic Standard. **Science:** 4.3.5 — Describe how waves, wind, water, and glacial ice shape and reshape the Earth's land surface by the erosion of rock and soil in some areas and depositing them in other areas.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe where water is located on Earth and identify which sources are available for us to use.
2. Describe the movement of water in the hydrologic cycle.
3. Identify the three states of water—solid, liquid, gas.
4. Explain what impacts a watershed.
5. Identify some uses of water.
6. Describe some methods of conserving water.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Clean Water Team Booklet. Park Ridge, Illinois: American Farm Bureau Foundation for Agriculture, 2000. (Order online at www.ageducate.org)

DeYonge, Sandra Chishom. *Spring Waters Gathering Places.* Bozeman, Montana: The Watercourse, 2000.

Give Water a Hand: Action Guide & Leader Guidebook. (Download for free from www.uwex.edu/erc/gwah/.)

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Locker, Thomas. *Water Dance.* San Diego, California: Hartcourt Brace & Company, 1997.

The Water Cycle: Nature's Recycling System (poster). USDA NRCS, 1999. May be ordered free of charge by calling 1-888-LANDCARE. (It contains information on the back side and reproducible black line masters.)

Your Hometown Clean Water Tour Booklet. USDA NRCS, 1999. May be ordered free of charge by calling 1-888-LANDCARE.

Web Sites of Interest:

Environmental Protection Agency: Drinking Water for Kids. www.epa.gov/ogwdw/kids/index.html (Classroom activities, online games, and information for students and teachers.)

Environmental Protection Agency: Surf Your Watershed. www.epa.gov/surf/ (You can find a map of watersheds for each state here.)

Getwise.org. http://getwise.org/shared/ind_teach.html (Interactive water cycle with descriptions, questions, answers, and illustrations.)

The Groundwater Foundation. www.groundwater.org/KidsCorner/kidscorner.htm (Great groundwater site for kids.)

U.S. Geological Service: Water Resources. http://water.usgs.gov/education.html (Lots of water resources information for students and teachers.)

U.S. Geological Service: Water Science for Schools. http://ga.water.usgs.gov/edu/ (Excellent site for water science information for students and teachers.)

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Inflatable globe

Terms. The following terms are presented in this lesson (shown in bold italics):

- Condensation
- Evaporation
- H_2O
- Hydrologic cycle
- Infiltration
- Nonpoint source pollution
- Point source pollution
- Precipitation
- Runoff
- Transpiration
- Water conservation
- Watershed

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *To begin the lesson, play a game of "Planet Toss." Show the students an inflatable globe and point out that the blue represents water and the rest is land. Carefully toss the globe to a student. After catching the globe, ask the student where his or her right thumb landed—on water or on land. Record the result on the writing surface. Each student should toss the globe to another student until all students have had a chance to catch it and report where their right thumb landed. Tally up the responses. A higher percentage will usually end up on the water. Explain to students that these results correspond to the fact that ¾ of the earth is water and ¼ is land.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1:

Describe where water is located on Earth and identify which sources are available for us to use.

Anticipated Problem: Where is water located on Earth? Which sources of water can we use?

I. Water is one of the most important natural resources. All living things depend on water for survival. Without water we would not be able to live.

A. Our body is about 65 percent water.

B. An ear of corn is about 70 percent water.

C. A potato is about 80 percent water.

D. A tomato is about 95 percent water.

E. Water covers more than 70 percent of the earth's surface.

F. Water is in the oceans, glaciers, rivers, lakes, ground, and even in the air we breathe.

G. Only some of the water on earth is available for us to use.

1. Oceans—the water found in oceans is saltwater, which we cannot use.
2. Glaciers and polar icecaps—this type of water is frozen and cannot be used.
3. Groundwater—groundwater is water found under the ground. Many people use groundwater for their source of usable water.
4. Lakes—some lakes have freshwater and some have saltwater. We can use the freshwater lakes, but not the saltwater lakes.
5. Rivers and streams—the water in rivers and streams is available for us to use.
6. Soil moisture—the soil absorbs and holds water for use by plants. Plants use the water and then release it back into the atmosphere. We cannot use this water.
7. Atmosphere—the water in the atmosphere is in gas form and cannot be used by us.

Use TM: F–2A to show students a graph and chart that illustrate the distribution of the earth's water supply. Use WS: F–2A to demonstrate where the earth's water supply is and which of those sources are available for us to use.

Objective 2: Describe the movement of water in the hydrologic cycle.

Anticipated Problem: How does water move in and around the earth?

II. The continuous path water takes as it moves throughout the earth is called the ***hydrologic cycle***. The water that is on the earth now is the same water that has always been here. No "new" water is being made. Water is recycled throughout the earth's environment by the hydrologic cycle.

A. Water moves from the earth's surface into the atmosphere by evaporation. ***Evaporation*** is the conversion of water from liquid to gas by exposure to air or heat. Water is taken into the atmosphere as an invisible vapor.

B. Transpiration of water from plants also contributes water vapor to the atmosphere. ***Transpiration*** is the release of water from the leaves of plants. For example, a mature birch tree will give off 70 gallons of water a day. An acre of corn (about the size of a football field) will give off about 4,000 gallons of water per day.

C. As the water vapor rises into the air, it begins to cool and condensation occurs. ***Condensation*** is the process by which water vapor turns back into liquid form. The moisture on the outside of a glass of cold water is condensation.

D. As vapor condenses, clouds form. The vapor particles join and form tiny droplets in the clouds. When the droplets get too large, they fall to the earth. Water falling as rain or snow is called ***precipitation***.

E. Some precipitation falls directly into the oceans, rivers, streams, and lakes. Precipitation that lands on the ground may run into the oceans, rivers, streams, and lakes. ***Runoff*** occurs when water flows over land and into surface water sources.

F. Some precipitation soaks into the ground through a process called ***infiltration***. This water may become part of our groundwater supply. Plants also use some of the water that soaks into the ground.

G. The hydrologic cycle repeats again with evaporation from surface water and transpiration from plants.

Use TM: F–2B to illustrate the hydrologic cycle to students. Use WS: F–2B to familiarize students with the concepts of this objective. Use WS: F–2C to have students create a simple example of the water cycle. Use WS: F–2D to have students create and observe the water cycle inside their own terrarium. Consider using a medium or large aquarium and doing this as a class activity. Allow all students to participate in setting up the terrarium. Many plants grow well in terrariums. It is best to choose types that fit the size of the container. Slower growing plants require less trimming and are less likely to take over the entire terrarium. Aggressive plants require more frequent trimming, but they give more variety to your terrarium. Suggested plants include: ardisia, podocarpus (Buddhist Pine), coffee plant, small ferns, wandering jew (aggressive grower), moss, boxus (boxwood), baby tears (very aggressive grower), pilea (aluminum plant), or creeping fig (aggressive grower). Plastic trees, animals, or other features can add interest to the terrarium.

Objective 3: Identify the three states of water—solid, liquid, gas.

Anticipated Problem: What are the three states or forms of water?

III. Water is made up of molecules. Each water molecule contains two hydrogen atoms and one oxygen atom, which is represented by the formula H_2O. Heat energy contributes to the motion of the molecules. Molecules move rapidly when warm and more slowly when cold. This motion determines the state of the water. Water is found throughout our planet in one of three states: solid, liquid, or gas. Water is the only substance on Earth that is able to exist naturally in all of these forms. In the water cycle, water changes from one form to another.

A. Water in the solid state exists as ice or crystal formations. Ice includes ice cubes, hail, and frozen surface water (glaciers and polar icecaps). Snowflakes are an example of water in a crystal formation. In order to form ice or crystal formations, water requires freezing temperatures of 32°F (0°C) or lower. In the solid state, the movement of molecules is very slow because it contains the least amount of heat energy.

B. Rivers, lakes, streams, ponds, and groundwater contain water in its liquid form. To be in the liquid state, water must be above freezing temperature but below the boiling point, which is 212°F (100°C). In the liquid state, the molecules move slower than in a gas state but faster than in a solid state. As a liquid, the molecules require more space than as a solid but less space than a gas. We drink water in the liquid state. Rain is also water in the liquid state.

C. Water in the gas state is made up of tiny particles of matter suspended in the air that are often invisible to the eye. By applying sufficient heat, we change water from a liquid to a gas state. This occurs when water is boiled. As some of the water vapor cools, we see it as a small cloud called steam. In the water cycle, this process is known as evaporation. Clouds and fog are composed of tiny little water droplets. In the gas state, the water molecules have a large amount of heat energy causing them to move rapidly. This rapid movement results in greater distance between the molecules. You may have seen water vapor when it is cold enough to see your breath.

Use TM: F–2C, TM: F–2D, and TM: F–2E to illustrate the various states of water. Use WS: F–2E to help students better understand the three states of water.

Objective 4: Explain what impacts a watershed.

Anticipated Problem: What impacts a watershed?

IV. A ***watershed*** is a geographic area of land from which surface runoff drains into a common body of water, such as a stream, channel, lake, reservoir, or other body of water. A watershed is sometimes referred to as a drainage basin. It is like a funnel. Watersheds are separated from each other by land forms, such as ridges or mountains. A watershed includes all the plants, animals, and people who live in it, as well as the nonliving components like rocks and soil.

A. We all live in a watershed.

B. The quality of water can change as it flows over the land or under the ground. These changes in water quality may be due to natural factors or human activities.

C. As rock minerals come in contact with water, some dissolve and become part of the water system. Soil, organic matter, and other natural materials become suspended in the water and move from one place to another.

D. Human activities can impact the quality of water by disturbing the land, which may increase what becomes suspended or dissolved in the water. Human activities can also lead to the addition of pollutants in the water. Water pollution may originate from a point source or nonpoint source.

1. ***Point source pollution*** is pollution that can be traced back to a specific location or point. Examples of point sources may include factories, storm drains, and wastewater treatment facilities.
2. ***Nonpoint source pollution*** is pollution in which the area where the contaminants entered the system is difficult to locate and may happen over a wide area of land. Examples of nonpoint sources may include residential areas, golf courses, parking lots, roads, construction sites, landfills, septic tanks, and agricultural fields.

Use TM: F–2F to cover the content of the objective. Visit the Environmental Protection Agency: Surf Your Watershed website at www.epa.gov/surf/ to find a map of the watersheds for your area. Use WS: F–2F to have students create their own watershed maps.

Objective 5: Identify some uses of water.

Anticipated Problem: What is water used for?

V. Water is used a lot and it is used for almost everything! Water is essential to all living things. Humans need water in order to survive. A person can live about a month without food, but only about a week without water. Your body contains about 60 percent water. Your brain is about 75 percent water. Your blood is 82 percent water. All the cells in your body contain water. Water is so much a part of us and our daily routines that we often take it for granted.

A. The United States uses about 341 billion gallons of fresh water each day.

1. One of the largest uses of water in the United States is for generating electricity. This accounts for 39 percent of the water used in the U.S. Power plants mainly use water to cool condensers in fossil fuel plants (coal, oil, etc.) and to cool the reactors in nuclear plants. Most power plants are located near bodies of water to supply the large amount of water needed. The vast majority of the water used by power plants is returned to the environment, making it available for other uses.
2. Irrigation, which is used to provide water to crops, golf courses, and other areas, accounts for 39 percent of the water used in the United States. This means that water used for generating electricity and water used for irrigation account for 78 percent of the water used in the United States! When it comes to water used for crop irrigation, California uses the most, followed by Nebraska and Texas. Agricultural irrigation is more common in the arid (dry) areas of the western United States than in the east. The western United States accounts for about 70 percent of irrigation water use.
3. Public supply represents water delivered to our homes and businesses by water departments. This accounts for 12 percent of the water used in the United States. The average cost for water supplied to a home is $2 for 1,000 gallons, which equals about 5 gallons for a penny.
4. Industry represents about 6 percent of the total water used in the United States. Industries produce wood, paper, gasoline, metal, and plastics. Many of the products we use today probably involve the use of water at some point in their production and manufacturing processes.
5. Livestock accounts for 1 percent of the total water used in the United States. All animals need water to live.
6. Domestic use represents the water used at home. This accounts for 1 percent of the total water used in the United States. Of the water we use at home, 55 percent comes from surface water sources (lakes, reservoirs, rivers) and 44 percent comes from groundwater. In many instances, especially in urban settings, water is piped to homes from public suppliers. At other homes, especially in rural settings, people provide water for themselves from wells, ponds, or streams.
7. Mining accounts for 1 percent of the total water used in the United States.
8. Commercial use accounts for 1 percent of the total water used in the United States. Commercial users include restaurants, hotels, stores, and other businesses.

B. It is estimated that the average person uses 80 to 100 gallons of water per day. We use water for drinking, cooking, cleaning, bathing, watering plants and lawns, washing automobiles, making ice, watering animals, and much more. Most of the water we use is used to flush the toilet. We use about 5 gallons of water to flush the toilet. Brushing your teeth uses about 2 gallons of water. To run the dishwasher, we need about 20 gallons of water. About 40 gallons of water are needed to do a load of laundry. It takes about 5 gallons per minute while the water is running to take a shower or bath. Recreational activities, such as swimming, also require the use of water.

C. We use water for direct and indirect purposes.

1. Direct uses of water include drinking, bathing, and cooking.
2. Indirect uses of water include the large quantities of water needed to process wood to make paper, grow grains to make bread, and produce steel to make automobiles. Producing and manufacturing many of the products we use and consume requires the use of water. For example:
   a. A 12-ounce can of soda requires 16.5 gallons of water to make.
   b. To make 40 sheets of paper requires 100 gallons of water.
   c. The steel in a 30-pound bicycle requires 480 gallons of water.
   d. A 2-pound loaf of bread requires 1,000 gallons of water.
   e. A pair of jeans made from cotton requires 1,800 gallons of water.
   f. A pound of hamburger requires 4,000 gallons of water.
   g. The ton of finished steel to make a car requires 32,000 gallons of water.

Use TM: F–2G to illustrate water usage in the United States in 1995. Each slice in the pie chart shows a category of water use and the total amount of water used in billion of gallons per day. Use TM: F–2H to point out to students some of our personal uses of water. Use TM: F–2I to discuss direct and indirect uses of water with students. Use WS: F–2G to help students identify the ways they use water.

Objective 6: Describe some methods of conserving water.

Anticipated Problem: How can we conserve water?

VI. While we use a lot of water for many different things, we need to remember that water is a limited natural resource. No "new" water is made. The water we have is recycled by means of the water cycle. We have access to only a small amount of fresh water. Many areas have enough water to supply their needs. However, water shortages may occur due to factors such as drought, flood, pollution, population growth, industrial needs, and others. When this happens, or better yet before it happens, conservation of water is needed.

A. ***Water conservation*** is using water-saving methods to reduce the amount of water needed and increase the water supply for optimum long-term economic and social benefits. Conservation of water can ensure that supplies of fresh water will be available for everyone, today and tomorrow. Every drop counts. Every individual can make a difference.

B. Conserving water makes sense, but it often involves changing habits which have evolved over time. Habits can be very hard to break.
   1. Begin by simply turning off water whenever it is not being used. For instance, turning off the water while brushing your teeth is a good start.
   2. Shorten the length of your shower or fill the bathtub with less water.
   3. Install low-flow showerheads to reduce the amount of water used while taking a shower.
   4. A capped bottle filled with rocks (or something to weigh it down) will take up space in the toilet tank and reduce the amount of water available to flush.
   5. The volume of water needed to water plants or the lawn can be reduced by watering in the early morning or late evening and by watering less often and more carefully.
   6. Fix leaky faucets.
   7. Keep a bottle of cold drinking water in the refrigerator instead of running water until it becomes cool.
   8. When washing dishes by hand, use a sink full of rinse water rather than letting the water run.
   9. Run the washing machine or dishwasher only with a full load.
   10. Use a hose with an on/off nozzle or use buckets when washing automobiles.

Use TM: F–2J to discuss some habits students can change to help conserve water. Use WS: F–2H to help students inform others about the importantance of water conservation and encourage them to conserve water. This activity could be done individually, in small groups, or as an entire class.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: F–2A, WS: F–2B, WS: F–2C, WS: F–2D, WS: F–2E, WS: F–2F, WS: F–2G, and WS: F–2H.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. c
2. d

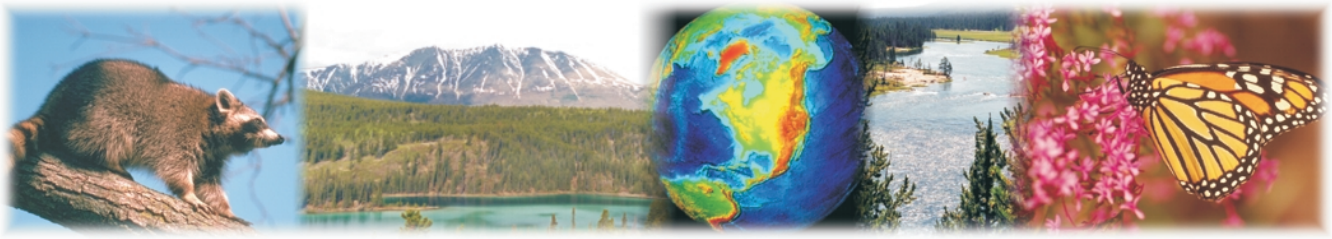
3. g
4. f
5. a
6. b
7. e
8. h

Fill-in-the-Blank

1. hydrologic cycle
2. H_2O
3. Point source pollution
4. Nonpoint source pollution

Short Answer

1. Solid, liquid, and gas.
2. Answers will vary. Students should list five ways that they can help conserve water.



Test F–2

Name_____

WATER RESOURCES

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. watershed	d. water conservation	g. precipitation
b. evaporation	e. runoff	h. transpiration
c. infiltration	f. condensation	

_____1. The process of water soaking into the ground.

_____2. Using water-saving methods to reduce the amount of water needed and increase the water supply for optimum long-term economic and social benefits.

_____3. Water falling as rain or snow from the atmosphere to the earth.

_____4. The process by which water vapor cools and turns back into liquid form.

_____5. A geographic area of land from which surface runoff drains into a common body of water, such as a stream, channel, lake, reservoir, or other body of water.

_____6. The conversion of water from liquid to gas by exposure to air or heat.

_____7. Occurs when water flows over land and into surface water sources.

_____8. The release of water from the leaves of plants.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. The continuous path water takes as it moves throughout the earth is called the _____ _____.
2. _____ is the formula for the water molecule.
3. _____ _____ _____ is pollution that can be traced back to a specific location.
4. _____ _____ _____ is pollution in which the area where the contaminants entered the system is difficult to locate and may happen over a wide area of land.

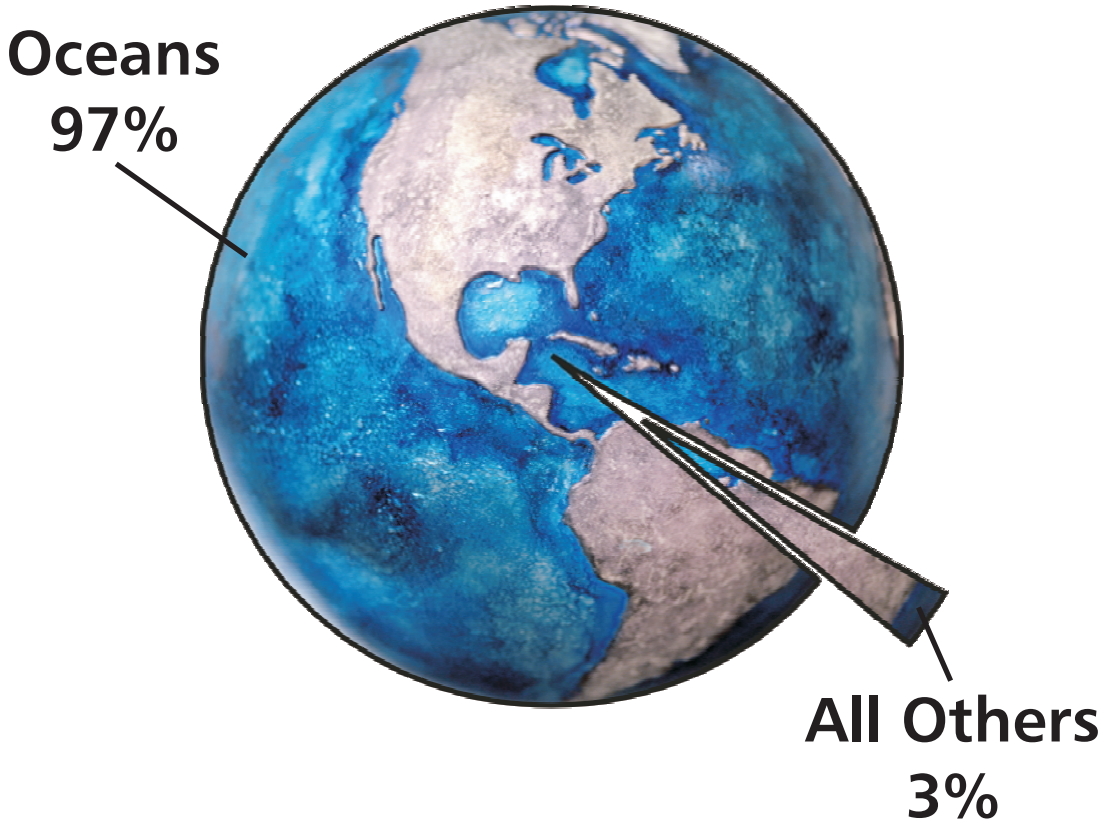
Short Answer

***Instructions*. Answer the following questions.**

1. What are the three states of water?

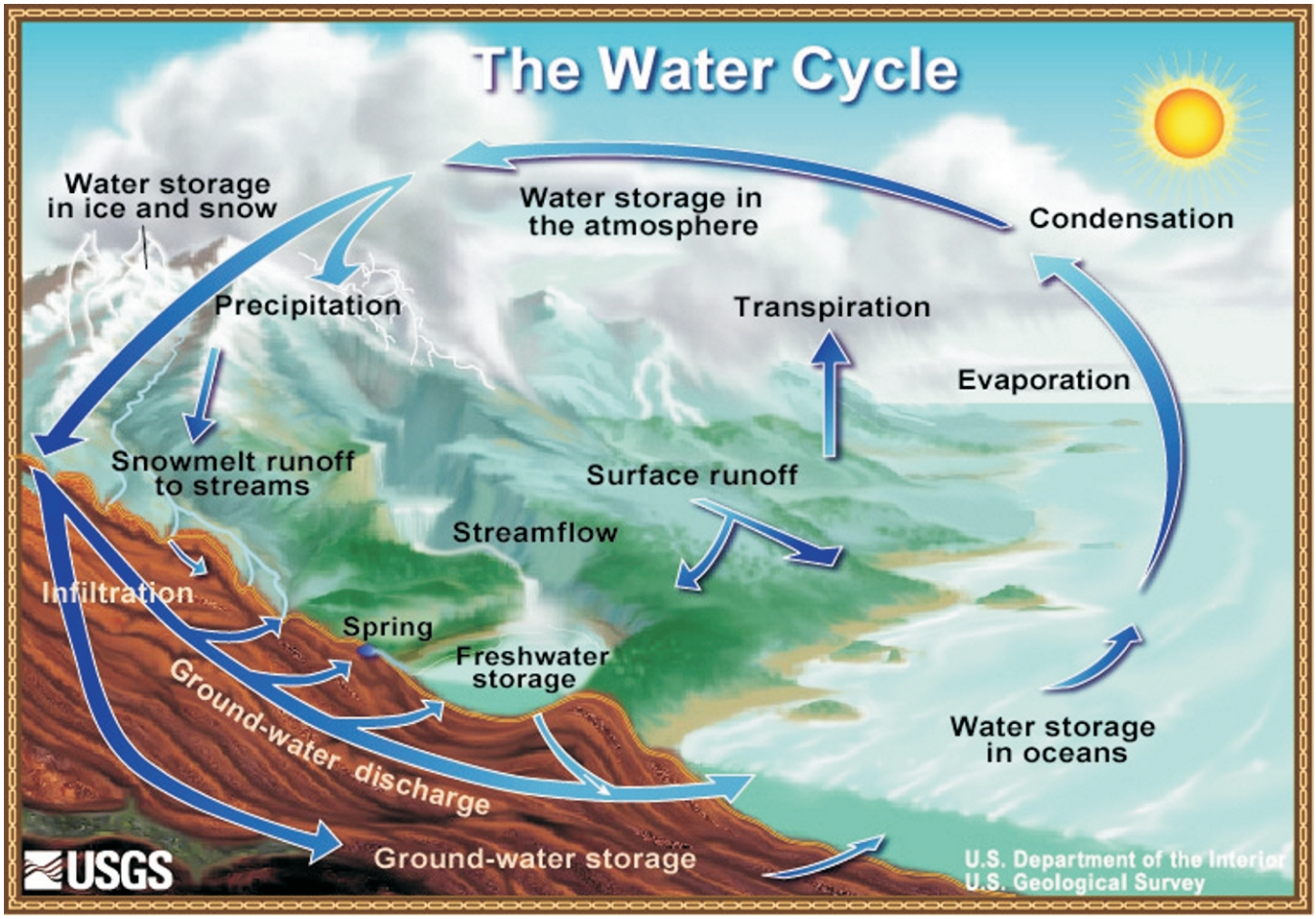
2. What are five ways that you can conserve water?

EARTH'S WATER SUPPLY



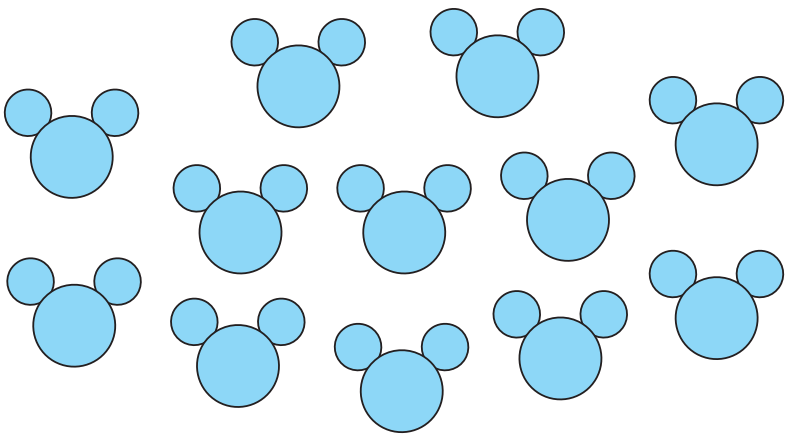
Oceans	**97.2170%**
All others—	
Icecaps, glaciers	2.1467%
Groundwater	0.6134%
Freshwater lakes	0.0092%
Saltwater lakes	0.0077%
Soil moisture	0.0049%
Atmosphere	0.0010%
Rivers	0.0001%
	100%

ILLUSTRATION OF THE HYDROLOGIC CYCLE

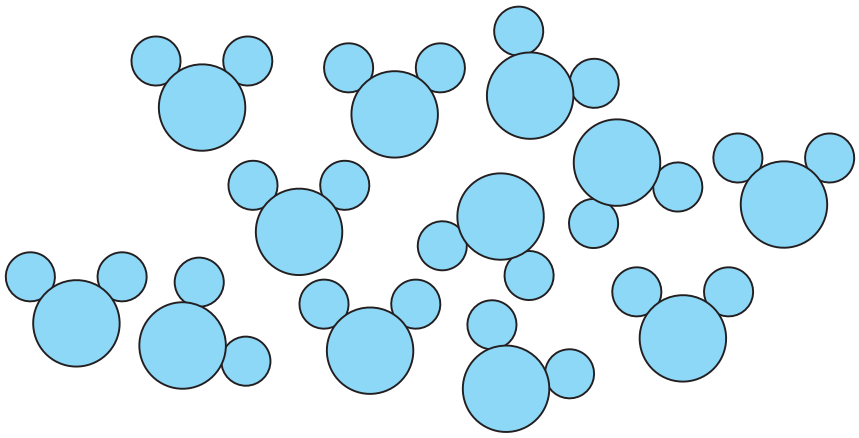


(Illustration by John Evans, USGS, Colorado District)

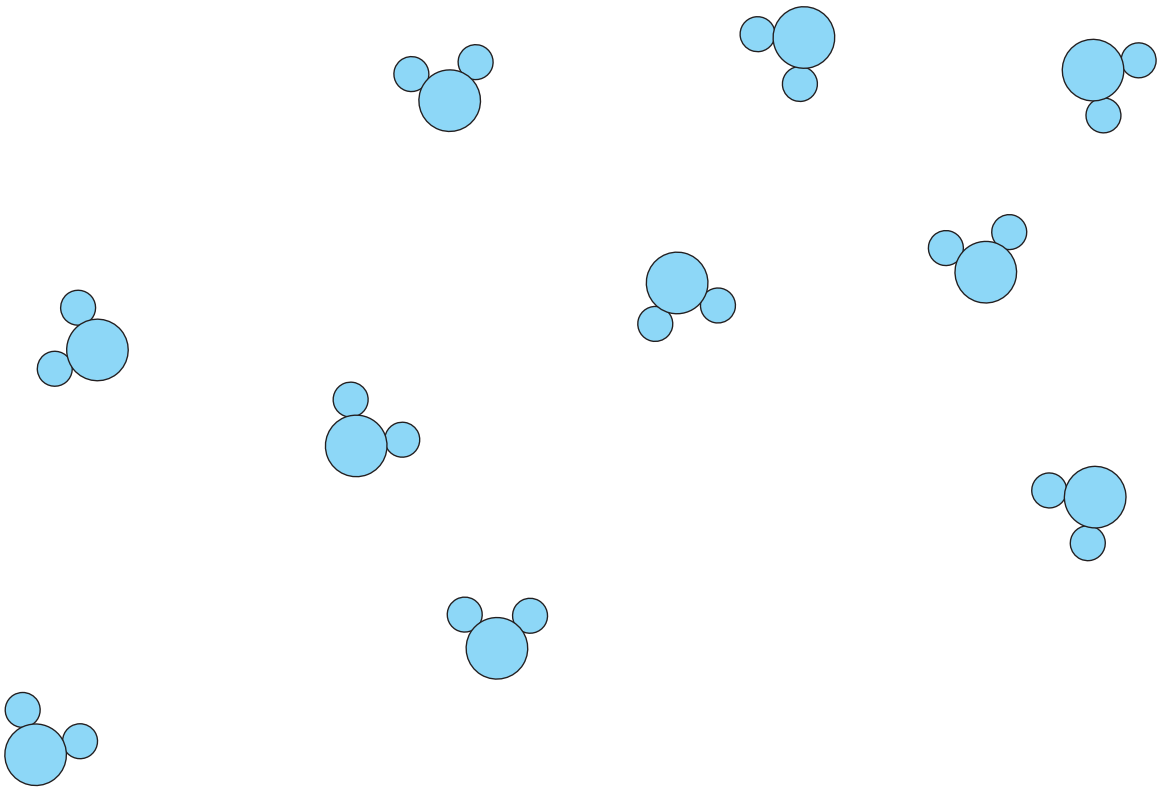
STATES OF WATER — SOLID



STATES OF WATER — LIQUID



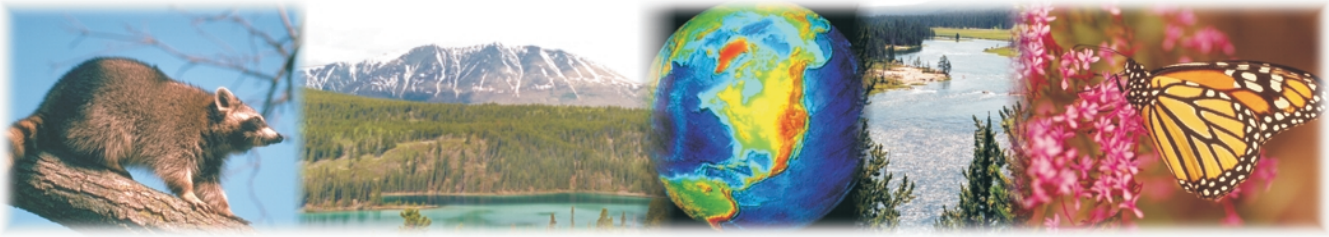
STATES OF WATER — GAS



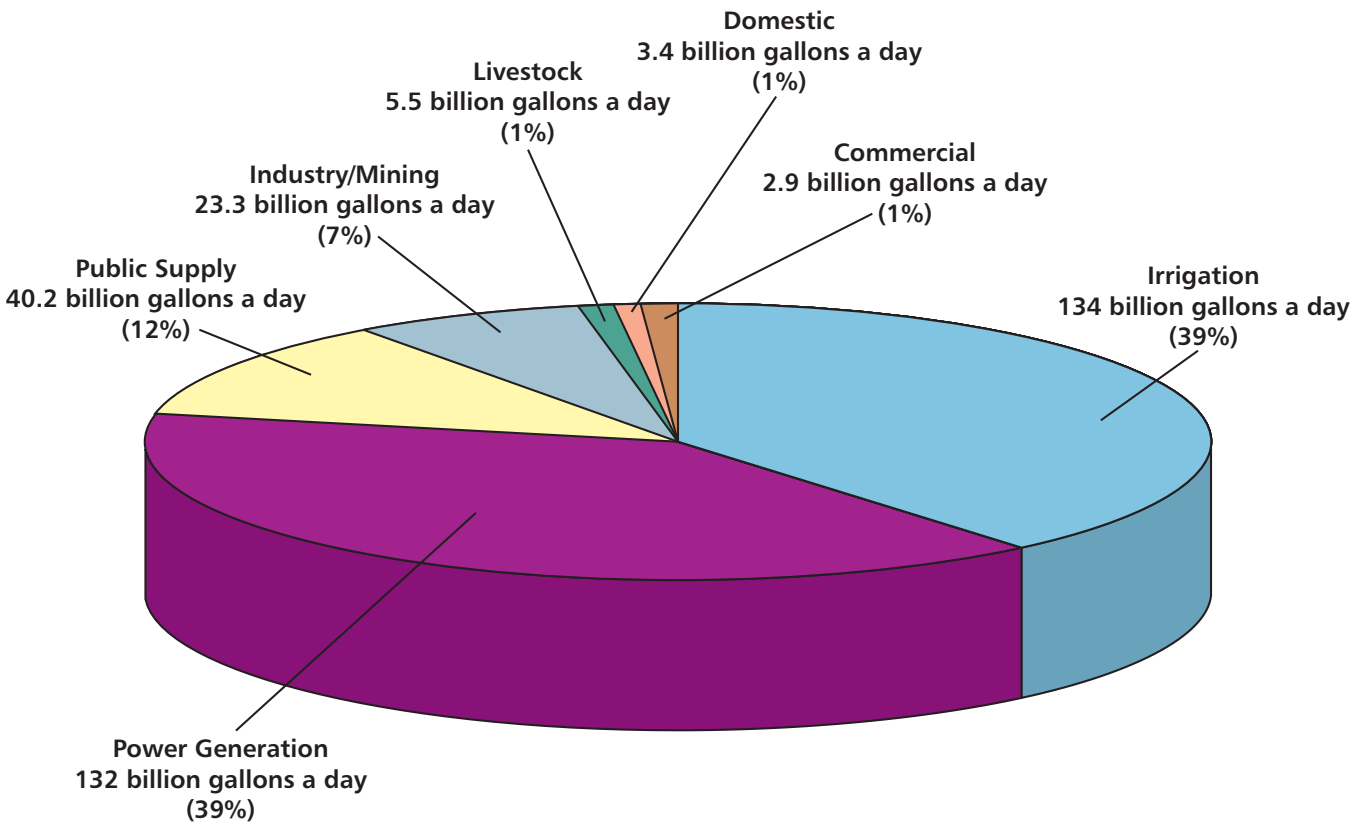
WATERSHEDS

Watershed—a geographic area of land from which surface runoff drains into a common body of water, such as a stream, channel, lake, reservoir, or other body of water.

- **The quality of water can change due to natural factors.**
- **Human activities can impact the quality of water.**
  - **Point source pollution—pollution that can be traced back to a specific location or point.**
  - **Nonpoint source pollution—pollution in which the area where the contaminants entered the system is difficult to locate and may happen over a wide area of land.**



WATER USE IN THE UNITED STATES



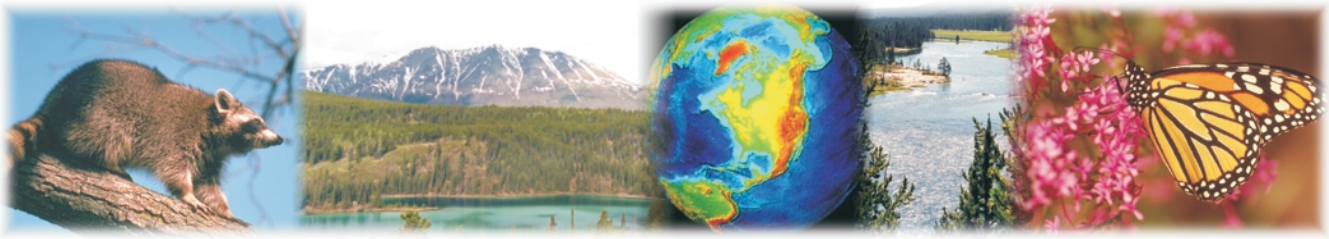
Total freshwater withdrawals in the United States in 1995, by category of water use.

(Source: U.S. Geological Service)

HOW DO WE USE WATER?

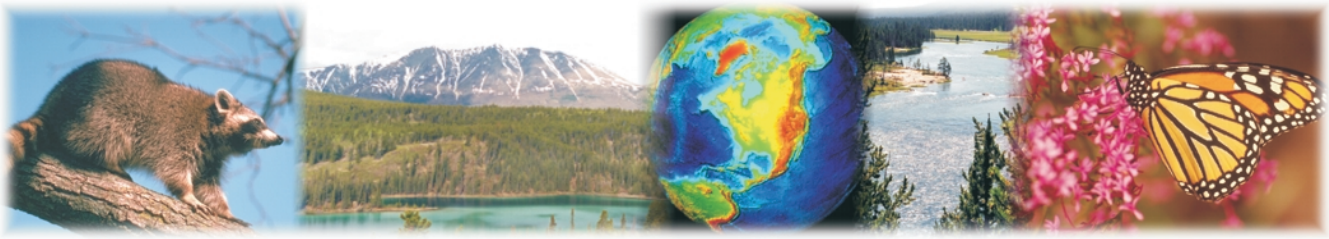
It is estimated that the average person uses 80 to 100 gallons of water per day.

- We use water for drinking, cooking, cleaning, bathing, watering plants and lawns, washing automobiles, making ice, watering animals, and much more.
- Flushing the toilet uses about 5 gallons of water.
- Brushing your teeth uses about 2 gallons of water.
- Running the dishwasher uses about 20 gallons of water.
- Doing a load of laundry uses about 40 gallons of water
- It takes about 5 gallons per minute while the water is running to take a shower or bath.



DIRECT/INDIRECT WATER USE

- Direct uses of water include drinking, bathing, and cooking.
- Indirect uses of water include the large quantities of water needed for producing and manufacturing many of the products we use and consume. For example:
  - 12-ounce can of soda — 16.5 gallons of water
  - 40 sheets of paper — 100 gallons of water
  - Steel in a 30-pound bicycle — 480 gallons of water.
  - 2-pound loaf of bread — 1,000 gallons of water.
  - Pair of jeans made from cotton — 1,800 gallons of water.
  - 1 pound of hamburger — 4,000 gallons of water.
  - 1 ton of finished steel to make a car — 32,000 gallons of water.



WAYS TO CONSERVE WATER

- Turn off water when it is not being used.
- Shorten the length of your shower.
- Install low-flow showerheads.
- Use a capped bottle filled with rocks to take up space in the toilet tank and reduce the amount of water available to flush.
- Reduce the water needed to water plants or lawn by watering in the early morning or late evening and by watering less often and more carefully.
- Fix leaky faucets.
- Keep a bottle of cold water in the refrigerator instead of running water until it becomes cool.
- Use a sink full of rinse water rather than letting the water run when washing dishes.
- Run the washing machine or dishwasher only with a full load.
- Use a hose with an on/off nozzle or use buckets when washing automobiles.

Name _____

EARTH'S WATER SUPPLY

Purpose

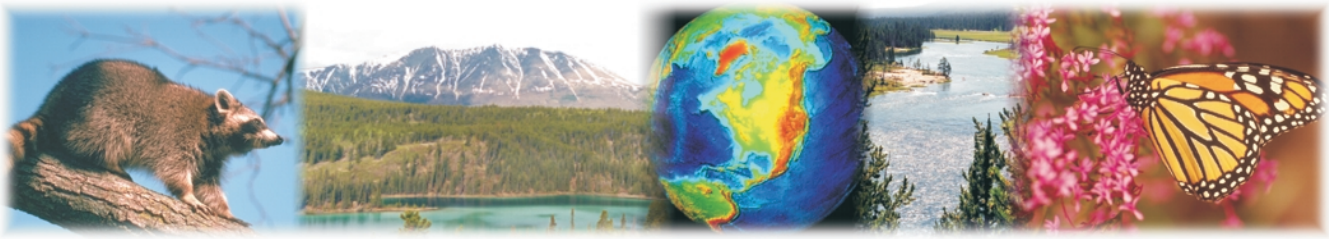
This activity will demonstrate where the earth's water supply is.

Materials

- ✓ One clear gallon container
- ✓ Measuring spoons (tablespoon, ½ tablespoon, and 1/8 teaspoon)
- ✓ Eyedropper
- ✓ 1 gallon of water with blue food coloring added
- ✓ Seven small, clear containers
- ✓ Water cards (provided)
- ✓ Scissors

Procedure

1. Cut out the water cards and place one next to each of the small containers. Keep the "OCEANS," "USABLE," and "UNUSABLE" cards separate; they will be used later.
2. Fill the large container with 1 gallon of blue water. This gallon represents all the water on Earth.
3. Place 5½ tablespoons of water from the large container into the "ICECAPS, GLACIERS" container. This represents the 2.1467% of the earth's water found in glaciers and polar icecaps, such as the north and south pole.
4. Place 1½ tablespoons of water from the large container into the "GROUNDWATER" container. This represents the 0.6134% of the earth's water that is found underground in cracks and spaces in soil, sand, and rocks.
5. Place $\frac{1}{8}$ teaspoon of water from the large container into the "FRESHWATER LAKES" container. This represents the 0.0092% of the earth's water that is found in lakes that have freshwater.
6. Place 6 drops of water from the large container into the "SALTWATER LAKES" container. This represents the 0.0077% of the earth's water that is found in lakes that have saltwater.
7. Place 4 drops of water from the large container into the "SOIL MOISTURE" container. This represents the 0.0049% of the earth's water that is found in the soil.
8. Place 2 drops of water from the large container into the "ATMOSPHERE" container. This represents the 0.001% of the earth's water that is found in the air and the clouds.



9. Place 1 drop of water from the large container into the "RIVERS" container. This represents the 0.0001% of the earth's water that is found in rivers.
10. The remaining water in the large container represents the 97.217% of the earth's water that is found in oceans. Place the "OCEANS" card next to the large container.
11. The water in the oceans is not usable by us because it is saltwater.
12. The water in icecaps and glaciers is not usable by us because it is frozen. Pour this water back into the large oceans container.
13. Groundwater is available for us to use. In fact, 72% of the people in Indiana rely on groundwater for their source of usable water.
14. The water in freshwater lakes is available for us to use. Add this water to the groundwater container.
15. The water in saltwater lakes is not usable by us because it is saltwater. Pour this water into the large oceans container.
16. Soil moisture is used by plants and is not available for us to use. Pour this water into the large oceans container.
17. The water in the atmosphere is in gas form and is not available for us to use. Pour this water into the large oceans container.
18. The water in rivers is usable by us. Pour this water into the groundwater container.
19. You should now have two containers. The large container represents water that we cannot use. Place the "UNUSABLE" card next to this container. The small container represents water that is usable by us. Place the "USABLE" card next to this container.
20. Compare the usable and unusable water amounts. The small amount of usable water (less than 1%) must supply everyone on Earth.

WATER CARDS

OCEANS 97.217%	ICECAPS, GLACIERS 2.1467%
GROUNDWATER 0.6134%	FRESHWATER LAKES 0.0092%
SALTWATER LAKES 0.0077%	SOIL MOISTURE 0.0049%
ATMOSPHERE 0.001%	RIVERS 0.0001%
USABLE	UNUSABLE

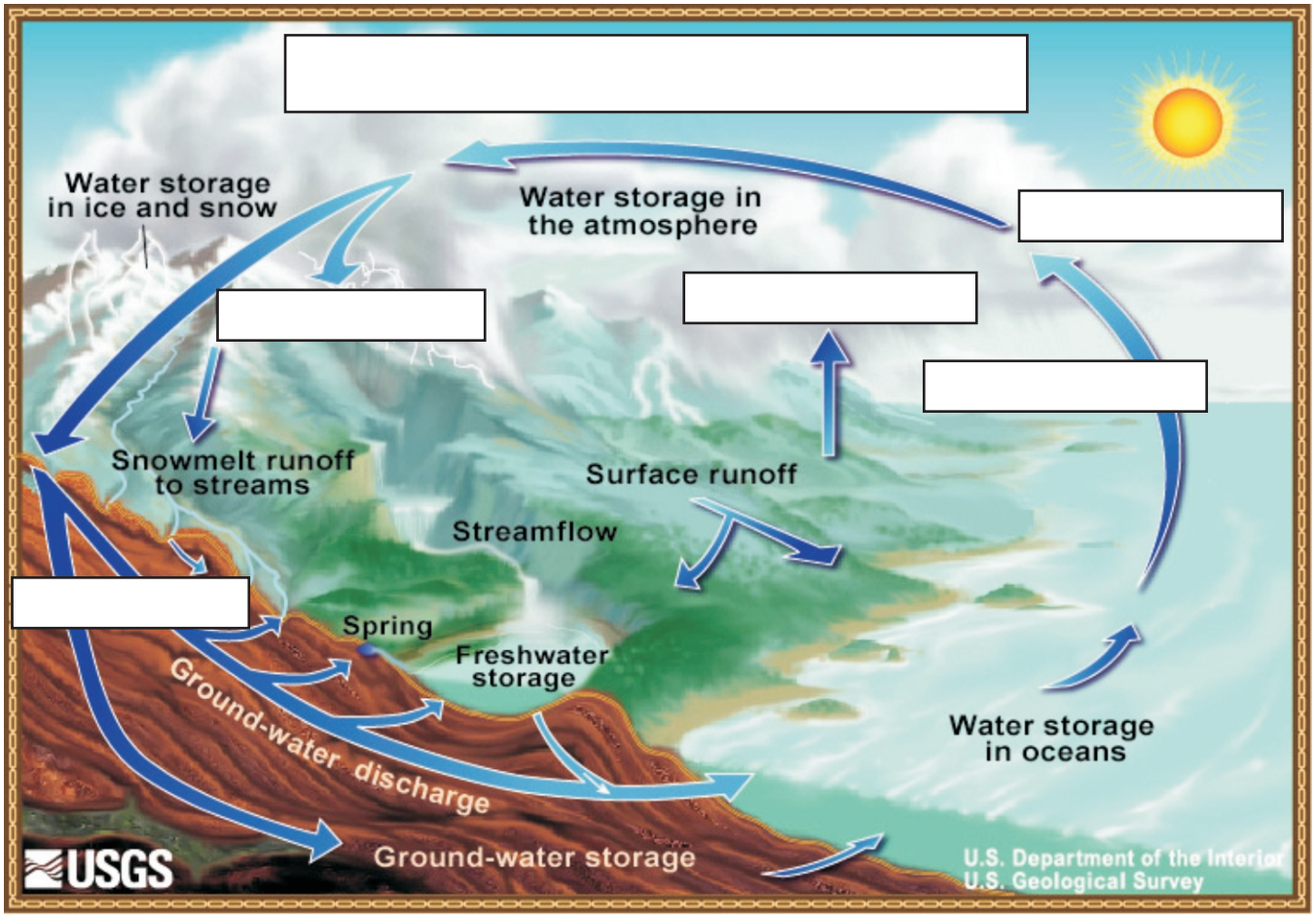
Name _____

PARTS OF THE HYDROLOGIC CYCLE

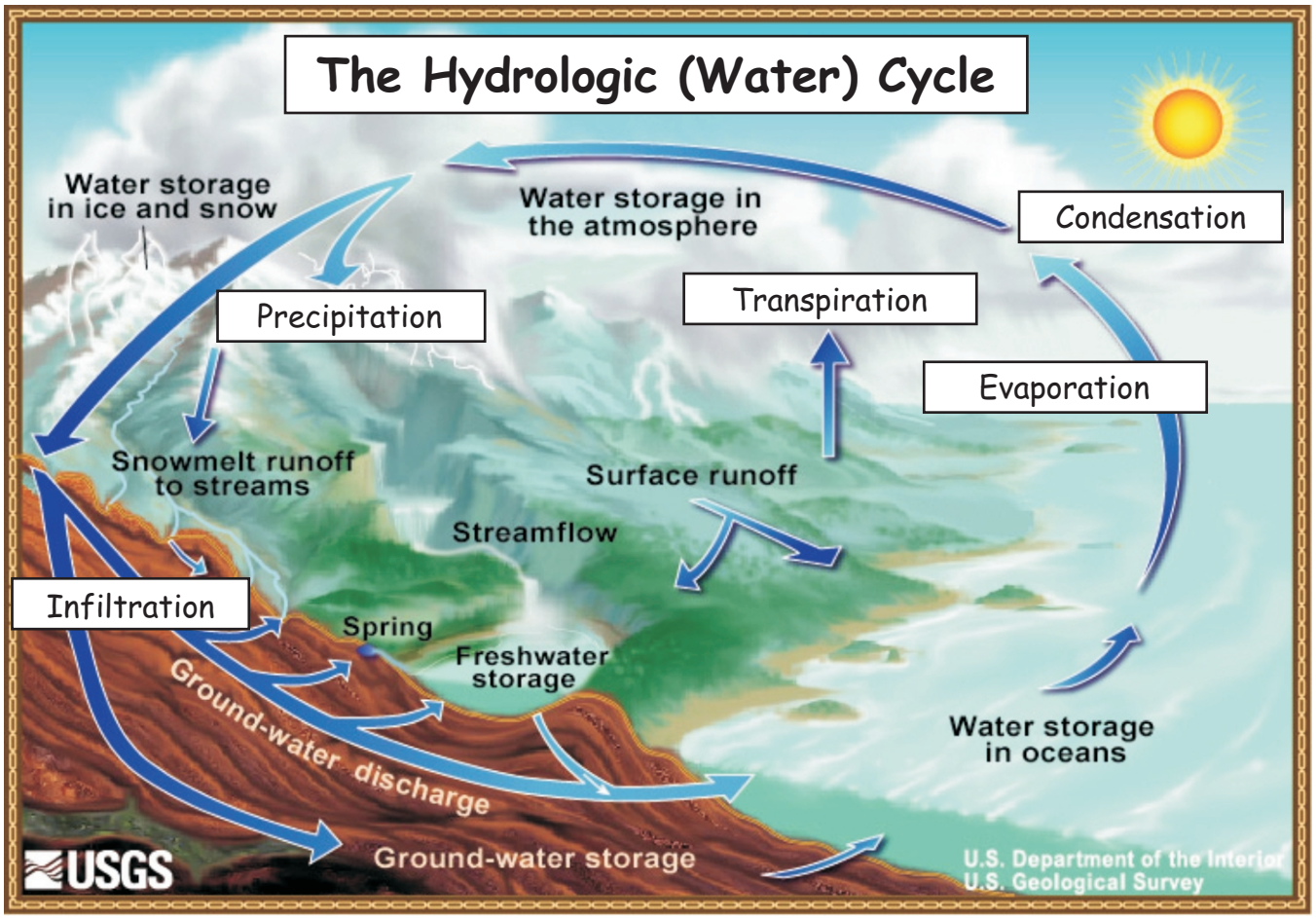
Directions

Fill in the blanks on the water cycle illustration with the words below. Each word will be used only once.

Precipitation	Infiltration
Evaporation	Condensation
Transpiration	The Hydrologic Cycle



PARTS OF THE HYDROLOGIC CYCLE KEY



Name _____

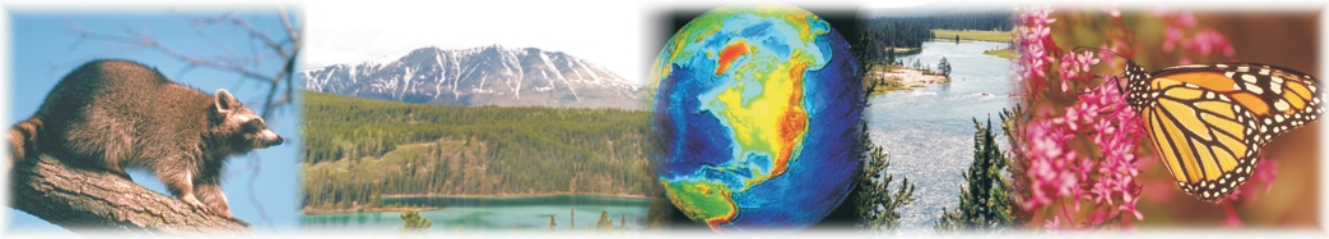
THE WATER CYCLE: LET'S MAKE SOME RAIN!

▶ Materials

- ✓ Clear plastic or glass jar with lid
- ✓ Hot water
- ✓ Ice

▶ Procedure

1. Fill the jar about 1/3 full of hot water.
2. Place the lid, upside down, on top of the jar.
3. Place some ice in the inverted lid.
4. Observe what happens inside the jar. Watch for steam rising from warm water (clouds) and drops forming on the lid (rain).
5. Write a description below of what you saw.



Name _____

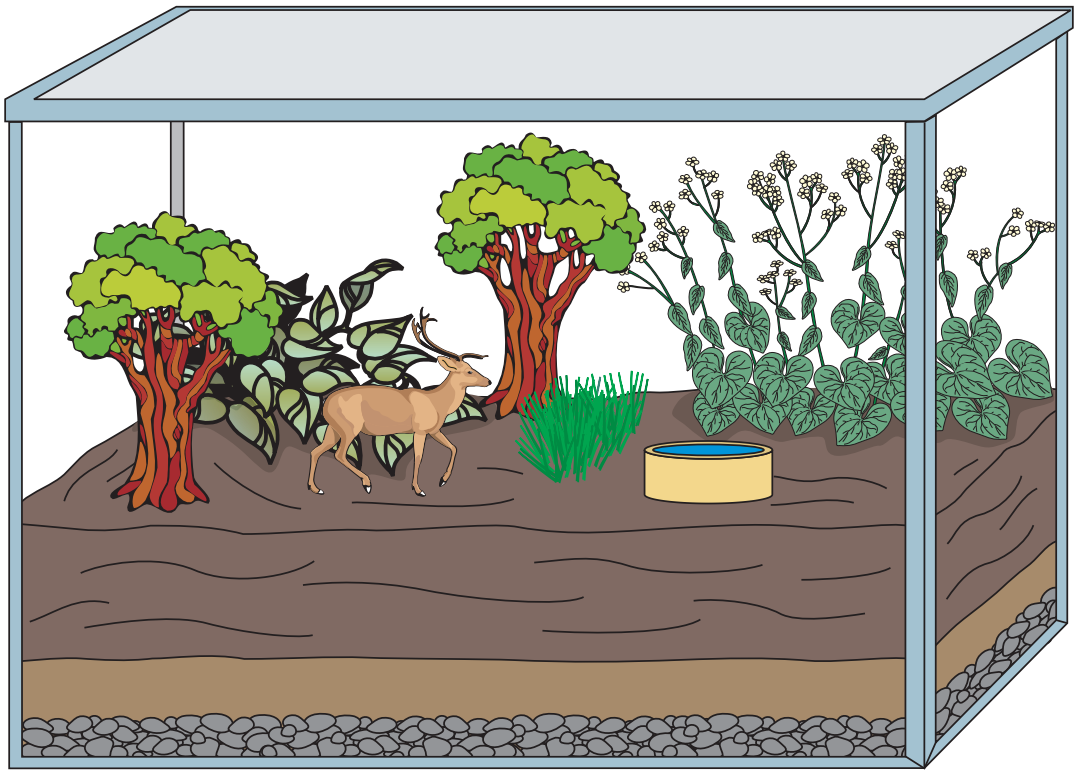
TERRARIUM: THE WATER CYCLE IN A CONTAINER

Purpose

In this activity you will create your own terrarium. Inside this terrarium will be a small ecosystem of living and non-living things. The water cycle will occur inside your terrarium just as it does on Earth!

Materials

- ✓ Large jar or an aquarium
- ✓ Small rocks
- ✓ Sand
- ✓ Potting soil
- ✓ Small container or a shell of water
- ✓ Grass seed
- ✓ Plant(s)
- ✓ Plastic trees, animals, etc., to decorate your terrarium (optional)



▶ Procedure

1. Place a ½-inch layer of small rocks in the bottom of your terrarium.
2. Place a 1-inch layer of sand on top of the rocks.
3. Add about a 2-inch layer of potting soil on top of the sand. (The amount of potting soil to use depends on the size of your container and the size of the plants you want to use.)
4. Plant your plant(s) in the potting soil. Be careful to leave the correct amount of space between your plants to allow them to grow. You might want to place one plant near the edge of your container so you can watch the roots grow.
5. Sprinkle a pinch of grass seed on the surface in an empty area and lightly cover it.
6. Water your plants and seeds lightly.
7. Fill your small container or shell with water and carefully place it inside the terrarium.
8. Decorate your terrarium with small rocks, plastic trees and animals, or whatever else you want.
9. Seal your terrarium with the lid or cover it with plastic wrap.
10. Carefully place your terrarium in a safe location that is very bright. Do not place it in direct sunlight.
11. Continue to care for you terrarium. Water it lightly and only when the soil is dry. Trim the plants to keep them from overgrowing.
12. Observe your terrarium and record your findings. Watch the water cycle in action!

Name _____

THREE STATES OF WATER: SOLID—LIQUID—GAS

▶ Objective

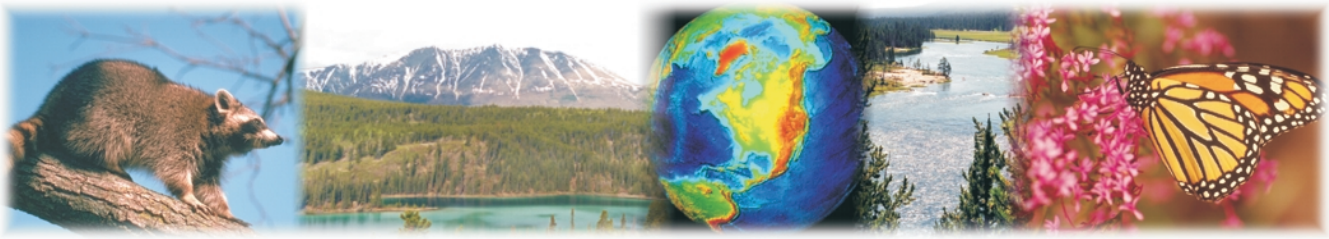
In this activity, you will witness all three states of matter—solid, liquid, gas.

▶ Materials

- ✓ Ice cubes
- ✓ Large clear bowl
- ✓ Small clear bowl
- ✓ Plastic wrap
- ✓ Rubber band (large enough to fit tightly around the large bowl)
- ✓ Small rock

▶ Procedure

1. Place the small bowl in the center of the larger bowl.
2. Fill the large bowl with ice cubes (around the small bowl). Do not allow any ice to fall into the small bowl. Ice is the solid form of water. For ice to stay in solid form, it must stay at or below freezing (32°F or 0°C). Because the temperature in your classroom is above freezing, the ice is going to eventually melt and return to its liquid form.
3. Cover the large bowl with a piece of plastic wrap, and secure it with a rubber band.
4. Place the weight (small rock) in the middle of the plastic wrap.
5. Place your "water cycle" in a safe, sunny spot.
6. In the water cycle, water changes from one form to another naturally in the environment. In your water cycle, the ice is going melt because it is too warm (solid to liquid). The sun will continue to heat the water and cause it to evaporate (liquid to gas). The evaporated water will rise and condense on the plastic wrap (gas to liquid). Because of the weight (rock), the water droplets will slide down the plastic wrap and fall into the smaller container, which collects the recycled water. You could freeze the collected water and start all over again!



Name _____

CREATE YOUR OWN WATERSHED MAP

▶ Materials

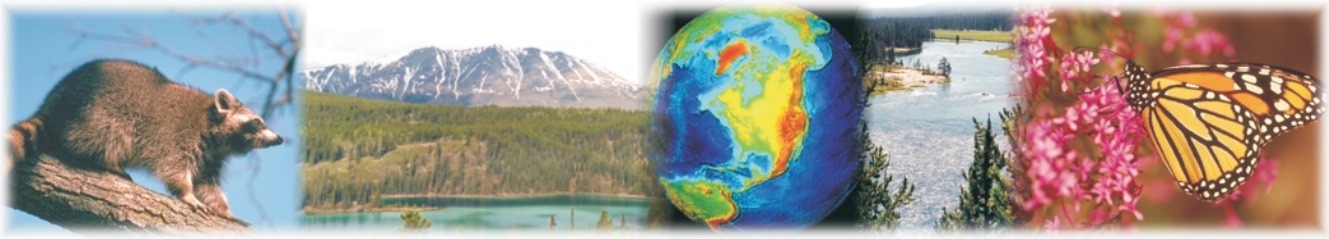
- ✓ One sheet of 8½" × 11" paper
- ✓ Water-soluble markers (three different colors)
- ✓ Newspaper (to protect work surface)
- ✓ Spray bottle
- ✓ Water

▶ Procedure

1. Crumple a sheet of 8½" × 11" paper into a tight ball.
2. Gently open up the paper, but don't flatten it out completely. You now have your own watershed map. The highest points on the paper represent mountain tops, and the lowest wrinkles represent valleys.
3. Choose one color of marker and use it to mark the highest points on the map. These points are the mountain ridge lines.
4. Use a second color of marker and to mark the places where different bodies of water (creeks, rivers, lakes, etc.) might be.
5. Use a third color of marker to mark four or five spaces that represent human settlements, such as housing tracts, factories, shopping centers, office buildings, schools, etc.
6. Lay some old newspaper over your work surface.
7. Use a spray bottle of water to lightly spray your finished map. The spray represents rain falling into the watershed.
8. Observe how water travels through your watershed system and answer the questions below.

▶ Questions

1. What changes happened to your map?



2. Where does most of the rain fall in your watershed?

3. What path does the water follow?

4. What happened to the human settlements marked on your map?

5. How does the flow of water through the watershed affect a person's choice of building sites?

Name _____

WATER AWARENESS TEST: HOW DO YOU MEASURE UP?

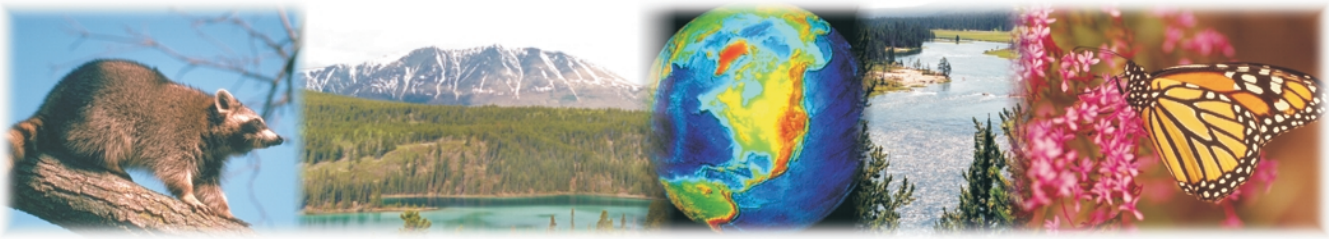
Introduction

Every day we do or don't do things which affect the amount of water we use and the condition we leave it in as it is disposed. Here is an opportunity for you to consider what your impact is to both the problem and the solution. Take a few moments to check the box you feel is most appropriate.

Do You...

	Never	Sometimes	Often
1. Leave the faucet running as you brush your teeth	_____	_____	_____
2. Leave the faucet running while you wash your hands	_____	_____	_____
3. Take long showers	_____	_____	_____
4. Fill the bathtub as full as possible	_____	_____	_____
5. Let the tap water run until it gets cold	_____	_____	_____
6. Wash your bike (or other recreational item) every weekend	_____	_____	_____
7. Leave the hose running while soaping down your bike	_____	_____	_____
8. Sweep lawn and garden trimmings into the curb or down storm drains	_____	_____	_____
9. Let buckets or glasses overflow	_____	_____	_____
10. Place buckets or containers under leaky faucets	_____	_____	_____

	Yes	No
11. Know where your water comes from	_____	_____
12. Know where your water goes	_____	_____
13. Know the name and location of your watershed	_____	_____
14. Volunteer to help clean up your community	_____	_____
15. Encourage others to fix leaks	_____	_____
16. Let your friends and family members know about ways they can help	_____	_____

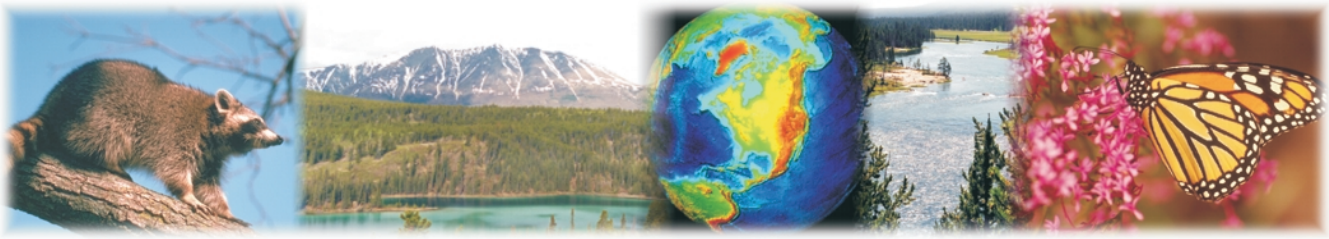


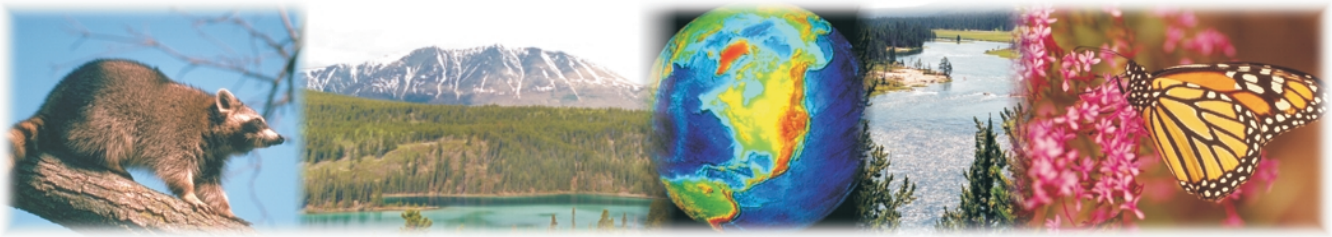
Name _____

WATER CONSERVATION: HOW CAN YOU HELP?

Directions

Review your answers on the Water Awareness Test. Were you aware of all of the ways you waste water? Are there any habits that you could change to help reduce the amount of water that you use? Design a pamphlet, poster, or bulletin board display that informs others of the importance of conserving water and the things they may not be aware of that waste water. Be sure to include information on the limited amount of water that is available on Earth and the many simple ways that we can all conserve water. Share your design with family members and other students and encourage them to help save precious water!





Lesson F–3

WILDLIFE

Indiana Agricultural Literacy Lesson Plan Library

Unit F. Environmental Science

Lesson 3. Wildlife

Indiana's Academic Standard. **Science:** 4.4.3 — Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain what wildlife is.
2. Recognize the connections within an ecosystem.
3. Identify the components of a habitat.
4. Describe different types of habitats.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Discover Wild Reference Set. Portland, Oregon: Positive Solutions USA, 2001. (Teacher's guide full of lessons and activities, video, and set of nine fur samples.)

Hickman, Pamela. *Animal Senses: How Animals See, Hear, Taste, Smell and Feel.* Buffalo, New York: Kids Can Press Ltd., 1998.

Indiana Department of Natural Resources — www.in.gov/dnr/

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Project Learning Tree. Washington, D.C.: American Forest Foundation, 2001.

Project WILD. Bethesda, Maryland: Council for Environmental Education, 1992.

Project WILD Aquatic. Houston, Texas: Council for Environmental Education, 2001.

U.S. Fish and Wildlife Service education web site (useful for fact sheets, pictures, sound clips and more) — http://educators.fws.gov/educators.html

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Carnivore
- Community
- Domestication
- Ecology
- Ecosystem
- Food chain
- Food web
- Habitat
- Herbivore
- Omnivore
- Population
- Predator
- Scavenger
- Wildlife

- Wildlife animal
- Wildlife plant

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Write the word "wildlife" on the writing surface. Ask students to share what they think of when they hear and see the word wildlife. Record their words or phrases on the writing surface. This will help identify what they know about wildlife. Then ask students what they would like to learn about wildlife.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain what wildlife is.

Anticipated Problem: What is wildlife?

I. ***Wildlife*** refers to plants, animals, and other living things that have not been domesticated. ***Domestication*** is the process of bringing living things under the control of humans. Animals are usually the first thing we think of when we hear the word *wildlife*. However, plants and other living things are also a part of wildlife.

A. A ***wildlife animal*** is an animal that has not been domesticated. Wildlife animals include bears, deer, rabbits, squirrels, and many others.

1. Domesticated animals, like dogs, cats, horses, and cows, are tame animals that are kept and bred in captivity by humans who provide for all their needs.
2. Wildlife animals are free to roam the land, water, or air.
3. Wildlife animals live on their own. They must depend upon their own actions for survival. They must find their own food, water, and shelter.
4. Protection from predators and the elements is critical to the survival of wildlife animals.
5. Wildlife animals must compete to survive among many different species of animals.
6. Wild animals in zoos are not domesticated. They still retain much of their natural behavior.

B. A ***wildlife plant*** is a plant that has not been domesticated.

1. Many plant species are considered to be wild. Think about the wildflowers that are found along roadsides and in parks.

2. Wildlife plants include a variety of grasses, vines, flowers, shrubs, and trees.
3. Wildlife plants can be found on land or in water.
4. Wildlife plants grow on their own without any effort from us.

Use TM: F–3A to show students some examples of wildlife animals. Use TM: F–3B to show students some examples of wildlife plants. Discuss the different types of wildlife the students have seen in their area. Use WS: F–3A to allow students to create an informative card about a wildlife animal. This card will be used throughout the lesson as students add more information. Encourage students to choose different wildlife animals so that a variety of cards will be created.

Objective 2: Recognize the connections within an ecosystem.

Anticipated Problem: What connections are found within an ecosystem?

II. An ***ecosystem*** is a self-contained living system. John Muir, a noted conservationist of the 1800s, said, "When we try to pick out anything by itself, we find it hitched to everything else in the universe." In this statement he was emphasizing that all living things are both interrelated and interdependent. These connections of living organisms and nonliving organisms within a particular environment make up an ecosystem.

A. All things depend upon one another in some way to survive.
   1. ***Ecology*** is the branch of science that deals with the relationships living things have to each other and to their environment.
   2. An ecosystem contains communities made up of populations. A ***population*** is all of the organisms that live in a given area. A ***community*** is a group of interacting populations living together in the same environment.
   3. Communities are affected by the land, water, climate, and the species living in the community. The species in a community include both plants and animals, including humans. Human activity can be helpful or harmful depending on what is done.
      a. For instance, if trees are cleared from a piece of land for development, it may be harmful to the wildlife.
      b. On the other hand, if more trees and prairie grasses are planted in an area it may establish a habitat for wildlife.

B. A ***food chain*** is the sequence in which living things in a community get their food. A food chain shows how energy is passed from one life form to another.
   1. The food chain begins with natural resources—sun, water, air, and soil. These resources provide what plants need to grow, produce their own food, and reproduce. As plants grow, some energy is stored in their leaves, stems, fruit, seeds, and roots.
   2. When other living creatures eat the plants, the energy is passed along the chain to the animal. Animals also store energy in their bodies.
   3. Stored energy from animals is passed along the food chain when another animal eats them. An animal that hunts, kills, and eats other animals is called a ***predator***.

4. When an animal or plant dies, it either decomposes or is eaten by a scavenger. A ***scavenger*** is an animal that usually eats dead animals and rarely kills its own prey.
5. When something decomposes, it is broken down into smaller parts as it returns to the earth. The food chain cycle then begins again.

C. A ***food web*** is a way of showing how food chains in a community are connected. It also shows how all food begin with resources, such as sunlight and water. Animals in the food web are classified into groups based on the types of food they consume.
1. A ***herbivore*** is an animal that eats only plants for food.
2. A ***carnivore*** is an animal that eats only other animals for food.
3. An ***omnivore*** is an animal that eats both plants and animals for food.

D. Because all parts of an ecosystem are connected, changes in one area of the ecosystem can have an effect on all of the things in the entire ecosystem.
1. Changes occur all of the time in an ecosystem.
2. Changes may happen daily, seasonally, or over a period of years.
3. Ecosystems generally find a way to stay as balanced as possible.
4. Natural events, such as floods, droughts, fires, tornados, or hurricanes, can cause major changes to take place in an ecosystem.
5. People can also force changes to occur in an ecosystem.
6. Because everything is connected, when one thing changes it affects something else, that affects something else, which in turn affects something else, and so on.

Use TM: F–3C, TM: F–3D, and TM: F–3E to help students better understand the food chain and how it works. Use TM: F–3F to show students an example of a food web. Use TM: F–3G, TM: F–3H, and TM: F–3I to show students examples of herbivores, carnivores, and omnivores. Use WS: F–3B to have students add more information to their Wildlife Cards (created in WS: F–3A). Use WS KEY: F–3C to set up a food web activity for your students. The activity will allow students to see for themselves the ways in which all members of a community depend on each other.

Objective 3: Identify the components of a habitat.

Anticipated Problem: What are the basic components of a habitat?

III. A ***habitat*** is the physical area in which a wildlife species lives in natural conditions. Many things make up a habitat: climate (temperature, rain, etc.), the lay of the land, the nature of the soil and water, and other plants and animals in the area. Life's most fundamental necessities—food, water, shelter, and space—in a suitable arrangement must be available in a habitat. Without these basic components, organisms cannot survive.

A. Food is necessary in a habitat to sustain life.
1. The food that animals eat provides all the nutrients they need to live, grow, move, and reproduce.

2. The food available in a habitat varies throughout the year with the changing seasons.

B. Another basic need for all living things is water.
   1. Habitats have to have an ample, clean supply of water to support the wildlife living there.
   2. Animals may obtain water directly by drinking or indirectly through the foods they eat.

C. Shelter or cover is the vegetation or other material needed in a habitat to protect the species living there.
   1. Different species require different amounts of shelter during certain stages of their development, such as during the reproductive season, during hibernation, or during molting.
   2. Wildlife animals depend on cover to conceal themselves from predators as they move about.
   3. Animals also need cover to help protect them from the weather.
   4. Shelter is also needed while resting, sleeping, or nesting.

D. A habitat must also provide space. Space is the area or territory around an organism. It is used by the organism for living.
   1. Space provides air, food sources, and cover.
   2. Space requirements vary by species, season of the year, and quality of the habitat.

Use TM: F–3J to cover the content of the objective. Use TM: F–3K to show students an illustration of a sample habitat that contains all of the basic components. Use WS: F–3D to have students add more information to their Wildlife Cards and reinforce the content of the objective. Invite a speaker from the Department of Natural Resources to come visit with your class and provide information about the work he or she does. If possible, give your students the opportunity to explore a habitat of some type. As they explore, discuss what kinds of wildlife may live in the habitat based on the sources available for food, water, shelter, and space.

Objective 4: Describe different types of habitats.

Anticipated Problem: What are the different types of habitats?

IV. There are many different types of habitat. Habitats can be identified by soil type, how much water is present, the climate, or the major type of plant species in the area. Habitats can be land, water, or both. Terrestrial wildlife live on land. Aquatic wildlife live in water.

A. Prairies are grasslands that have no trees at all or widely scattered trees.
   1. Prairies can be found all over the world.
   2. About 32 to 40 percent of the world's land is or was covered by grasslands.
   3. In North America, prairies cover 15 percent of the land surface.

4. Prairies made up about 15 percent of the area in Indiana, primarily in the northwest and west-central portions of the state. Most of the original prairies in Indiana have been lost to drainage, urbanization, and agriculture.

B. Forests can be divided into deciduous forests and rainforests.
   1. Deciduous forests contain mostly plants that periodically (usually in the fall of the year) lose all their leaves.
   2. Rainforests are forests that receive more than 80 inches of rain per year. Rainforests grow in more than 50 countries. Although we often think of the tropical rainforests along the equator, there are others.
      a. Temperate rainforests are found in the U.S. Pacific Northwest.
      b. Flooded mangrove forests are found along the salty coastlines of the Southeast Asian Islands.
      c. High altitude cloud forests are found in South America.
   3. The Indiana state forest system consists of 13 properties containing 150,000 acres of forest. There are over 3.8 million acres of privately owned forested land in Indiana.

C. Deserts are areas that receive very little or no rainfall. The temperatures in a desert range from very hot to cold.

D. Wetlands are areas that periodically have standing water or waterlogged soils.
   1. Swamps, marshes, and bogs are types of wetlands.
   2. In the early 1700s, wetlands covered 25 percent of the total area of Indiana. These wetlands were converted to protect people's health and for cities, roads, and farms. Wetlands now cover less than 4 percent of Indiana.

E. Oceans are large salty bodies of water that cover 75 percent of the earth's surface.

F. Lakes and ponds are natural or artificial reservoirs that hold water.
   1. Most lakes and ponds have freshwater.
   2. Some lakes and ponds have saltwater.
   3. Water temperature in lakes and ponds varies with the surrounding climate and the source of the water.

G. Streams are bodies of flowing water that move from higher to lower elevations. Stream size varies. Creeks are small streams; rivers, such as the Mississippi River, are large streams.

Use TM: F–3L to cover the content of the objective. Use TM: F–3M to show students some examples of the different types of habitats. Use WS: F–3E to have students create posters that provide a habitat that their Wildlife Card animals can live in. It may be possible to divide the class into groups and allow students with similar habitat requirements to work together to complete a poster. Create a class bulletin board to display all of the different habitats. Use WS: F–3F to have students complete their wildlife cards and then place them into their habitats on the bulletin board created in WS: F–3E. If possible, use yarn or string to connect the different animals through a food web on the bulletin board as well.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: F–3A, WS: F–3B, WS KEY: F–3C, WS: F–3D, WS: F–3E, and WS: F–3F.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

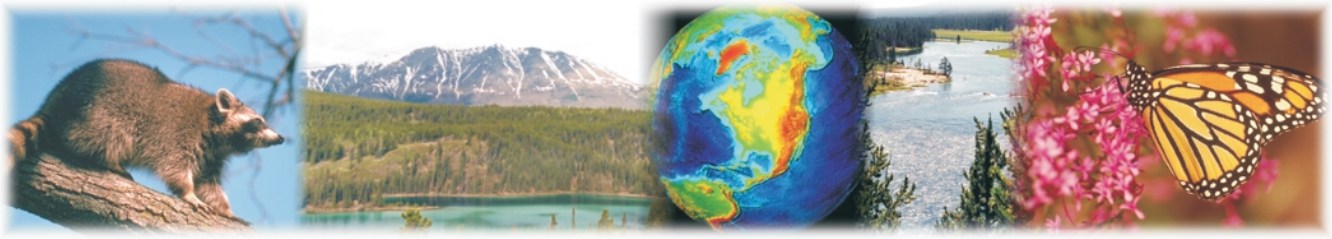
1. f
2. h
3. e
4. d
5. b
6. g
7. a
8. c

Fill-in-the-Blank

1. ecosystem
2. ecology
3. food chain

Short Answer

1. Wildlife refers to plants, animals, and other living things that have not been domesticated.
2. The basic components of a habitat are food, water, shelter, and space.
3. Answers will vary. Use Objective 4 for scoring this question.



Test F–3

Name _____

WILDLIFE

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. carnivore	e. omnivore
b. community	f. population
c. food web	g. predator
d. herbivore	h. scavenger

_____1. All of the organisms that live in a given area.

_____2. An animal that usually eats dead animals and rarely kills its own prey.

_____3. An animal that eats both plants and animals for food.

_____4. An animal that eats only plants for food.

_____5. A group of interacting populations living together in the same environment.

_____6. An animal that hunts, kills, and eats other animals.

_____7. An animal that eats only other animals for food.

_____8. A way of showing how food chains in a community are connected.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A(n) _____ is a self-contained living system.
2. The branch of science that deals with the relationships living things have to each other and to their environment is called _____.
3. A(n) _____ _____ is the sequence in which living things in a community get their food.

Short Answer

***Instructions*. Answer the following questions.**

1. What is wildlife?

2. Name the basic components of a habitat.

3. Describe two different types of habitats.

WILDLIFE ANIMALS


Caribou


Dolphins


Elephant


Tiger


Rattlesnake


Chimpanzee


Humpback Whales

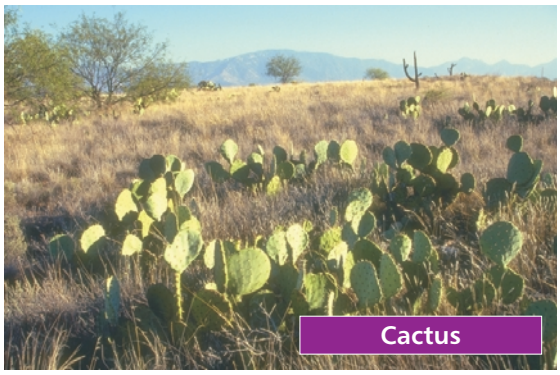

Whitetail Deer

WILDLIFE PLANTS


Lupines


Milkweed


Ferns


Cactus

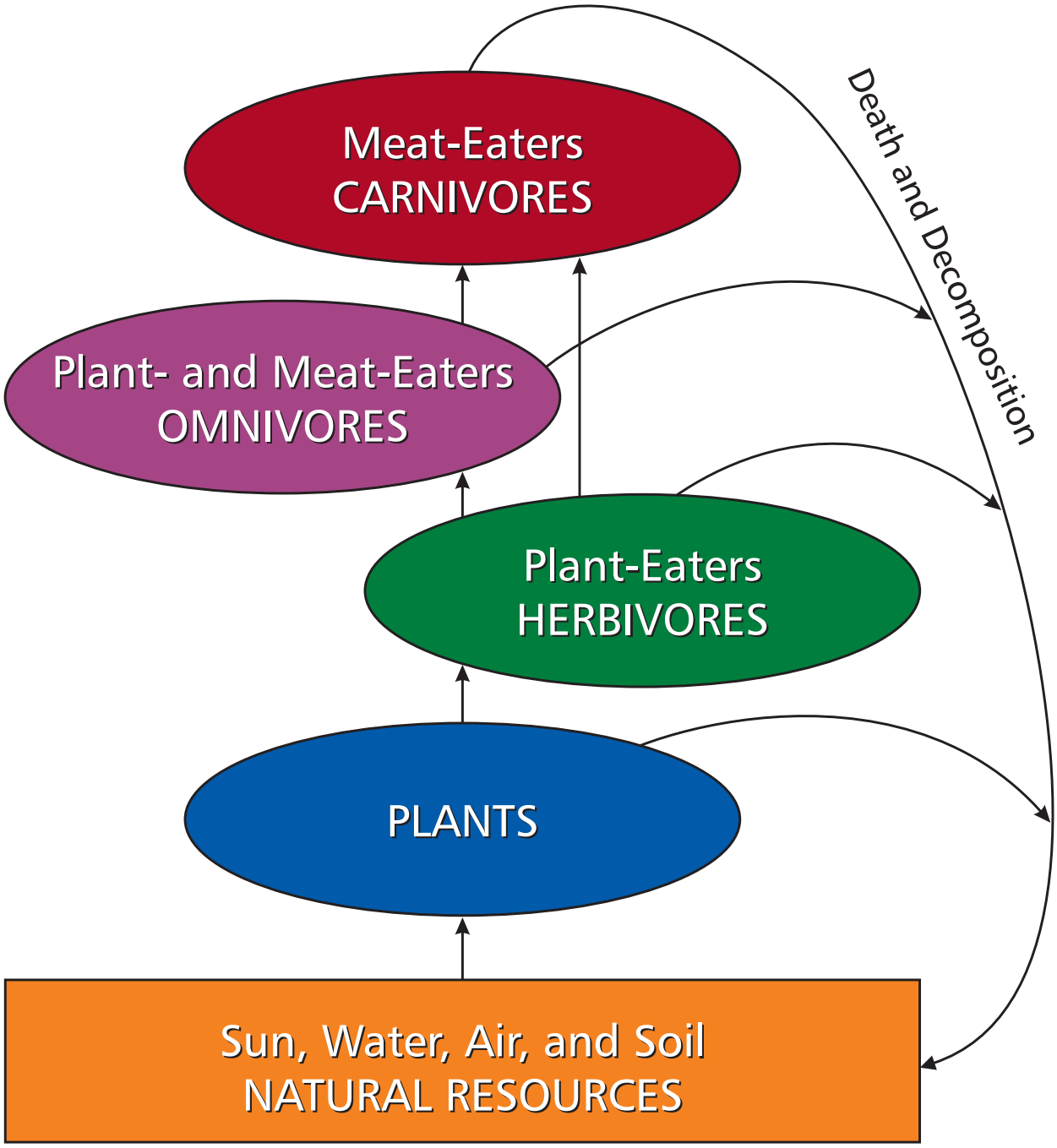

Bluebells


Vine and Cypress


Poppies

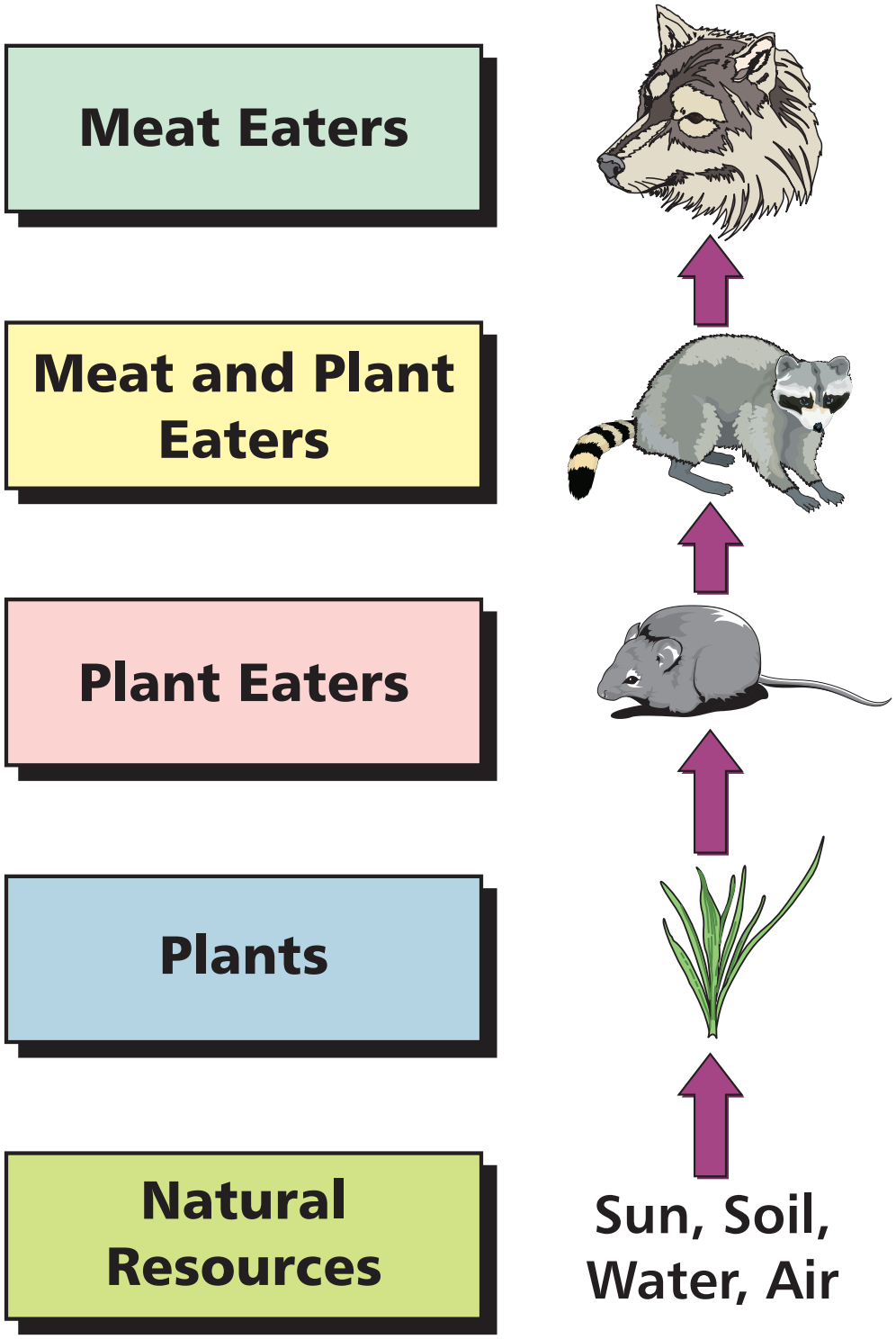

Blue Violet

HOW A FOOD CHAIN WORKS

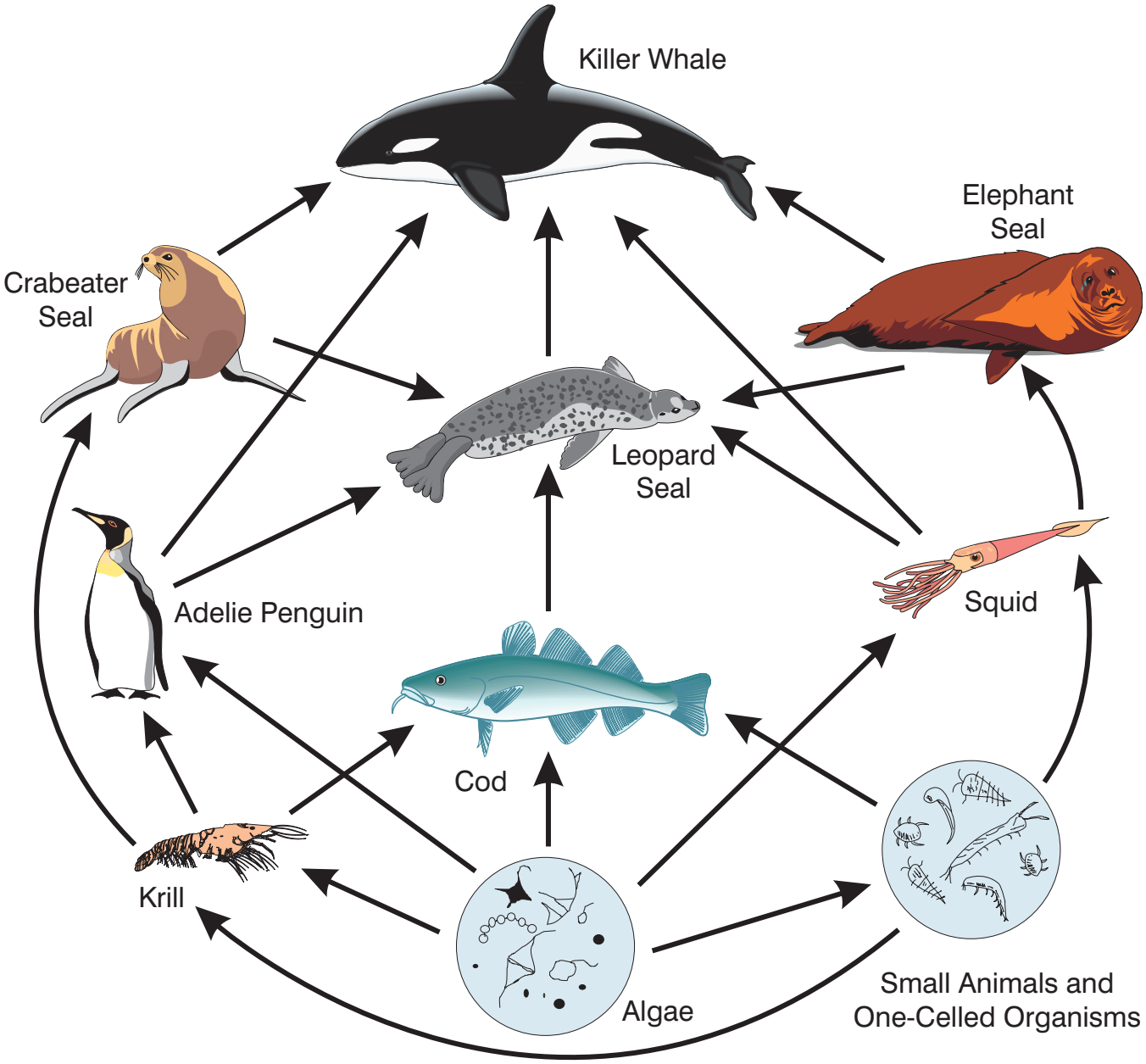


FOOD CHAIN

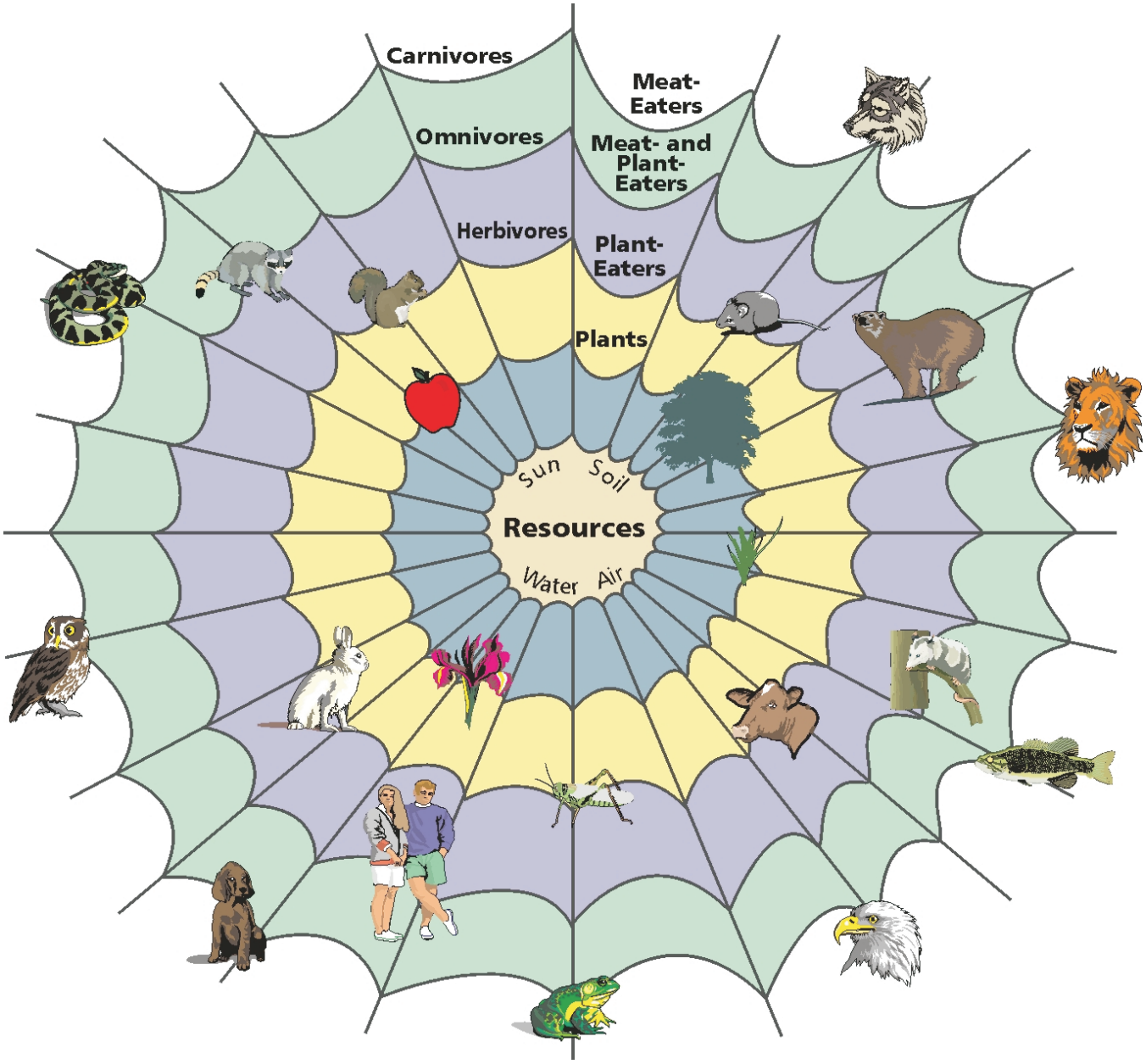
SIMPLIFIED FOOD CHAIN



FOOD CHAIN


Killer Whale
Elephant Seal
Crabeater Seal
Leopard Seal
Adelie Penguin
Squid
Cod
Krill
Algae
Small Animals and One-Celled Organisms

SAMPLE FOOD WEB



HERBIVORES


Rabbit


Moose


Antelope


Zebras


Squirrel


Big Horn Ram


Elk


Mountain Goat

CARNIVORES


Bobcat


Cougar


Timber Wolves


Bald Eagle


Alligators


Lion


Great Horned Owl


Red Fox

OMNIVORES


American Black Bear


Raccoon


Tortoise


Skunk


Opossums


Monkey

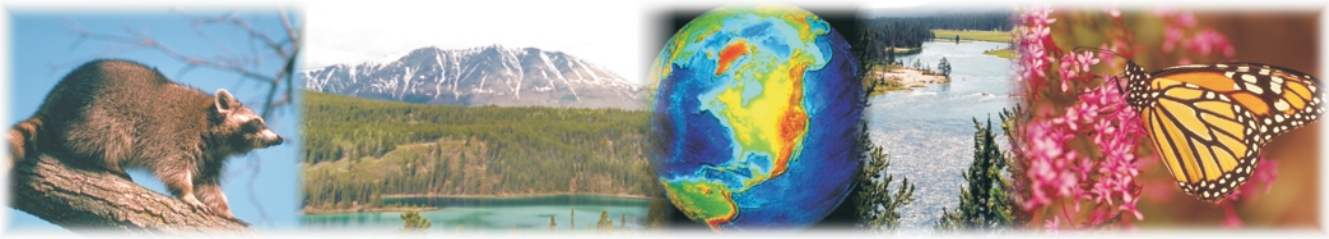

Porcupine


Common Starling

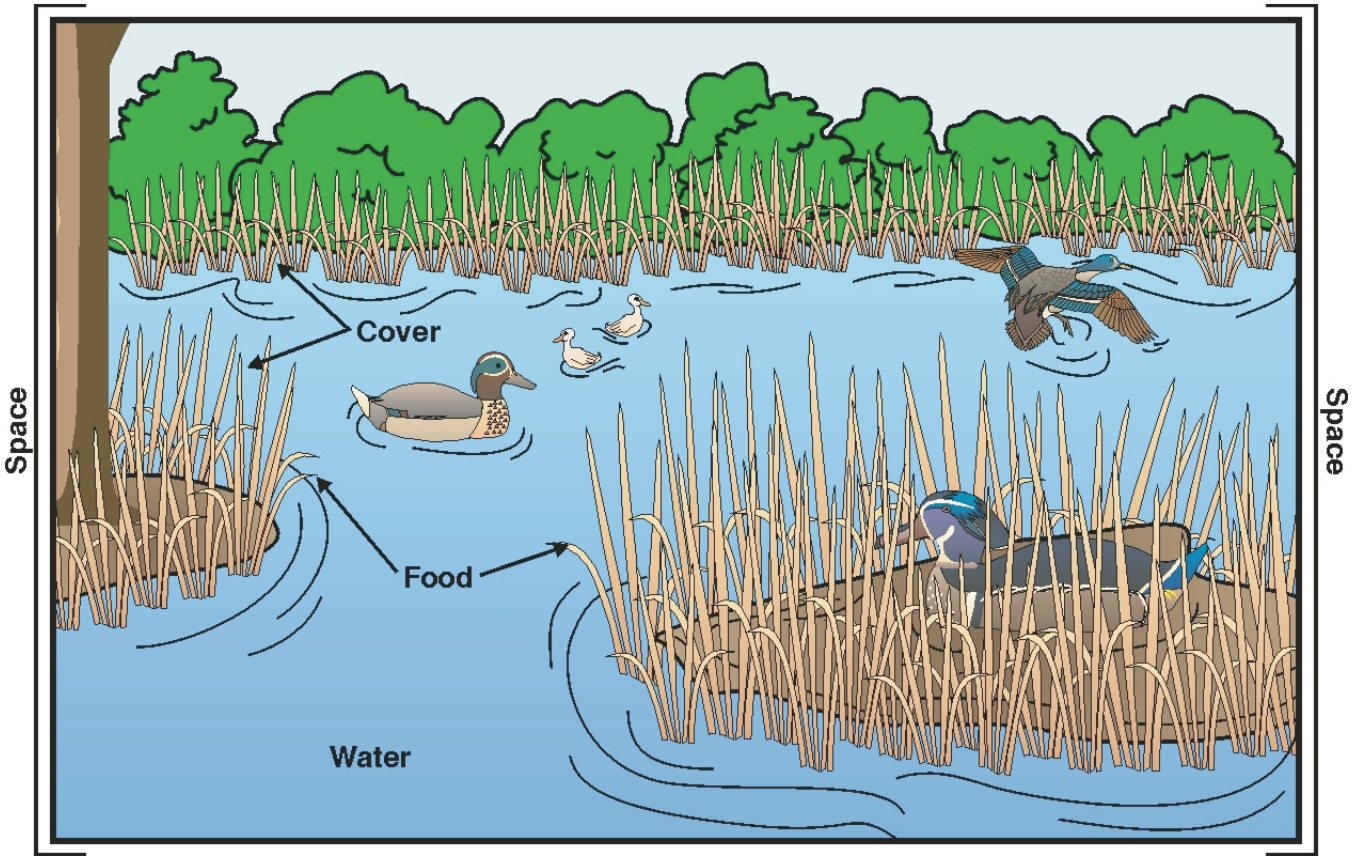
BASIC COMPONENTS OF A HABITAT

A habitat is the physical area in which a wildlife species lives. A habitat must provide organisms with a suitable arrangement of basic needs:

- Food
- Water
- Shelter
- Space

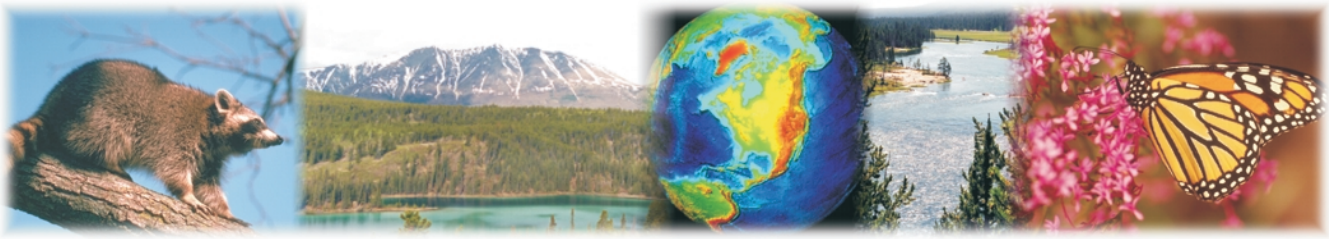


SAMPLE HABITAT



TYPES OF HABITATS

- Prairies—grasslands that have no trees at all or widely scattered trees.
- Deciduous forests—contain mostly plants that periodically lose all their leaves.
- Rainforests—forests that receive more than 80 inches of rain per year.
- Deserts—areas that receive very little or no rainfall.
- Wetlands—areas that periodically have standing water or waterlogged soils.
- Oceans—large salty bodies of water that cover 75 percent of the earth's surface.
- Lakes and ponds—natural or artificial reservoirs that hold water.
- Streams—bodies of flowing water that moves from higher to lower elevations.



HABITATS

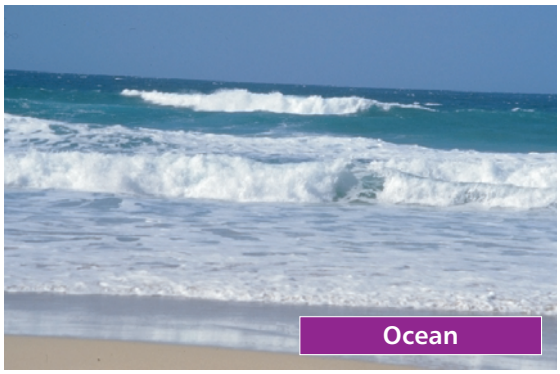

Prairie


Deciduous Forest


Rainforest


Desert


Wetland


Ocean


Lake


Stream

Name _____

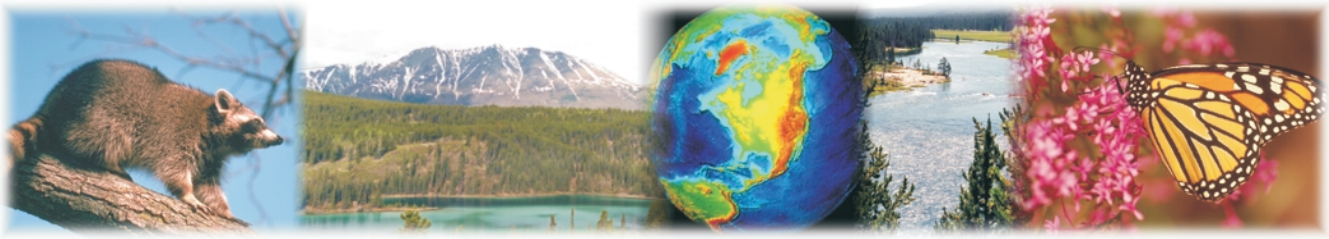
WILDLIFE CARD: PART 1

Materials

- ✓ One 4" × 6" note card
- ✓ Magazines or other materials with photographs of different wildlife animals
- ✓ Reference materials with information about wildlife animals
- ✓ Scissors
- ✓ Glue
- ✓ Markers

Directions

1. Think of a wildlife animal that you are interested in knowing more about.
2. Use magazines or other materials to find a photograph of your animal.
3. Cut out a photo of your animal and glue it in the upper lefthand corner of your note card. Make sure to leave room for the information you will be adding to the card.
4. Write the common name (the name most people use when describing the animal) on your note card.
5. Find and write the animal's scientific name on your note card.
6. You will keep your Wildlife Card and continue to add more information about your wildlife animal throughout this lesson.



Name _____

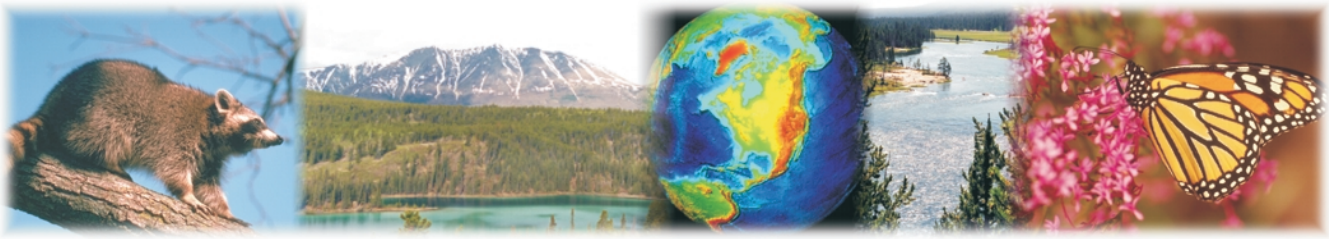
WILDLIFE CARD: PART 2

▶ Materials

- ✓ Wildlife Card (created in Part 1)
- ✓ Reference materials with information about wildlife animals
- ✓ Markers

▶ Directions

1. Based on what you have now learned, add some new information to your wildlife card.
2. Look for some of the following information about your wildlife animal and add it to your card:
   a. Is it a predator? Prey? Scavenger?
   b. Is it a herbivore, omnivore, or carnivore?
   c. What plants or other animals does it mostly eat?
3. Keep your Wildlife Card so you can add more information to it later.



WS KEY: F–3C

HOW TO SET UP A FOOD WEB ACTIVITY

Materials

- ✓ Index cards (one per student)
- ✓ Writing pen or marker
- ✓ Ball of yarn or string

Procedure

1. Create name cards for the activity by writing one item that is a part of a food chain on each index card. (Any item can be included. Here are a few to get you started: water, sun, deer, grass, snake, flower, oak tree, mouse, mallard duck, hawk, fly, ant, squirrel, trout, mosquito, spider, earthworm, sparrow, coyote, fox, walnut, acorn, walnut tree, bee, etc.) Be sure to make a card for each member of the group including yourself. You might want to laminate the cards. You could also punch holes in the cards and attach string to them so students can wear them around their necks during the activity.
2. Pass out one card to each student and have him or her assume the identity of that item.
3. Gather all students together in a circle.
4. Hand the ball of yarn or string to the student with the "SUN" card to begin the web. He or she should state the item he or she is and how that item fits into the ecosystem. While holding on to the end, the student should unwind the ball of yarn and toss it to someone else in the circle who has some type of connection or relationship with the sun. As the yarn is passed, the student should explain why he or she made this choice. For example, "The sun gives energy to the oak tree."
5. The next student should wrap the yarn around his or her hand while sharing what item he or she represents and its role in the ecosystem. Then, this student tosses the ball of yarn to someone else in the circle who has some type of connection or relationship. As it is passed, the student should explain why he or she made the choice.
6. Continue this same process until everyone is linked together with the yarn.
7. Have the students step back until the web is taut. Ask the student who started the web to begin gently tugging on the yarn. The rest of the students should not do anything unless they feel a tug on their yarn. If they feel a tug, they should respond with a tug. Eventually, everyone will be acting and reacting, causing the yarn to be in constant motion.
8. Explain that this activity illustrates how everything is connected to something else. It also illustrates that when something happens to one item, it affects something else.
9. Ask the students what they think would happen if something happened to one of the elements in the web.
10. Point to one student and announce that this plant or animal has been killed by a natural or human cause (storm, disease, pollution, habitat loss due to construction, etc.). That student should drop out of the web and let go of the yarn.
11. Each student who feels slack in the yarn must also let go. The entire web will soon be gone because one member of the food web was killed. Point out to students that members of a food web rely on one another, and when something happens to one member, it affects the entire web.

Name _____

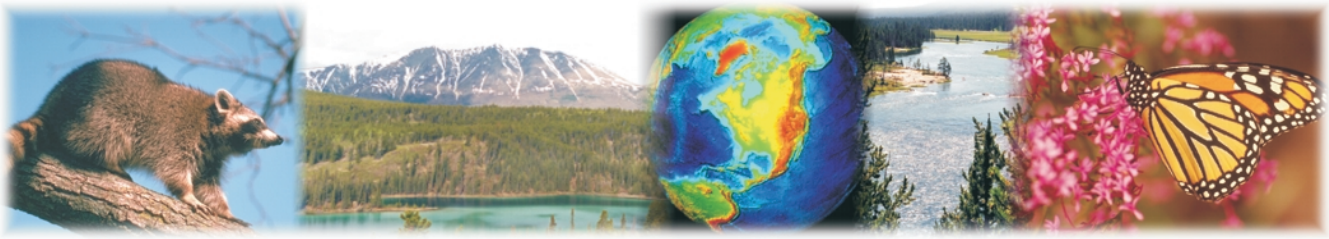
WILDLIFE CARD: PART 3

Materials

- ✓ Wildlife Card (from Parts 1 and 2)
- ✓ Reference materials with information about wildlife animals
- ✓ Markers

Directions

1. Based on what you now know about habitats, add some new information to your wildlife card.
2. Look for some of the following information about your wildlife animal's habitat and add it to your card:
   a. What type and how much food should the animal's habitat provide?
   b. Does the animal need a large supply of water in its habitat?
   c. What type of shelter or cover does the animal need in its habitat? Does it need protection from predators? Will the color of the surrounding vegetation blend in with the animal to help protect it? Does the animal need special shelter during hibernation, molting, reproductive season? Does the animal prefer to live in a tree, a cave, the water, the ground, etc.?
   d. How much space does the animal need? Is the animal large or small? Does it generally roam around over a large area or stay mostly in one particular area? Does it need a certain area for hunting or for grazing?
3. Keep your Wildlife Card so you can add more information to it later.



Name _____

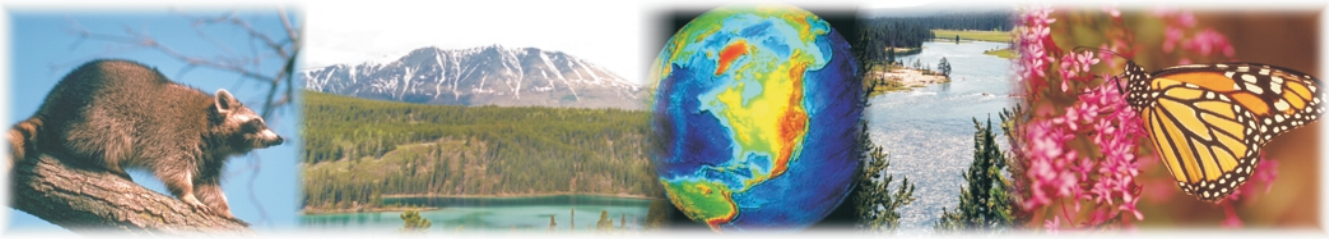
TYPES OF HABITAT

Materials

- ✓ Posterboard
- ✓ Information about different types of habitats
- ✓ Magazines with photographs of various wildlife habitats
- ✓ Markers or crayons
- ✓ Scissors
- ✓ Glue

Procedure

1. Look up information on the type of habitat your Wildlife Card animal would live in.
2. Create a poster for the habitat. You can use photographs from magazines for the different elements of the habitat, or you can use markers or crayons to draw the habitat. Be sure to include food, cover, water, and space in your animal's habitat.
3. Label the poster with the type of habitat.
4. Share your poster by creating a class bulletin board to display all of the different habitats.



Name _____

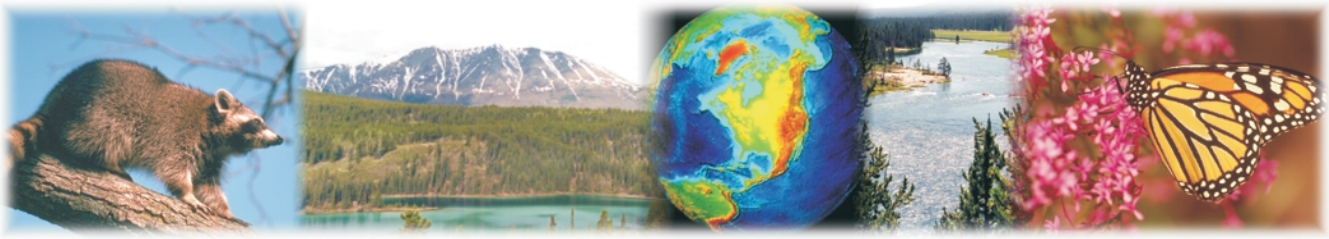
WILDLIFE CARD: PART 4

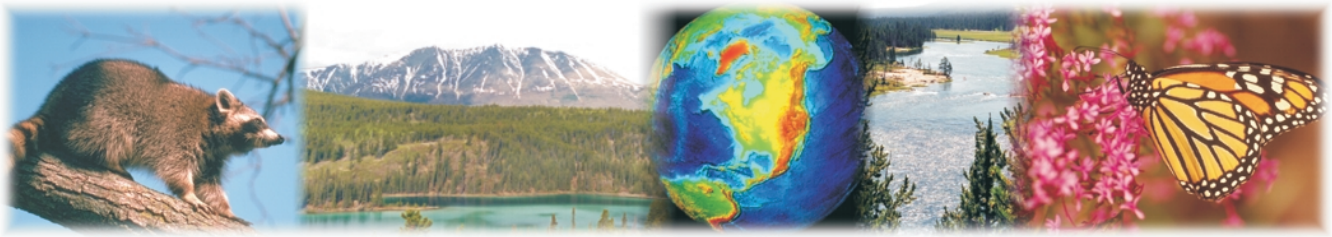
Materials

- ✓ Wildlife Card (from Parts 1, 2, and 3)
- ✓ Reference materials with information about wildlife animals
- ✓ Markers

Directions

1. Based on what you now know about different types of habitats, add some new information to your Wildlife Card.
2. Look for some of the following information about your wildlife animal's habitat and add it to your card:
   a. Is your animal terrestrial or aquatic?
   b. What type of habitat does your animal prefer?
   c. Where in the world would your animal find its particular habitat?
3. Your Wildlife Card is now complete! It contains valuable information about the wildlife animal you chose. Share your information with the rest of your class by placing your wildlife card in its correct habitat on the bulletin board you created in the last activity.





Lesson F–4

RENEWABLE RESOURCES

Indiana Agricultural Literacy Lesson Plan Library

Unit F. Environmental Science

Lesson 4. Renewable Resources

Indiana's Academic Standard. **Science:** 4.3.14 — Explain that energy in fossil fuels comes from plants that grew long ago.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe the difference between renewable and nonrenewable resources.
2. Recognize substitution possibilities of renewable resources, such as corn and soybeans, for nonrenewable resources.
3. Describe reasons for using agricultural products for industrial products.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

K-5 Soybean Science Kit: Polymers and Oil. Developed by Purdue University with support by the Indiana Soybean Development Council.

Indiana Soybean Association: Soy Uses Page—
www.indianasoybeanboard.com/SoyProductsToUse.html

National Corn Growers Association: Corn Based Products Guide—
http://lepton.marz.com/ncga/comm_dev_center/index.htm

Renewable Fuels Association: Student Information Page—
www.ethanolrfa.org/students.shtml

National Biodiesel Board: Student Information Page—
www.biodiesel.org/pdf_files/kids_sheet.pdf

Cargill Dow: Corn Plastics and Fibers — www.cargilldow.com/corporate/home.asp
(Shows how corn plastic and fibers are made in the "Nature Works" section.)

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Piece of candy for each student (such as a Hershey's kiss)

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Biodegradable
- ➤ Nonrenewable resource
- ➤ Renewable resource

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Give each student a piece of candy, such as a Hershey's Kiss, but tell them not to do anything with it yet. Have the students number off—1, 2, 3. Give the students the following information:*

1. *Tell the 1s that they may eat their candy. They represent consumption. Their candy comes from a renewable source. This is like a 24-hour store—open all the time if you need more.*
2. *Tell the 2s that they can eat their candy, but they have to make it last. Tell them to unwrap it slowly, eat in small bites, savor it for as long as possible, etc. They represent conservation. Their candy comes from a more limited source. This is like a store that is not always open and you have to drive a long distance to the store if you need more.*
3. *Tell the 3s that they only get to admire their candy. They cannot eat it. Tell them to admire the shiny wrapper, the shape, the smell, etc. They represent preservation. Their candy comes from a nonrenewable source that has been used up. This is like a store that the candy used to be available from has closed down and will never sell any more.*

Finish the activity by letting the students know that there is a place for all of them in our world. Some items are renewable and can be consumed without worry. Some items are more limited, such as a nonrenewable resource, and need to be conserved. Other items have been used up or the resources are so low that they need to be preserved because once they are gone, we cannot get more.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe the difference between renewable and nonrenewable resources.

Anticipated Problem: What is the difference between renewable and nonrenewable resources?

I. The earth's supply of natural resources such as petroleum oil is a limited supply that cannot be replenished once it is used up. Other resources are available in large amounts and can be replenished after they are used.

A. A ***nonrenewable resource*** is a resource that cannot be replaced by natural and/or human processes. Nonrenewable resources exist in limited amounts. Once these resources are depleted, they cannot be replaced or made again. Nonrenewable resources include petroleum oil and coal.

B. A ***renewable resource*** is a resource that can be replenished through natural and/or human processes. Corn and soybeans are two examples of agricultural products that are renewable resources. Corn and soybeans are grown every year. The supply from one year can be used and then replaced the following year by the new crop. Trees are renewable resources.

When trees die naturally or are harvested, new trees are naturally reseeded or can be replanted by humans.

Use TM: F–4A to cover the content of the objective. Use WS: F–4A to help students distinguish between renewable and nonrenewable resources.

Objective 2:

Recognize substitution possibilities of renewable resources, such as corn and soybeans, for nonrenewable resources.

Anticipated Problem: What are the possibilities of using renewable resources as substitutes for nonrenewable resources?

II. Many experts believe that unless drastic efforts are taken, the present reserves of some of our nonrenewable resources will be exhausted in our lifetime. To prevent this from happening, we can takes steps to save our resources. Researchers, scientists, and engineers throughout history have developed many industrial products made from renewable resources, such as corn and soybeans, as substitutes for nonrenewable resources. New uses for renewable resources are being discovered all the time.

A. George Washington Carver discovered the nutritional properties and industrial uses of soybeans in his soybean research at the end of the 19th century at the Tuskegee Institute. He developed more than 300 products from peanuts and soybeans, including plastics, soap, dye, rubber, and glue.

B. William Morse, also known as the "Father of Soybeans," was responsible for expanding the variety of soybeans grown in the United States. He brought more than 2,000 varieties of soybeans to the United States in 1931. He co-founded the American Soybean Association which continues to look for new uses for soybeans among other areas of research today.

C. Henry Ford was in the business of making cars. Ford helped popularize the soybean among all audiences. Having learned of the discoveries made by Carver, Morse, and other researchers, Ford became convinced that the soybean could be useful to the automobile industry. The scientists working for Ford eventually derived a strong plastic from soybeans used for gearshift knobs, horn buttons, window frames, accelerator pedals, light-switch assemblies, and ignition-coil casings. They also tried to make upholstery but didn't have any success. They did derive a thread-like substance from soybeans which was woven into cloth. Ford had two suits made from the soybean cloth which he wore for photo opportunities. The suits were quite fragile, however, and no one else is known to have worn a similar garment. Ford's scientists made the exterior of an automobile from soybean plastic. Ford publicized this finding through a famous photograph that shows him hitting an automobile with an ax to demonstrate the toughness of the soybean plastic exterior. By 1935, Ford was using a full bushel of soybeans in the manufacturing of each car. After World War II, petroleum based plastics replaced the soybean plastics in the automobile industry. Since then, no automobile manufacturer has done much with soybeans.

D. Rudolf Diesel, who was a French engineer and inventor of the diesel engine, originally designed the pressure-ignited heat engine that bears his name to run on pure peanut oil. From 1885 to 1898, Diesel worked on his invention until it was ready for production. Diesel engines revolutionized industry by replacing expensive, fuel-wasting steam engines. Diesel engines were used in farm equipment, industrial machines, trucks, buses, and boats. In the United States, diesel engines were primarily powered with petroleum fuel due to the availability and relatively low cost of petroleum oil.

E. Ethanol or ethyl alcohol (CH_3CH_2OH) is an alcohol fuel made from abundant agricultural resources. In the United States, ethanol is primarily produced from the starch contained in grains such as corn, grain sorghum, and wheat. One acre of corn produces 300 gallons of ethanol, which is enough to drive four cars for one year and replace 400 gallons of imported oil. Ethanol is non-toxic, water soluble, and is the most harmless and biodegradable component of gasoline.

F. Biodiesel refers to biodegradable diesel fuel made from renewable biological sources, such as vegetable oils. Rising petroleum prices, feared shortages of fuel, and the nonrenewable nature of petroleum make biodiesel an appealing alternative to petroleum diesel. In the United States, biodiesel is usually blended with petroleum diesel for optimum performance. Unlike petroleum diesel, biodiesel fuel emits a much lower amount of pollutants, is sulfur-free, and does not produce explosive vapors. Biodiesel provides similar horsepower, torque, and miles per gallon as petroleum diesel. Biodiesel is being used in buses, farm equipment, trucks, and boats.

G. Biodegradable plastic made from corn can be used to make many items, such as trash bags, cutlery, plates, and cups. Most plastics are made from petroleum based oil which uses up this nonrenewable resource. Petroleum based plastics also take much longer to break down in landfills. Plastics made from corn products such as cornstarch will break down in a much shorter time frame and not take up valuable landfill space. For example, a petroleum based trash bag may take about 100 years to decompose in a landfill. A cornstarch based trash bag, which is equal in strength, can decompose in five years or less.

H. Ecofoam is a packing peanut made with over 95 percent cornstarch. Ecofoam packing peanuts are used as loose fill in boxes to protect the contents. They are lightweight, shock absorbing, totally biodegradable, do not attract rodents, and contain no oil. Ecofoam can either be reused or simply dissolved in water to dispose of. Regular Styrofoam packing peanuts never break down. A very similar product called Wet N' Set Nuudles come in a variety of colors and are used as biodegradable building blocks.

I. Eco golf tees, ball markers, and golf balls can all be made from corn additives. In an active organic environment they degrade naturally within a year. The golf balls decompose within 96 hours with no toxic or hazardous residues left behind. Think about the length of time a cornstarch based golf tee takes to break down (less than a year) compared to a wooden tee (several years). Also, traditional wooden tees are made from trees, which can take 30 years to grow while corn grows each year.

J. Hydrosorb, also known as Super Slurper, is a cornstarch based polymer that absorbs water and converts it into a solid substance similar to Jell-O. Some varieties can absorb up to 2,000 times their weight in water. This powder simply gels when water is added. It is used in gel hot and cold packs, fuel filters, and some baby diapers. It has also been used in the horticulture industry. It is biodegradable and non-toxic.

K. Soy ink, which is made from soybean oil, is being used as a substitute for the petroleum oil in ink. Printing companies are using soy ink in a paste form to print newspapers and various printed literature. It is considered to be a high quality ink providing vibrant, rich colors. It prints more paper per pound and offers better color reproduction. Soy ink is much healthier for people who run printing presses because soybean oil is not volatile. Volatile substances are those that can be smelled easily because they give off a vapor. Soy ink is unique in that it will not rub off onto your hands as petroleum based ink does. Soy ink is removed more effectively during de-inking of the printing presses than petroleum ink, which means less solvent is needed. The resulting waste from soy ink is not considered hazardous. This ink is also safer for the environment. Soy ink is easier to remove from paper when recycling. Over 90 percent of all U.S. daily newspapers are printed using soy ink.

L. Soy glue was a product George Washington Carver discovered in the early 1900s. Soy adhesives are just now breaking through in the wood adhesives segment of the market. Lumber and plywood are two specific applications making progress towards soy adhesives. The wood industry previously relied on quick drying foamed glues that were formaldehyde based and made from dried animal proteins. Researchers have developed a foamed glue made from soybean protein. Soy based glues don't give off harmful fumes like the formaldehyde based products.

M. Environ is a biocomposite building material made from high-protein soy flour, recycled newspaper, and adhesives. It contains no hazardous or toxic substances. It is intended for indoor construction, such as counter tops, flooring, furniture, wall paneling, plaques, and more. It looks like polished granite. It is harder than oak and weighs less than granite. The advantage of Environ over other building materials is that it can be worked with like wood. The original idea came from a fifth grade girl from Minnesota as a part of a science fair project.

N. Soy crayons, which are made from soybean oil, are available on the market. The soy crayons are completely natural, environmentally safe, non-toxic, biodegradable, and relatively inexpensive to produce. One bushel of soybeans will make 2,112 crayons. They draw better than petroleum based paraffin wax crayons. They are smoother to work with because there is no waxy build-up.

O. Candles can be made from soybeans. When soy candles burn, they don't get as hot as many other candles and their fragrance spreads a lot faster. Soy candles also burn cleaner and don't leave the soot that other candles do.

P. Corn can be used to make clothing, bedding, and more. This is relatively new technology. Some corn based bedding products were recently released on the market in the United States.

Use TM: F–4B to show students some examples of products made with renewable resources. Use WS: F–4B to provide students with the opportunity to compare petroleum ink (nonrenewable resource) with soy ink (renewable resource). In this activity, students will be able to notice the difference in smell, thickness, and color. The chromatography experiment should also show students that the pigments in the soy ink will not separate due to their non-volatility; while the pigments of the petroleum ink

will separate into red, blue, orange, and yellow due to their volatility. Use WS: F–4C to have students make soy crayons.

Objective 3: Describe reasons for using agricultural products for industrial products.

Anticipated Problem: What are some reasons for using agricultural products for industrial products?

III. Industrial products made from agricultural products, such as corn or soybeans, have many benefits.

A. Agricultural products are a renewable resource. Using agricultural products as substitutes conserves our nonrenewable resources for other products that cannot be made from a renewable source.

B. Industrial products made with agricultural resources are more environmentally friendly than their petroleum counterparts.

1. Most of these products are ***biodegradable***, which means the substances are able to be broken down by microorganisms into simple, stable compounds such as carbon dioxide, water, and minerals.
2. Ethanol and biodiesel burn cleaner than petroleum based fuels, which results in less pollution.
3. Soy ink does not give off harmful, volatile fumes, which makes it safer for the workers and better for the environment.
4. Soy crayons are non-toxic.
5. Soy candles burn cleaner.

C. There is an abundant supply of agricultural resources. The United States produces enough corn and soybeans annually to supply all that is needed for the industrial products. This reduces our dependence on petroleum oil supplies from foreign countries.

D. Agricultural resources are relatively inexpensive to produce. This might also help keep the price of making industrial products lower.

E. Industrial products made from agricultural sources help to keep the surplus of agricultural commodities down.

Use TM: F–4C to cover the content of the objective. Use WS: F–4D to have students demonstrate the difference between Ecofoam and Styrofoam packing peanuts. Use WS: F–4E to have students make biodegradable plastics from corn. As an extension of this activity, you could have the students design an experiment to see what conditions affect the speed of the plastic to biodegrade. Students could put their corn plastic in different locations (dark area, window sill, refrigerator, desk, in the bag exposed to little air, out of the bag exposed to air, mixed with soil, mixed with water, etc.). Over the next several weeks students can observe the effects of each location on the process of biodegradation.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: F–4A, WS: F–4B, WS: F–4C, WS: F–4D, and WS: F–4E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

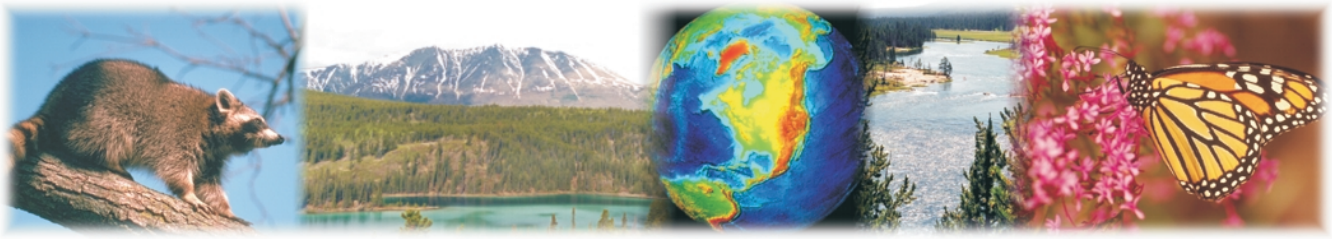
1. b
2. c
3. a

Fill-in-the-Blank

1. nonrenewable
2. renewable
3. William Morse
4. soybean

Short Answer

Answers will vary. Students should list four examples of the products discussed in Objective 2.



Test F–4

Name_____

RENEWABLE RESOURCES

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. renewable resource
b. nonrenewable resource
c. biodegradable

_____1. A resource that cannot be replaced by natural and/or human processes.

_____2. Substances are able to be broken down by microorganisms into simple, stable compounds such as carbon dioxide, water, and minerals.

_____3. A resource that can be replenished through natural and/or human processes.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Petroleum oil and coal are _____ resources.
2. Trees are _____ resources.
3. _____ _____, also known as the "Father of Soybeans," was responsible for expanding the variety of soybeans grown in the United States.
4. A famous photograph of Henry Ford shows him hitting the exterior of an automobile that was made from _____ plastic with an ax.

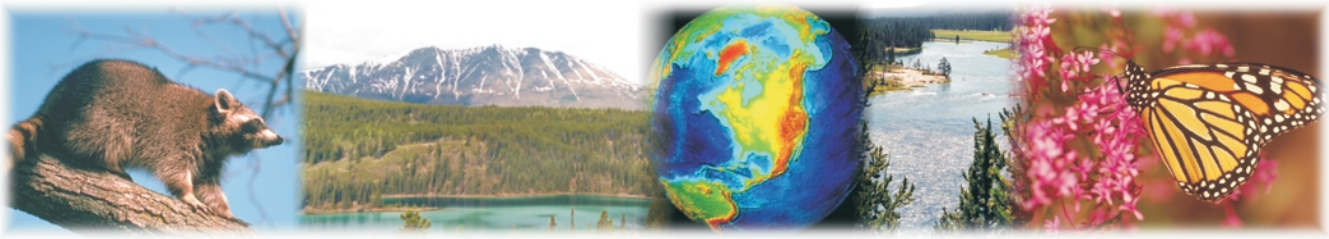
▶ Short Answer

***Instructions*. Answer the following question.**

Name four substitution possibilities of renewable resources for nonrenewable resources.

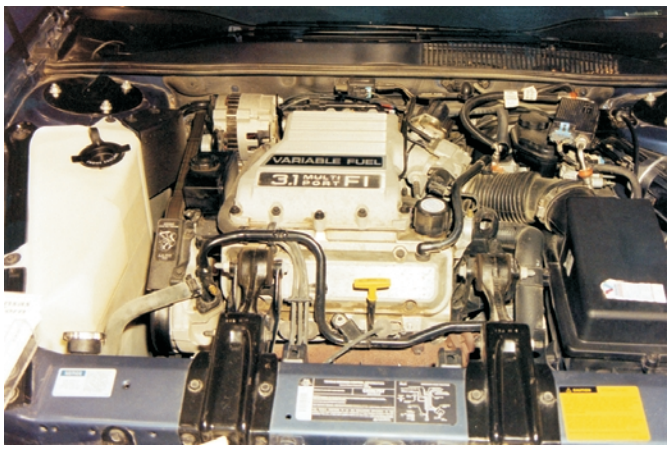
RESOURCES

- Nonrenewable resource—a resource that cannot be replaced by natural and/or human processes.
- Renewable resource—a resource that can be replenished through natural and/or human processes.



PRODUCTS MADE WITH RENEWABLE RESOURCES

ETHANOL ENGINE AND VAN



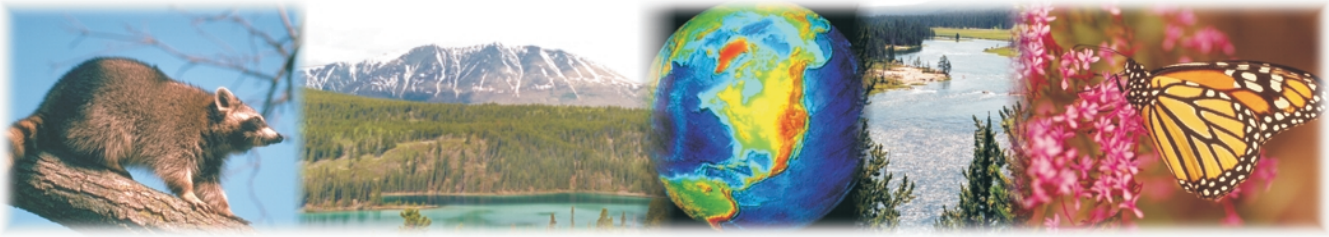
BIODIESEL TRUCK AND FARM EQUIPMENT

(Courtesy, Agricultural Research Service, USDA)

BENEFITS OF AGRICULTURAL SUBSTITUTES

Industrial products made from agricultural products, such as corn or soybeans, have many benefits.

- Agricultural products are a renewable resource.
- Industrial products made with agricultural resources are more environmentally friendly than their petroleum counterparts.
- There is an abundant supply of agricultural resources.
- Agricultural resources are relatively inexpensive to produce.
- Industrial products made from agricultural sources help to keep the surplus of agricultural commodities down.



WS: F–4A

Name _____

RENEWABLE OR NONRENEWABLE RESOURCES?

Directions

Decide whether the items listed below are renewable or nonrenewable resources. Write "R" for renewable or an "N" for nonrenewable on the line under each item.

_____1. Oil

_____2. Corn

_____3. Trees

_____4. Gold

_____5. Peanuts

_____6. Coins (made with minerals)

_____7. Coal

_____8. Soybeans

RENEWABLE OR NONRENEWABLE RESOURCES KEY

1. N
2. R
3. R
4. N
5. R
6. N
7. N
8. R

Name _____

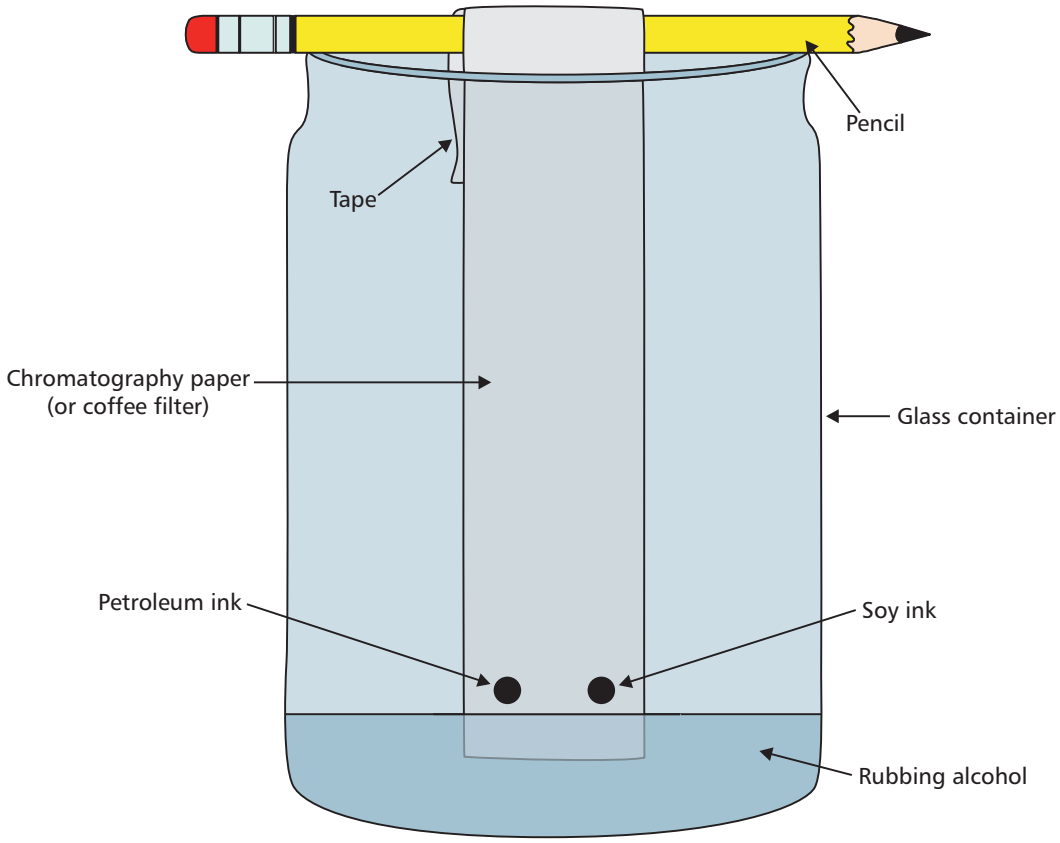
SOY INK VERSUS PETROLEUM INK

Materials

- ✓ Sample of soy ink
- ✓ Sample of petroleum ink
- ✓ One piece of chromatography paper or coffee filter (cut 1 inch longer than the container is tall)
- ✓ Small, clear glass container
- ✓ Toothpicks
- ✓ Pencil (long enough to fit across the opening of the container without falling in)
- ✓ Rubbing alcohol
- ✓ Tape

Procedure

1. Look at the soy ink and petroleum ink samples. Record your observations in the Data Table. What do they look like? What do they smell like?
2. Use a toothpick to place a spot of soy ink on to lower right-hand side of the chromatography paper. (See drawing.)



3. Use a new toothpick to place a spot of petroleum ink on the lower left-hand side of the chromatography paper.
4. Fold the opposite end (the end without ink on it) of your paper over a pencil so that the bottom of the paper does not touch the bottom of the container. Tape the paper around the pencil.
5. Place the pencil across the container so the paper hangs in the container.
6. Carefully pour rubbing alcohol into the container so that it touches the bottom of the paper but does not touch the ink spots. Make sure you do not splash the alcohol on the paper. Do not fill the container too high. Do not let the liquid reach the ink spots.
7. The alcohol will be drawn up into the paper. When the liquid has risen as high as the tape, take the paper out.
8. Record the results in the Data Table. What colors do you notice in the inks?

DATA TABLE		
	Soy Ink	Petroleum Ink
Observations of ink samples:		
Results of experiment:		

Name _____

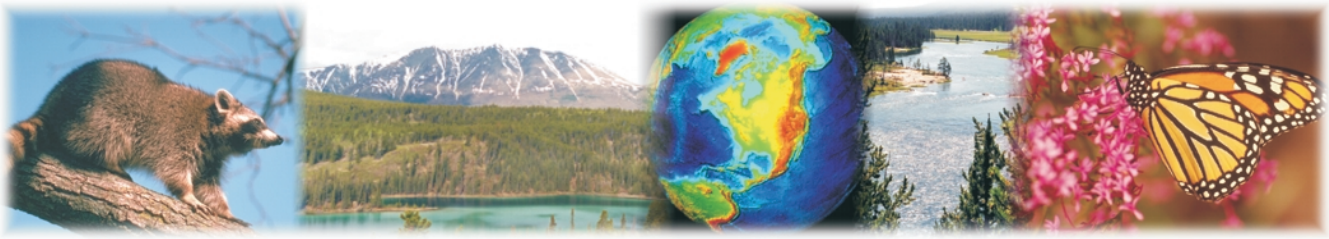
SOY BASED CRAYONS

Materials

- ✓ One 600 ml beaker
- ✓ 1½ cups fully hydrogenated soybean oil flakes
- ✓ Hot plate
- ✓ Stirring rod
- ✓ 4 teaspoons crayon pigment
- ✓ Candy molds (crayon-shaped, if available)
- ✓ Paper (for creating crayon labels)
- ✓ Scissors
- ✓ Markers
- ✓ Tape or glue (for crayon labels)

Procedure

1. Put 1½ cups of fully hydrogenated soybean oil flakes in the 600 ml beaker.
2. Place the beaker on the hot plate on the low setting.
3. Continue heating, stirring occasionally, until the solid oil flakes turn to liquid.
4. When the oil is liquefied, add 4 teaspoons of crayon pigment.
5. Continue heating, stirring frequently, until the pigment is evenly distributed in the oil. (The pigment is encapsulated and must be heated to melt the capsule.)
6. Remove the mixture from the heat. Let it cool for two minutes to prevent damage to the plastic candy molds.
7. Pour the mixture into the candy molds and allow to cool for about 30 minutes.
8. While the crayons are cooling, create labels for your crayons out of paper. Cut out pieces of paper that will wrap around your crayons. Put your name on the labels and use markers to decorate them.
9. When cool, remove the crayons from the molds.
10. Tape or glue your crayon labels around the crayons.
11. Try out your new soy crayons! Be careful with your crayons because they may break easier than store-bought soy crayons due to the simplified process in which you made them.



Name _____

COMPARING PACKING PEANUTS

Materials

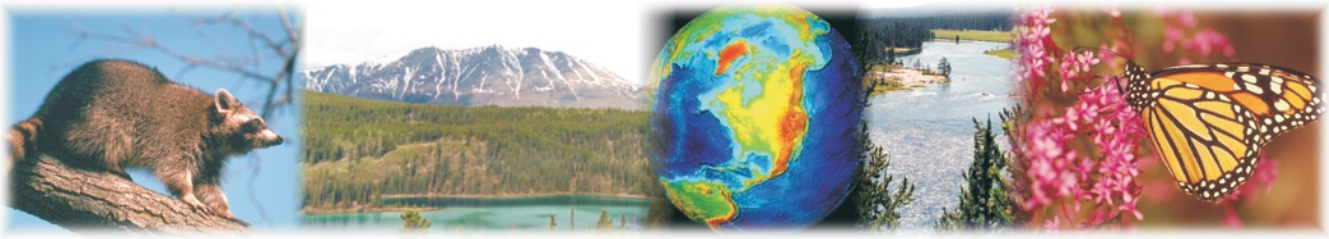
- ✓ Two quart size resealable plastic bags
- ✓ 5–10 Styrofoam packing peanuts
- ✓ 5–10 Ecofoam packing peanuts
- ✓ Water
- ✓ Permanent marker

Procedure

1. Label one plastic bag "STYROFOAM," and label the other bag "ECOFOAM."
2. Fill the STYROFOAM bag ¾ full of water.
3. Add the Styrofoam packing peanuts.
4. Seal the bag tightly, and shake the bag for a couple of minutes.
5. Record your observations.
6. Fill the ECOFOAM bag ¾ full of water.
7. Add the Ecofoam packing peanuts.
8. Seal the bag tightly, and shake the bag for a couple of minutes.
9. Record your observations.

Conclusion

Styrofoam packing peanuts are made from petroleum oil—a nonrenewable resource. Ecofoam packing peanuts are made from cornstarch—a renewable resource. What happened to the different packing peanuts? What does this tell you about which type of peanut creates more waste? Why would it be a good idea to use one type of peanut over the other? Which type of packing peanut would be better for our environment?



Name _____

BIODEGRADABLE PLASTICS FROM CORN

Materials

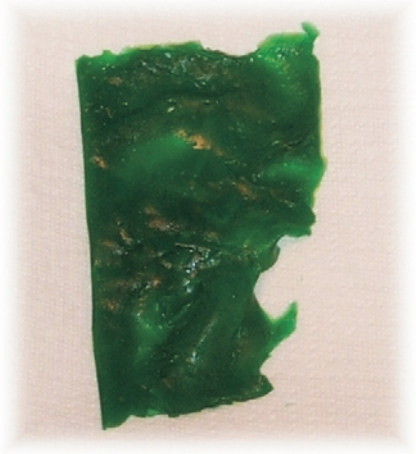
- ✓ One quart size resealable plastic bag
- ✓ 1 tablespoon cornstarch
- ✓ 2 drops corn oil
- ✓ 1 tablespoon water
- ✓ 2 drops food coloring (any color)
- ✓ Microwave

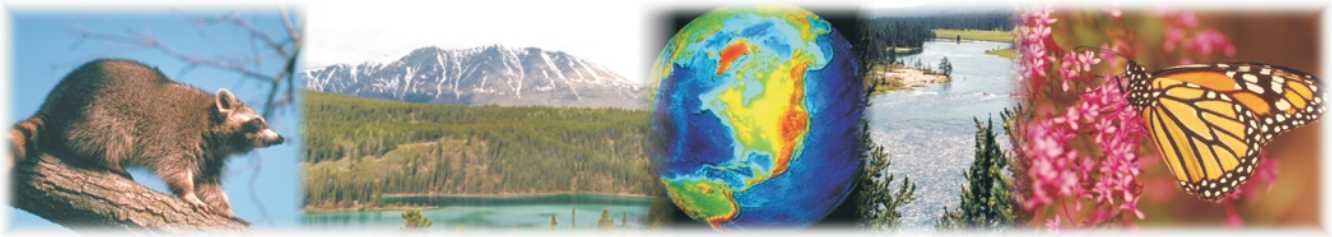
Procedure

1. Place 1 tablespoon of cornstarch in the plastic bag.
2. Add 2 drops of corn oil to the bag.
3. Add 1 tablespoon of water to the bag.
4. Add 2 drops of food coloring to the bag.
5. Seal the bag tightly and knead the mixture well.
6. Heat the bag in the microwave for 20 to 30 seconds on high power.
7. Carefully remove the bag from the microwave and take a look at your biodegradable plastic! **CAUTION:** Mixture will be hot.
8. Place the bag in a safe location. Observe the plastic over the next several weeks to watch the biodegrading process.

Conclusion

What properties does your biodegradable plastic have? Is your biodegradable plastic the same as the other students? How is it similar or different? What could you make out of this plastic if you let it harden (remember, it will eventually dissolve)?





Lesson F–5

RECYCLING

Indiana Agricultural Literacy Lesson Plan Library

Unit F. Environmental Science

Lesson 5. Recycling

Indiana's Academic Standard. **Science:** 4.3.13 — Observe and describe the things that give off heat, such as people, animals, and the sun.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain what a landfill is.
2. Recognize that landfills are not the answer to the solid waste problem.
3. Explain what is needed for decomposition to occur.
4. Identify reducing, reusing, and recycling as ways to reduce solid waste.
5. Recognize recycling symbols.
6. Explain the benefits of composting and vermicomposting.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Appelhof, Mary. *Worms Eat My Garbage: How to Setup and Maintain a Vermicomposting System.* Kalamazoo, Michigan: Flower Press, 1997.

Appelhof, Mary. *Wormania!* Kalamazoo, Michigan: Flower Press, 1995. (26 minute video shows unique footage of live worms at work and baby worm hatching from cocoon; includes 48 page teaching guide.)

Backyard Conservation. Ankeny, Iowa: U.S. Department of Agriculture Natural Resources Conservation Service, 1998. (Available for free by calling 888-LANDCARE or online at www.nrcs.usda.gov/feature/backyard/)

Children's Television Workshop. *The Rotten Truth.* Pleasantville, New York: Sunburst/WINGS for Learning, 1990. (30 minute video about garbage, landfills, and recycling)

Gilman, Phoebe. *Something from Nothing.* New York, New York: Scholastic Inc., 1992.

Indiana Department of Energy Management: Kid's Site — www.in.gov/idem/enviroville/

Indiana Department of Energy Management: Recycling Home Page — www.in.gov/idem/oppta/recycling/

Indiana Recycling Coalition — http://indianarecycling.org/precycle/index.html

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Mary Appelhof's Website for Worm Composting Resources — www.wormwoman.com

Pollution Prevention Brochure — www.in.gov/idem/oppta/p2/p2basics.pdf

Project LEAP (resources for teachers) —www.in.gov/idem/leap/

Silverstein, Shel. *Where the Sidewalk Ends.* New York, New York: Harper Collins, 1974.

The 3R's Activity Book: An Educator's Guide to Fun Recycling Projects. Springfield, Illinois: Illinois Department of Commerce and Community Affairs, 2001.

Things We Can Learn from a Cow and a Worm. Chicago, Illinois: National Cattlemen's Beef Association, 1996. (Teachers can receive a free copy by calling 800-368-3138. Poster and activities portray nature's models for conserving the earth's resources.)

University of Illinois Extension's Just for Kids Website of Herman the Worm — www.urbanext.uiuc.ed/worms/ (Great site for all ages—interactive, provides good links, information for teachers, available in Spanish.)

U.S. Environmental Protection Agency's Planet Protectors Club — www.epa.gov/epaoswer/osw/kids/index.htm

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Trash in a clear bag
- ✓ Old newspaper
- ✓ Rubber gloves

Terms. The following terms are presented in this lesson (shown in bold italics):

- Composting
- Decomposition
- Dump
- Landfill
- Leachate
- Methane gas
- Mobius loop
- Recycle
- Reduce
- Reuse
- Sanitary landfill
- Solid waste
- Vermicomposting

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Bring in a clear trash bag full of trash (no food scraps or harmful items). As a class, examine what has been thrown away. If possible, you could put down some newspaper and use gloves to pull out some items. Have students think about where the trash came from and whether it could have been used for something else rather than being thrown away. Ask students to think about where this bag of trash will go. Help them trace a path and record it on the writing surface. The path may begin with someone throwing the item away. When the bag gets full, it is moved to a container in the backyard or garage. It may then be set out for trash pick up. A truck picks it up and takes it to a landfill and so on.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain what a landfill is.

Anticipated Problem: What is a landfill?

I. Americans have become a "throw-away" society over the last 50 years. Each year we generate millions of tons of trash. We use many disposable items every day. Once most people throw something away, they seldom think about where it goes.

A. Most of the trash we throw away is solid waste. ***Solid waste*** is waste material produced by people that does not include liquids, hazardous wastes, and nonsolid materials.

B. In the past, most of our solid waste was taken to a dump. A ***dump*** is an open hole in the ground where waste is thrown. Dumps are an invitation to rats, mice, snakes, mosquitoes, and insects. Areas near dumps are not inviting to live around because the stench, or odor, is not pleasant. The soil and groundwater near dumps can easily become polluted. Because of these problems, dumps are illegal today.

C. Today, most of our solid waste eventually ends up in a landfill. A ***landfill*** is a specially created place where solid waste is buried in layers and covered with soil.

1. First, land is surveyed by geologists to select the best possible location for a landfill.
2. Construction workers then dig a very large hole in the ground.
3. The sanitary landfill is then lined with clay and plastic to prevent potentially harmful liquids from leaking into the water supply. A ***sanitary landfill*** is a site for the disposal of nonhazardous wastes.
4. Landfills are designed to divert rainfall and keep it from being absorbed into the landfill.
5. A leachate collection system exists within the landfill to prevent contamination of groundwater sources. ***Leachate*** is the liquid resulting from solid waste drippings that may contaminate surface or groundwater. Groundwater monitoring wells also help watch for pollution.
6. The ***methane gas***, which is a product of waste decomposition, produced by the landfill is flared and released into the atmosphere or is converted into an energy resource.
7. Each day that waste is added to the landfill, bulldozers compact the waste and cover it with a layer of soil.
8. When the landfill reaches its capacity, the hole is sealed with at least 6 feet of soil. It is then planted with grass.
9. The landfill site is monitored for many years. Many of these sites are eventually converted into parks, playgrounds, parking lots, or airports. The LaGuardia and JFK airports in New York were built on top of landfills.

Use TM: F–5A to show students an illustration of how a landfill operates. Use TM: F–5B to show students how a sanitary landfill is designed. Help students locate the nearest landfill. Contact local solid waste haulers to find out where their waste goes. Students could also research where old landfills and dumps may have been located near your area (ask city officials, check at a local library, or look for information on the Internet).

Objective 2: Recognize that landfills are not the answer to the solid waste problem.

Anticipated Problem: Are landfills the answer to the solid waste problem?

II. Sanitary landfills may work well for disposing of wastes, but they create many problems.

A. Landfills require a lot of space. They have to be lined to prevent leachate from polluting groundwater. Recovery systems must be in place to collect the methane gas to prevent fires and explosions.

B. Suitable sites for landfills are difficult to find. Sites are scientifically planned to protect the groundwater and air. The local climate and geology have to be considered. They must be located in an environmentally safe place. New sites are expensive to buy. People generally do not want a landfill placed near their home. Most people respond "not in my backyard."

C. Landfills fill up quickly. We generate millions of tons of trash. As landfills fill up, waste has to be hauled elsewhere. With many landfills already full, we will have to continue to try to find room for landfills now and in the future. Biodegradable materials decompose very slowly in a landfill because of the compaction, which limits air, water, and light.

D. Many old landfills contaminate the soil and water. Landfills were not always lined. Some waste requires special attention before it goes into a landfill to prevent pollution and to keep from endangering the public.

Use TM: F–5C to cover the content of the objective. Use WS: F–5A to have students conduct a survey to determine overall opinions of landfills. As students research the nearest landfill, they may want to find out what some of the costs are for solid waste hauling, landfill management costs, etc.

Objective 3: Explain what is needed for decomposition to occur.

Anticipated Problem: What is needed for decomposition to occur?

III. ***Decomposition*** occurs when something naturally decays or breaks down into smaller parts.

A. Microorganisms, like fungi and bacteria, feed on organic matter and help break it into smaller and smaller parts.

B. Light, air, and moisture are needed for decomposition. All of these things are limited, if present at all, in sanitary landfills due to compaction. Therefore, waste will not decompose

at a normal rate. People have recovered paper and other items from landfills that were essentially unchanged after 15 to 25 years.

C. Different items also require different amounts of time to decompose. For example:
   1. Banana peel — 3 to 4 weeks
   2. Paper bag — 1 month
   3. Cotton rag — 5 months
   4. Wool sock — 1 year
   5. Wood — 10 to 15 years
   6. Leather shoe — 40 to 50 years
   7. Tin can — 80 to 100 years
   8. Aluminum can — 200 to 500 years
   9. Disposable diapers — 500 to 600 years
   10. Plastic jug — 1 million years

Use TM: F–5D to illustrate some of the different lengths of time needed for items to decompose. Use WS: F–5B to have students build a mini-landfill and observe the decomposition that takes place.

Objective 4: Identify reducing, reusing, and recycling as ways to reduce solid waste.

Anticipated Problem: How can reducing, reusing, and recycling help reduce solid waste?

IV. A lot of the waste that we discard doesn't have to end up in a landfill. Of the materials we generally throw away, 37.4 percent is paper, 12 percent is yard wastes, 11.2 percent is food wastes, 10.7 percent is plastics, 7.8 percent is metals, 6.7 percent is rubber and leather, 5.5 percent is wood products, and 5.5 percent is glass. Most of the items in this list can be reused or recycled. Products that can't be reused or recycled may have alternatives that could be considered to reduce the amount we throw away.

A. ***Reduce*** means to make less of. Reducing waste involves not sending as much trash to the landfill. There are many ways that individuals and businesses can try to reduce waste.
   1. When products are created and designed, packaging should be minimized to reduce the amount that will be thrown away when the product is purchased.
   2. Buy frequently used items in larger quantities so less packaging has to be thrown away.
   3. Buy items that are refillable (such as soap).
   4. Purchase durable, long-lasting goods to reduce the need for replacing items.
   5. Maintain or repair items to reduce the amount that is thrown out (furniture, electronics, storage containers, etc.).
   6. Limit the amount of products that you use which contain hazardous compounds.
   7. Share or rent items that are not used very often.
   8. Use both sides of a piece of paper to reduce the amount of paper needed.
   9. Pack your lunch in reusable containers to reduce the amount of trash thrown away.

10. Use dishes, silverware, and glasses instead of disposable utensils, cups, and plates.

B. ***Reuse*** means to use a product more than once in its same form for the same or different purpose. Reusing items helps our environment. They are many ways we can reuse items instead of throwing them away.
   1. Pass on items to others through yard sales, secondhand stores, and donations to charitable organizations rather than just throwing them out.
   2. Give away before you throw away. Clothing, especially for youth, can often be reused because many young people outgrow the items before they wear out. Household furnishings and decorations that are no longer needed or wanted may be of use to someone else.
   3. Reuse boxes and bags for storage and gifts.
   4. Reuse packing materials.
   5. Use washable containers over and over again instead of buying new paper or plastic items that will get discarded after use.
   6. Use leftover paper as scratch paper.
   7. Jars and coffee cans make great storage containers.
   8. Donate old magazines, books, or surplus equipment. The Indiana Department of Energy Management's Office of Pollution and Technical Assistance established an electronic bulletin board to aid in the dissemination of information on surplus and waste materials either available from or wanted by industrial and commercial entities.

C. ***Recycle*** means to make something into a new product so that it can be used again. Recycling involves collecting materials, separating them by type, remaking them into new products, and marketing and reusing the materials as new products. Recycling helps reduce solid waste.
   1. Items that may be recycled include newspaper, office and computer paper, aluminum cans, tin cans, glass, phone books, magazines, cardboard and paper board, some plastic bottles, milk jugs, steel, used oil, tires, and old batteries.
   2. Some communities offer curbside recycling that allows residents to simply put their recyclables out for pickup.
   3. Recycling drop off locations provide a place for consumers to take their recyclables. According to a survey done at the end of 2001, at least 95 percent of Indiana residents live within 8 miles of a recycling location or are directly serviced by a curbside recycling program.
   4. Our recycling efforts should not stop with recycling products. It is also important to then buy recycled materials. This helps conserve energy and resources.
   5. Products made from recycled materials include school and office paper, paper and plastic bags, facial and toilet tissue, clothing, carpeting, cereal and cracker boxes, aluminum cans, packaging supplies, plastic containers, and lumber.

Use TM: F–5E to illustrate the percentages of different materials we discard. Use TM: F–5F to show students some examples of recycling. Use WS: F–5C and WS: F–5D to help students recognize ways they can reduce and reuse. Use WS: F–5E to have students set up a recycling center in the classroom. Students can bring in recyclables

to be sorted for a week, two weeks, or as a long-term commitment to recycling. They can also create posters or flyers to encourage other students in the school to bring in materials to be recycled. Locate the nearest recycling center to take the items to. You may check if the recycling center gives tours, or if someone from the center is available to come to the school to speak with the students.

Objective 5: Recognize recycling symbols.

Anticipated Problem: What do recycling symbols mean?

V. Different symbols are used to represent different areas of recycling. Recycling symbols can be used to represent the recycling concept, to help determine how items need to be sorted to be recycled, or to identify items made from recycled products.

A. The ***Mobius Loop*** symbolizes the continuous circle of recycling. It looks like three arrows chasing each other in the form of a triangle. Just like the loop, recycling can be a never-ending cycle.

B. Items that can be recycled usually have the Mobius Loop symbol located somewhere on them. For example, if you look on the bottom of most plastic containers such as a milk jug, you will find the Mobius Loop.

C. Recycling symbols can also help you sort items into the proper containers at recycling facilities. Plastic containers often have a number inside the Mobius Loop to identify the type of plastic it is. For instance, many milk jugs have the number 2 within the Mobius Loop to indicate that it is made from high density polyethylene. Some plastics are easier to recycle than others.

D. Items that are made from recycled materials have the Mobius Loop enclosed in a circle on them. Paper is a common item made from recycled materials.

Use TM: F–5G to discuss with students the different recycling symbols and their meanings. Use TM: F–5H to show students the different plastic recycling symbols. Use WS: F–5F to have students construct their own Mobius Loop. Use WS: F–5G to encourage students to decorate a Mobius Loop with recyclable items. Have students look for the recycling symbols on products they have at home. Ask them to bring in some containers or products with the symbols on them. Set up a display of the different symbols in the classroom or library.

Objective 6: Explain the benefits of composting and vermicomposting.

Anticipated Problem: What are the benefits of composting and vermicomposting?

VI. ***Composting*** is the controlled biological decomposition of organic materials. It is another form of recycling. Composting happens naturally in our environment. Think about the natural composting that takes place in forested or wooded areas. Plant materials (leaves, twigs, logs, etc.) and dead animals eventually decompose or deteriorate. ***Vermicomposting*** is using worms to recycle food waste into valuable fertilizer (plant food).

A. Composting enriches and improves the consistency of the soil while reducing the amount of solid waste requiring disposal. Composting turns organic material normally thrown away, such as grass clippings, leaves, coffee grounds, and fruit peels, into a rich, natural fertilizer. In a compost heap, microscopic (too small for the human eye to see) bacteria, fungi, and other decomposers, such as earthworms, mites, grubs, and insects, break down organic matter. When the organic wastes are combined with the decomposers and receive sufficient air and water, the decomposing organisms, especially bacteria, thrive and multiply. The bacteria generate a temperature of up to 150°F and literally "cook" the waste. The finished product is called compost, and it makes a great fertilizer.

B. When making a compost pile, you will need soil, organic wastes, fertilizer containing nitrogen, and manure or green grass clippings containing nitrogen, earthworms, water, air, time, heat, and mass (lots of material).

1. Soil contains microorganisms (bacteria) that help decompose organic matter.
2. Organic wastes should include carbon and nitrogen such as leaves, fruit, and vegetable scraps, eggshells, coffee grounds, and grass clippings. Do not compost meat scraps, fats, and oils. Those items will inhibit decomposition and strong odor can attract dogs, rats, raccoons, or other pests. Alternating layers of high-carbon and high-nitrogen wastes creates good environmental conditions for decomposition to occur.
3. Fertilizer containing nitrogen and manure or green grass clippings containing nitrogen should be included in the compost pile. Many of the organisms responsible for decomposition need extra nitrogen for rapid and thorough decomposition.
4. Earthworms eat the waste and help break it down. They eat almost anything soft enough to chew. As organic matter passes through their body, it is ground up by tiny stones in the gizzard, and leaves the body as waste in the form of dark, fertile castings containing partially digested material that enriches the soil. Earthworms also tunnel through and aerate the waste and soil, which aids decomposition. They eventually die and become part of the compost.
5. Water is an essential component of the decomposition process. Too much water can make the compost pile soggy and slow decomposition by reducing needed oxygen.
6. Air is necessary in a compost pile. Fungi, bacteria, small insects, and other decomposing organisms require adequate amounts of oxygen to survive and function.
7. Decomposition takes time. The amount of time required depends on the size of the compost pile, the temperature, the contents of the compost, and many other factors.

8. Heat is a by-product of the chemical reactions occurring during decomposition. A properly functioning compost pile can reach temperatures of 150°F. These high temperatures help sanitize compost by killing weed seeds, pathogens, and harmful insect larvae.
9. Effective composting requires mass. To generate enough heat for optimal decomposition, a compost pile should contain at least 1 cubic meter of organic material, oxygen, and moisture.

C. Vermicomposting uses worms to recycle food waste into plant food.
1. Worms prefer a dark, moist environment.
2. Red worms are better for indoor worm bins because they are more at home in the small space and warmer temperatures of the worm bin. They also reproduce faster than earthworms.
3. Earthworms like wide open spaces and prefer cooler temperatures. They don't like having their burrows disturbed. Adding food and scratching around in the bin upsets them. Although earthworms are not very good for your worm bin, they're great outdoors in gardens, fields, and compost areas.
4. Vermicomposting requires an aerated environment containing soil and moistened bedding which becomes a suitable habitat for red worms when organic waste is added.
5. Aerobic bacteria and other microorganisms decompose the waste and become worm food.
6. Worms recycle these nutrients into rich humus, excreted as castings which support plant growth.

D. Composting keeps organic wastes out of landfills, provides nutrients to the soil, increases beneficial soil organisms (such as worms and centipedes), suppresses certain plant diseases, reduces the need for fertilizers and pesticides, and protects soils from erosion.

Use TM: F–5I and TM: F–5J to show students some examples of various compost bins. Use WS: F–5H to have students create their own mini-vermicomposting bins. You may extend this activity by having students keep a journal to record their observations over the next several weeks. Throughout the course of their investigation, you might plan visits from the "Worm Doctor." The Worm Doctor can visit the worms in the evening and leave notes to the students in the form of advice on care, comments on the menu offered (including possible food suggestions), various worm facts or trivia, or simply praise for doing a good job. Consider creating a classroom vermicomposting bin at the beginning of the school year and follow it throughout the year.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: F–5A, WS: F–5B, WS: F–5C, WS: F–5D, WS: F–5E, WS: F–5F, WS: F–5G, and WS: F–5H.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

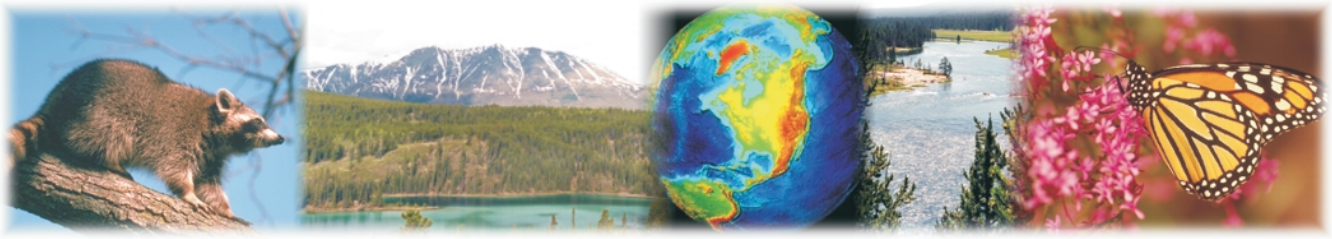
1. e
2. b
3. d
4. a
5. c

Fill-in-the-Blank

1. Decomposition
2. Recycle
3. Vermicomposting

Short Answer

1. Reduce, reuse, and recycle. Use Objective 4 to score this question.
2. Students should draw a reasonable representation of the Mobius Loop.



Test F–5

Name_____

RECYCLING

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. dump
b. landfill
c. leachate
d. methane gas
e. solid waste

_____1. Waste material produced by people that does not include liquids, hazardous wastes, and nonsolid materials.

_____2. A specially created place where solid waste is buried in layers and covered with soil.

_____3. A product of waste decomposition produced by the landfill that is flared and released into the atmosphere or is converted into an energy resource.

_____4. An open hole in the ground where waste is thrown.

_____5. The liquid resulting from solid waste drippings that may contaminate surface or groundwater.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ occurs when something naturally decays or breaks down into smaller parts.

2. _____ means to make something into a new product so that it can be used again.

3. _____ is using worms to recycle food waste into valuable fertilizer (plant food).

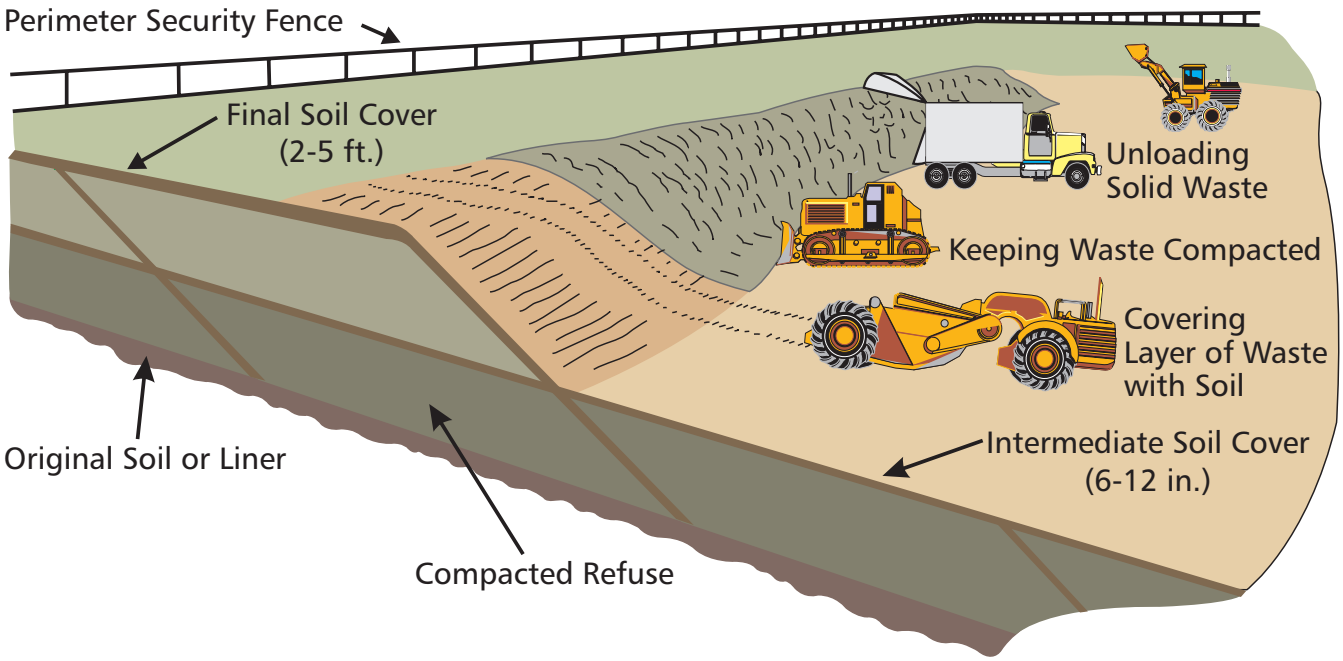
Short Answer

***Instructions*. Answer the following questions.**

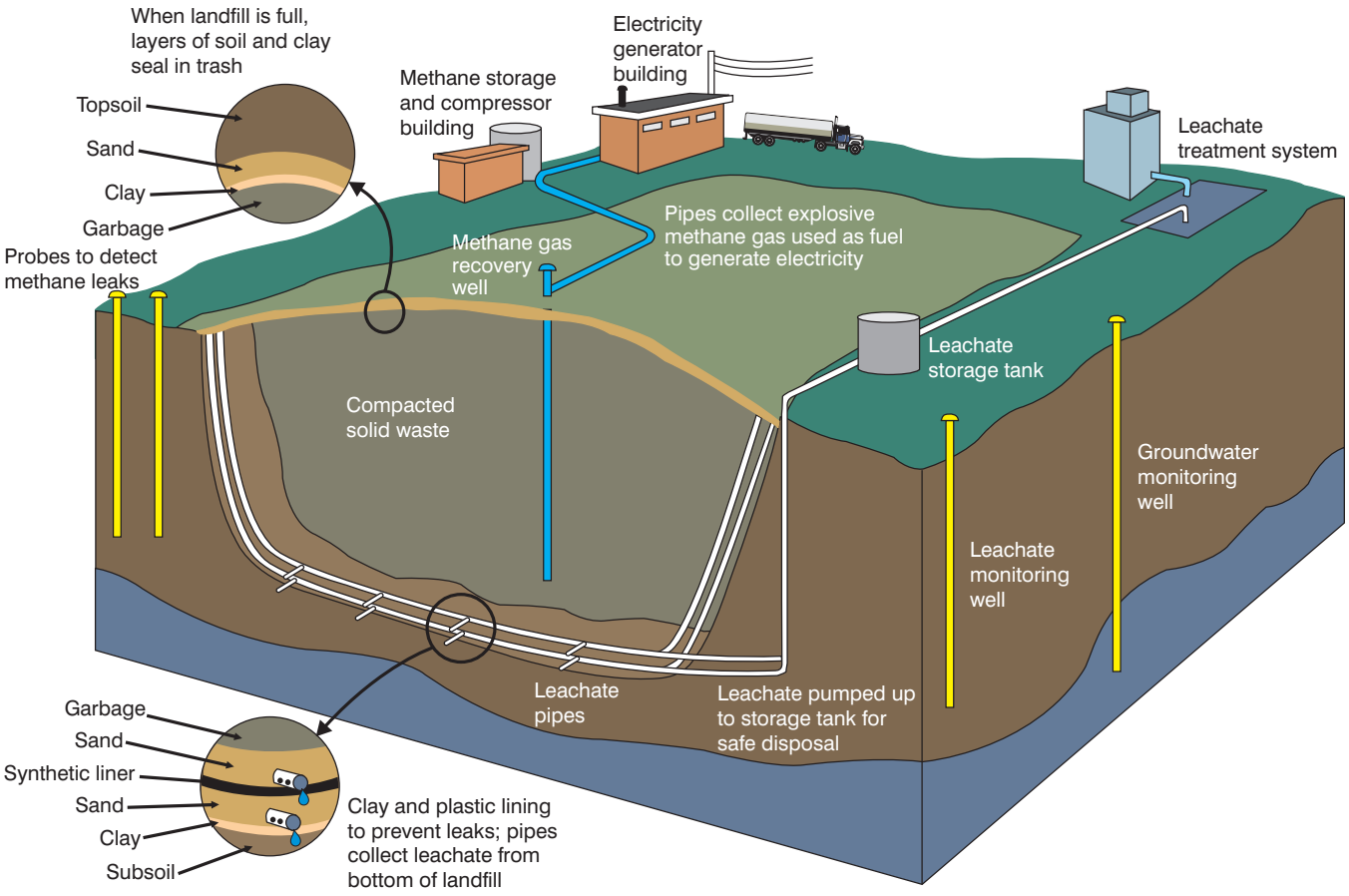
1. Explain how to cut down on the amount of solid waste that ends up in landfills.

2. Draw the symbol that you may find on the bottom of your plastic milk jug or plastic soda bottle.

HOW A LANDFILL OPERATES

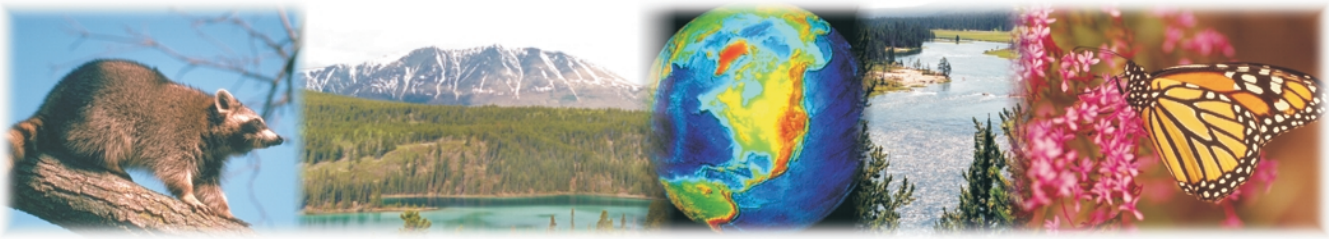


DESIGN OF A SANITARY LANDFILL



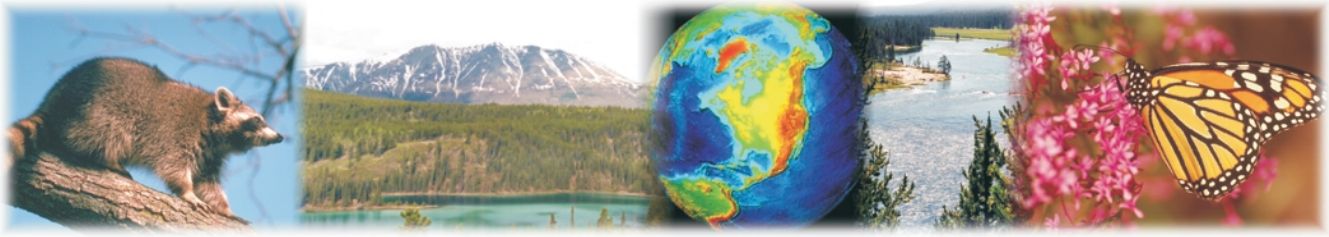
DISADVANTAGES OF LANDFILLS

- Landfills require a lot of space.
- Suitable sites for landfills are difficult to find.
- Landfills fill up quickly.
- Many old landfills contaminate the soil and water.

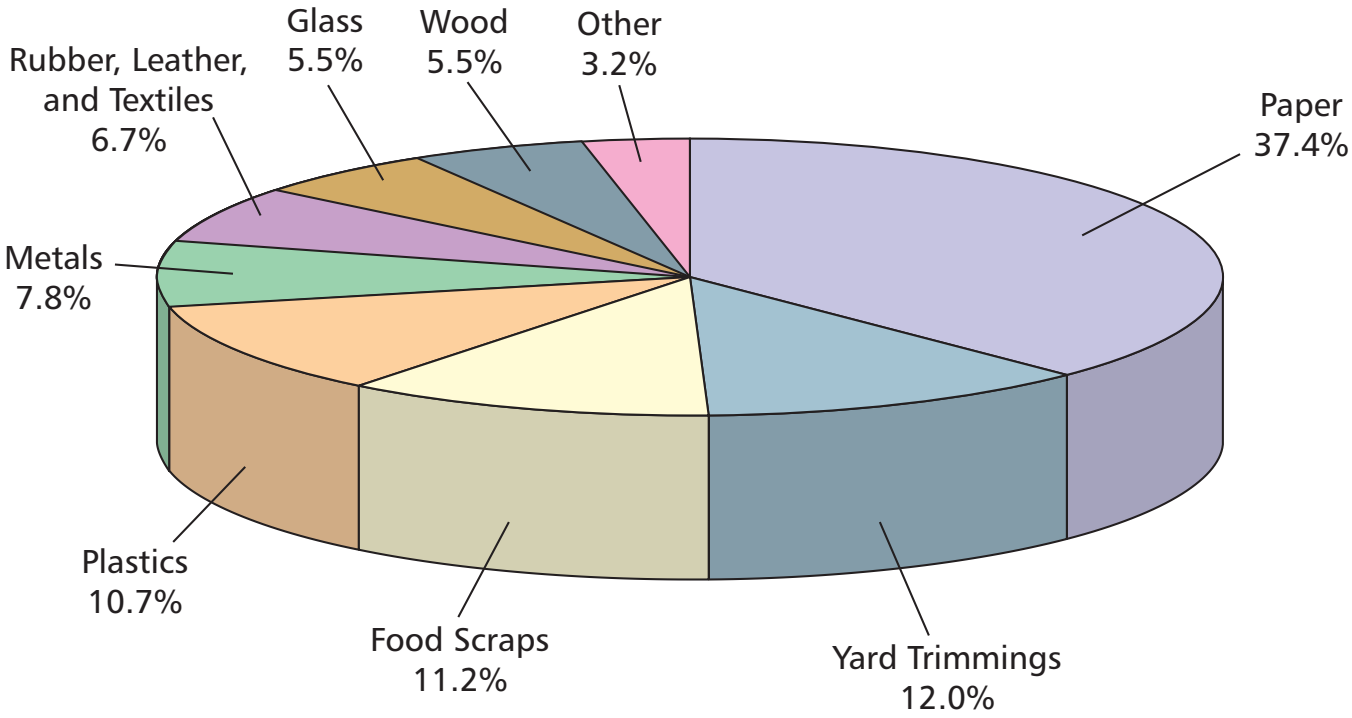


DECOMPOSITION TIME

- Banana peel — 3 to 4 weeks
- Paper bag — 1 month
- Cotton rag — 5 months
- Wool sock — 1 year
- Wood — 10 to 15 years
- Leather shoe — 40 to 50 years
- Tin can — 80 to 100 years
- Aluminum can — 200 to 500 years
- Disposable diapers — 500 to 600 years
- Plastic jug — 1 million years



MATERIALS DISCARDED



Source: U.S. Environmental Protection Agency

RECYCLING


Aluminum Cans
Plastic
Green Glass
Brown Glass
Clear Glass


BROWN GLASS
GREEN GLASS

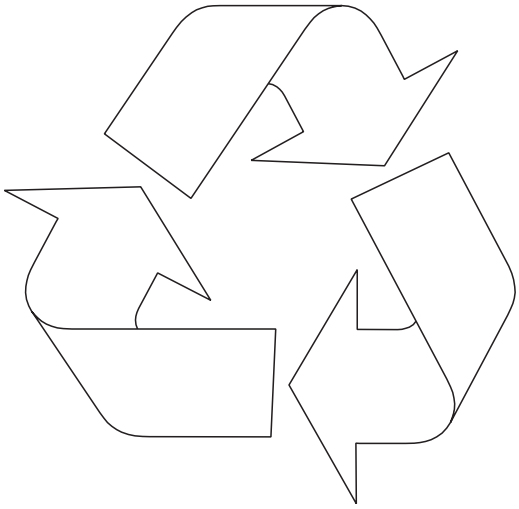

COLORED GLASS
GLASS BOTTLES & JARS CLEAR
PLASTIC


RECYCLE
for
Georgia Firefighters Burn Foundation Inc
404-320-6223
ALUMINUM CANS ONLY
NO BAGS PLEASE


TRASH ONLY

RECYCLING SYMBOLS

- Mobius Loop—indicates that the product can be recycled

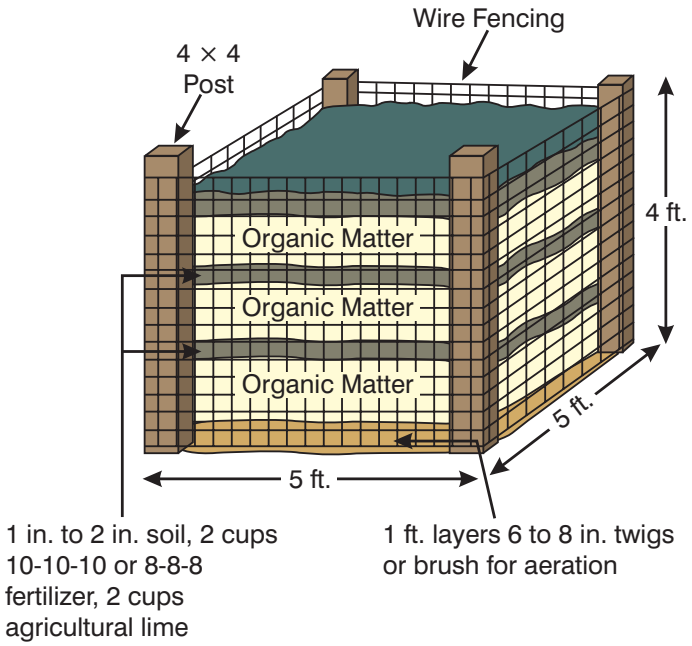


- Mobius Loop enclosed in a circle—indicates that the product is made from recycled materials

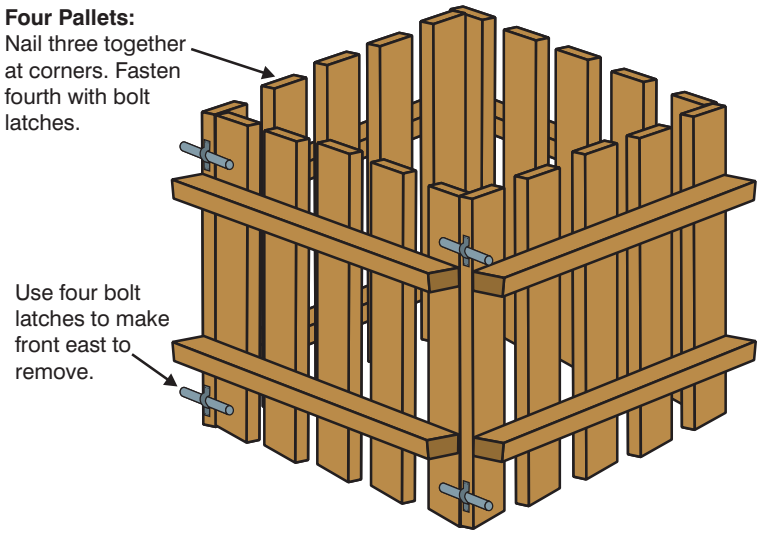
PLASTIC RECYCLING SYMBOLS

Symbol	Plastic Type	Examples
	polyethylene/ terephthalate	pop and juice containers, frozen food containers
	high density/ polyethylene	milk jugs, juice containers, some yogurt containers, shampoo bottles
	vinyl/polyethylene	packaging around meat, shower curtains, garden hoses, cooking oil bottles
	low density/ polyethylene	plastic bags, dry cleaning bags, shrink-wrap packaging for CDs and cassettes
	polypropylene	plastic lids, straws, bottle caps, yogurt containers, margarine tubs, syrup containers
	polystyrene	hot drink cups, carry-out containers, egg cartons
		all other plastics

COMPOSTING BINS

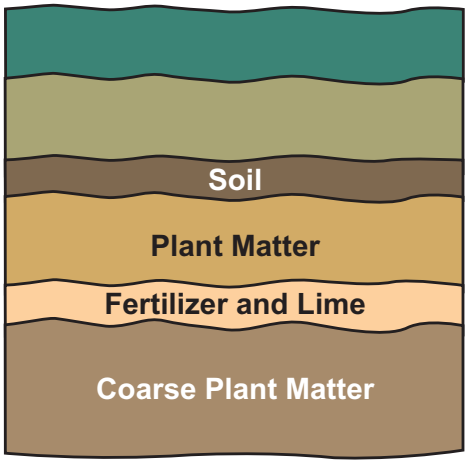


- Set up on level ground that is well drained.
- Do not put underneath a pine tree. (Pine needles are slow to decompose.)
- Locate near a water source.
- Line with plastic in dry climate.
- Locate away from garden to keep down pests.



COMPOSTING


CanDo


Soil
Plant Matter
Fertilizer and Lime
Coarse Plant Matter

Name _____

LANDFILL SURVEY

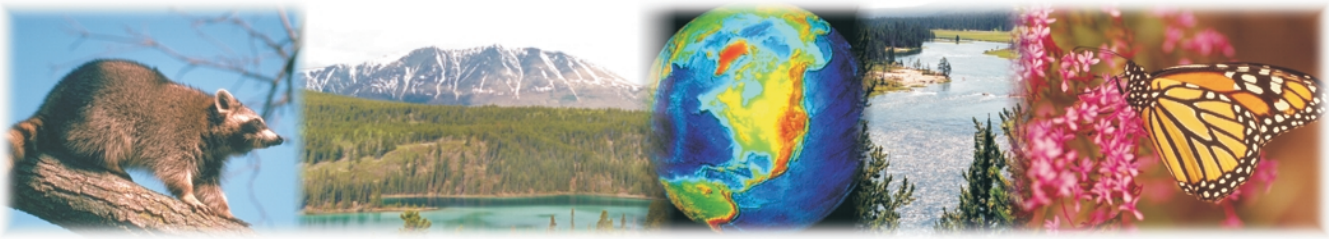
Directions

Develop a written survey to pass out to your family or friends to get their opinions on landfills. Include questions like those shown below. You could also ask questions about a nearby landfill, if you have one. (Do people know the landfill is there? Does it bother them in any way?)

After surveying several people in your community, combine your results with the rest of the class. What is the overall opinion of landfills in your area? Do most people know where the nearest landfill is located? Are most people for them, or against them? Did anyone suggest an alternative that might be better than building a landfill?

Sample Questions

1. Do you know where the nearest landfill is?
2. Do you think landfills are safe for the environment and our water supply?
3. Do you know how landfills work?
4. Would you mind having a landfill in the area where you live or work? Why or why not?
5. If you don't want a landfill in your area, do you have any suggestions on what we could do with our trash instead?
6. Would you be willing to cut down on the amount of trash you generate if it meant keeping a landfill out of your area?
7. Do you think recycling helps cut down on the number of landfills that are needed?



Name _____

MAKE A MINI-LANDFILL

▶ Materials (per group)

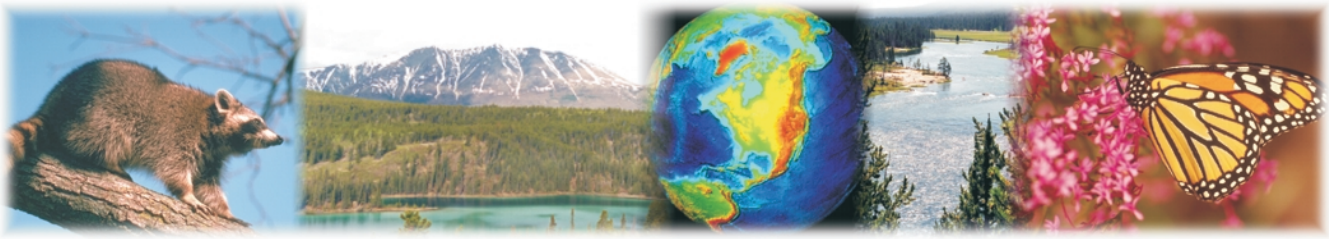
- ✓ Large jar with a tightly fitting lid
- ✓ Topsoil
- ✓ Trash (potato peels, coffee grounds, newspapers, piece of Styrofoam, paper clip, etc.)
- ✓ Rubber gloves
- ✓ Permanent marker
- ✓ Water

▶ Procedure

1. Add a ½-inch layer of topsoil to the bottom of the jar.
2. Wearing rubber gloves, place some trash on top of the soil. Arrange the trash towards the sides of the jar so you can see it from the outside.
3. Cover both layers with topsoil.
4. Water the soil so that it is slightly moist.
5. Place the lid securely on the jar.
6. Use the permanent marker to write your name and the date on your jar lid. Also mark the sides of the jar where you can see the trash.
7. Place your mini-landfill in a safe location away from direct sunlight.
8. Check your landfill every week and keep track of your observations.

▶ Conclusion

What happened inside your landfill? What does this tell you about what happens inside a real landfill? Are there any trash items in your landfill that could have been prevented, recycled, or composted to save room?



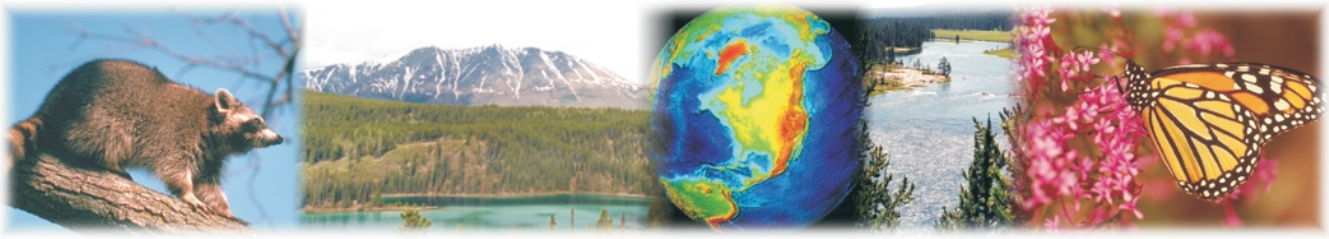
Name _____

REDUCE!

Directions

Keep track of the things you throw away in a day. Write each item in the table below. Next to each item, try to list at least one way that you could have reduced the amount you threw away. Was it something that you could have done without completely? Is there an alternative available that would have produced less waste?

Item Thrown Away	How to Reduce

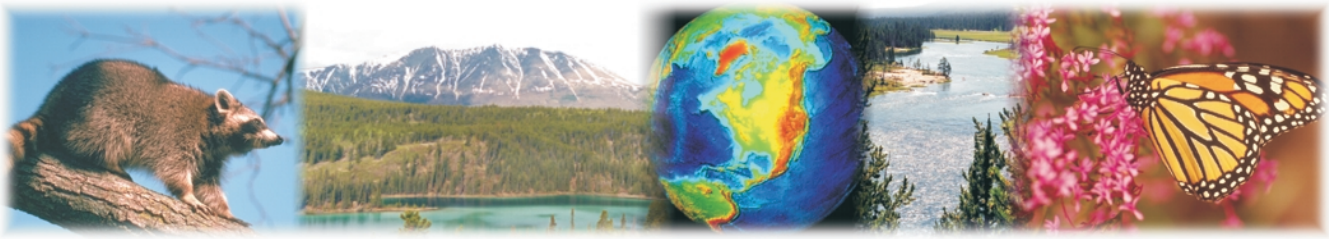


Name _____

REUSE!

Directions

Think about all the things you have thrown away simply because you didn't want/need them anymore. Maybe someone else could have used the item and saved it from ending up in a landfill. Set up a "Swap Table" in your classroom where you and other students can leave items that you want to get rid of and pick up items you may have been wanting. (Make sure all of the items are clean, still usable, and not broken in any way.) Instead of throwing your item away, you can give it to someone who wants it! Instead of spending your money buying a new item and creating trash from the packaging, you can get something from someone who is finished with it anyway! Each item that someone else is able to make use of is one less item that ends up in a landfill! If your Swap Table ends up full of items that none of the other students want, you could have a yard sale to raise money for your school or a local charity.

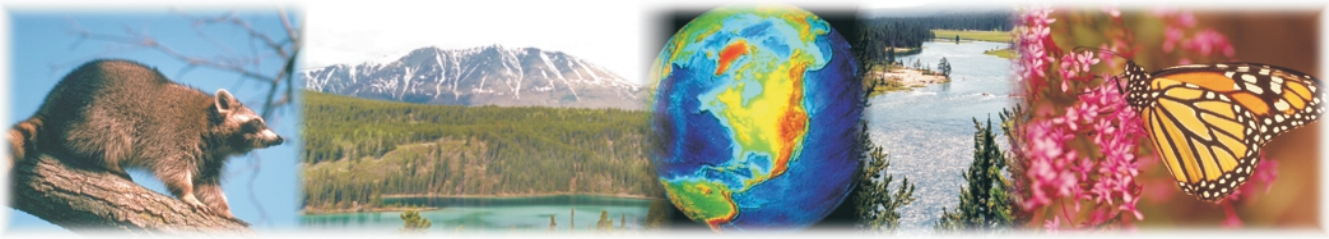


Name _____

RECYCLE!

Directions

Set up a recycling center in your classroom! Place containers labeled according to your local recycling center's categories (newspaper, office/school paper, magazines, aluminum cans, plastics, etc.) Bring in your own recyclable items and sort them into the correct containers. Design posters or flyers to display throughout the school to encourage other students and teachers to bring in their recyclables. Include information on the posters or flyers about how much trash we throw away in landfills. You may also want to design some posters and flyers that can be placed throughout your community to encourage everyone to make recycling a part of their everyday lives! (Make sure you get permission before hanging posters or flyers anywhere.)



Name _____

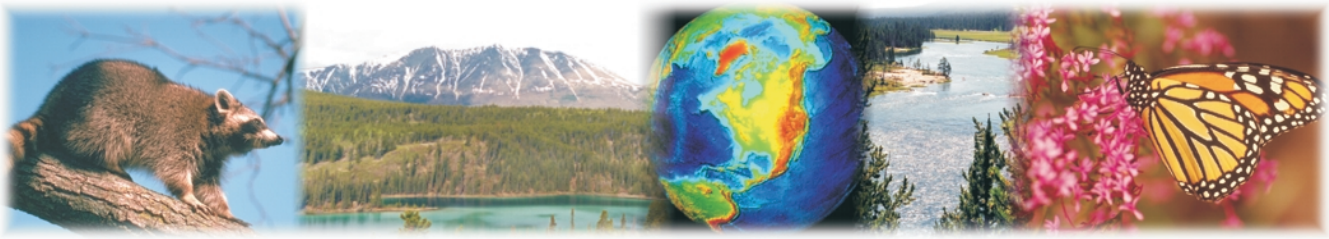
MAKE A MOBIUS LOOP

Materials

- ✓ 1" × 11" strip of paper
- ✓ Scissors
- ✓ Pencil
- ✓ Double-sided tape

Directions

1. While holding both ends of the strip of paper, twist one end once.
2. Overlap the two ends and tape them together. You now have a Mobius Loop!
3. Test your Mobius Loop. Use a pencil to draw a straight line lengthwise down the center of the strip of paper. Try not to lift the pencil point from the paper once you begin. You should see that the loop is connected.
4. Use scissors to follow the pencil marking to cut lengthwise down the center of the strip. The strip will now be twice as long as the original loop.
5. Cutting the loop lengthwise again gives you two connected loops.



Name _____

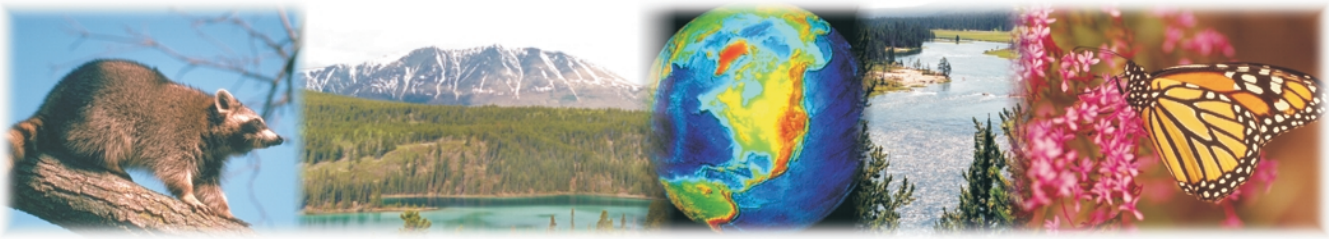
DESIGN YOUR OWN RECYCLING SYMBOL

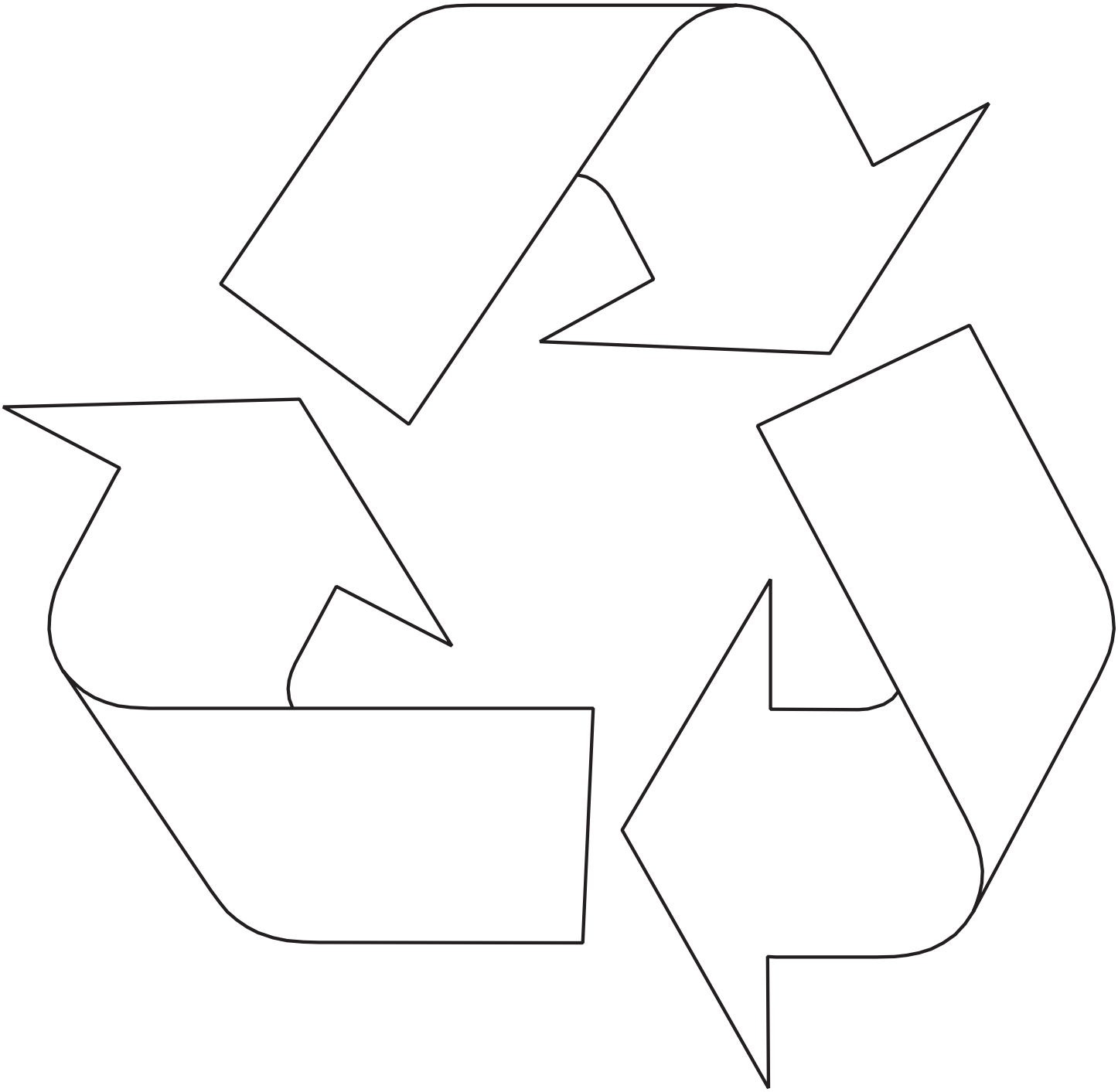
▶ Materials

- ✓ Copy of Mobius Loop outline (on next page)
- ✓ Magazines with photographs of recyclable items
- ✓ Scissors
- ✓ Glue

▶ Directions

1. Look through old magazines for photos of items that can be recycled (glass, plastic, newspaper, etc.).
2. Cut out some pictures and arrange them inside the Mobius Loop outline to create your own collage. You will probably have to trim the photos to get them to fit exactly inside the Mobius Loop.
3. Cut out your Mobius Loop and share it with the rest of the class. Did any other students find any recyclables that you forgot to include?





Name _____

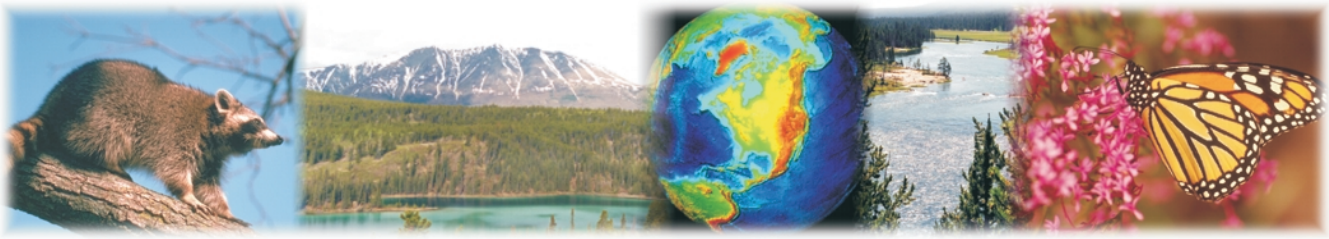
MAKE A MINI-VERMICOMPOSTING BIN

▶ Materials:

- ✓ Clear, quart-sized container with a tight-fitting lid (plastic deli containers work well)
- ✓ T-bar pin (to make holes in container and lid)
- ✓ Shredded newspaper
- ✓ Water
- ✓ Topsoil
- ✓ Sand
- ✓ Chopped vegetable peelings
- ✓ 5 red worms

▶ Procedure

1. Use a T-bar pin to make holes in the sides, bottom, and top of the container.
2. Moisten the shredded newspaper and place it in the bottom of the container.
3. Add 2 scoops of topsoil.
4. Add 1 tablespoon of sand.
5. Carefully add the 5 red worms.
6. Add a couple tablespoons of chopped vegetable peelings.
7. Place more moistened newspaper (bedding) on top of the peelings.
8. Fluff the bedding once or twice a week.
9. Feed the worms lunch scraps, crushed egg shells, coffee grounds, and chopped peelings. Do not feed them milk, meat, or bones.
10. Remember that your worms are live creatures and deserve to be treated kindly. Work carefully when fluffing their bedding and adding food scraps. When this activity is complete, ask your parents' permission before bringing you vermicomposting bin home. If you cannot take it home with you, place the container's contents and the worms in a garden, field, or other safe outdoor spot.



Lesson G–1

SAFETY

Indiana Agricultural Literacy Lesson Plan Library

Unit G. Agricultural Mechanics

Lesson 1. Safety

Indiana's Academic Standard. **Science:** 4.1.3 — Explain that clear communication is an essential part of doing science since it enables scientists to inform others about their work, to expose their ideas to evaluation by other scientists, and to allow scientists to stay informed about scientific discoveries around the world.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define safety, and describe how it is practiced.
2. Define hazard, and describe where hazards can be found.
3. Explain how household products could be hazardous.
4. Identify common personal protective equipment.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Illinois Farm Bureau. *Ag Mag 15:* "Safety Sleuths." Illinois Ag in the Classroom Website—www.agintheclassroom.org

National Safety Council Website—www.nsc.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Newspaper article about a recent safety related accident
- ✓ Safety goggles
- ✓ Vaseline

Terms. The following terms are presented in this lesson (shown in bold italics):

- Caution
- Danger
- Flammable
- Ground fault circuit interrupter (GFCI)
- Hazard
- Material safety data sheet (MSDS)
- Personal protective equipment (PPE)
- Poison
- Safety
- SMV emblem
- Warning

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Have students read a newspaper article about a recent safety related accident aloud as a class. Explain to them that because situations like this occur every day, it is important for them to learn about safety and the hazards that are around them all the time.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define safety, and describe how it is practiced.

Anticipated Problem: What does safety mean? How can you practice safety?

I. ***Safety*** is the prevention of injury and loss.

A. It would be impossible to make an activity or place totally safe. We can, however, take steps to make an activity or place as safe as possible. General safety guidelines should be considered at all times.

1. Be aware of safety at all times. Always pay attention to what is going on around you and the potential dangers presented.
2. Think before you act. Rushing into things can often lead to accidents.
3. Learn safe practices and follow them every time.
4. Note where dangers are and avoid them.
5. If you see a potential safety risk, alert others of the danger.
6. Always read and follow directions carefully and completely.
7. Keep all tools and equipment in good condition.
8. Always use the proper safety equipment.
9. Do not take unnecessary risks.
10. Follow all safety rules.

B. To practice safety, we must be prepared and have the proper tools.

1. Education—Education is an important step in keeping safe. Knowing what things to look out for helps us avoid dangers. Getting safety training before using a tool or performing an activity makes it easier for us to act safely.
2. Signs—Many signs are posted to help keep us safe. Always read and obey all signs. Learn what different signs mean and the dangers they point out. An example of a sign with special meaning is an SMV emblem. The ***SMV emblem*** is a colorful triangular shield mounted on a vehicle to indicate that its moves slowly. SMV emblems are usually seen on tractors and other pieces of farm machinery. Watching for the SMV emblem and knowing what it means helps us stay safe from accidents.
3. MSDS—All chemicals are shipped with an MSDS. A ***material safety data sheet (MSDS)*** is a sheet containing information about the safe use of a chemical. An MSDS should accompany not only agricultural chemicals but also chemicals used in school laboratories. The information provided in the MSDS helps us use chemicals properly and stay safe.

4. Proper storage—Dangerous chemicals and other solutions should be stored properly. Locked cabinets should be used to keep harmful substances and the people around them safe.
5. Emergency response—Even with all of the proper safety precautions, accidents do happen. The response time can make the difference between a minor accident and a serious injury. Know how to respond.

Use TM: G–1A to discuss general safety considerations with the students. Use TM: G–1B and TM: G–1C to show students examples of the SMV emblem and an MSDS. Ask students if they have ever seen an SMV emblem or an MSDS. Also ask them to name any other safety signs they have seen.

Objective 2: Define hazard, and describe where hazards can be found.

Anticipated Problem: What are hazards and where can they be found?

II. A ***hazard*** is a danger. We can often see danger, but we cannot always avoid it. Even though hazards are always around us, we can take steps to reduce the hazards that we face.

A. There are many areas in agriculture where hazards exist. Hazards can be found on the farm, in agribusiness, and in and around our homes. Plants and animals can always be hazards. Knowing where potential hazards exist can help us avoid them.

1. Hand tools (hammers, pliers, screwdrivers, etc.) should be in good working condition and used only for their intended purpose.
2. Power tools (saws, drills, grinders, etc.) are particularly hazardous. They should always be used properly according to the manufacturer's directions. All safety devices should be in place and working properly.
3. Engines and fuel can be hazardous. Prevent burns by being very careful of heat and hot parts. When working with engines and fuel, good ventilation is necessary. Fuels should always be stored in proper containers in a safe location.
4. Working with electricity requires great care to avoid hazards. Be sure all electrical devices are working properly and in good condition. Use ground fault circuit interrupters on all extension cords/receptacles in which cords are plugged. A ***ground fault circuit interrupter (GFCI)*** is a device that prevents electrical shock.
5. Tractors and other equipment involve using power to do work. Training on proper usage and operating at a reasonable speed are ways to decrease the danger of operating these machines. Be sure to wear a seatbelt and make sure that all safety shields are in place and functioning properly.
6. Chemicals must be handled carefully to avoid hazards. Always know what a chemical is intended to be used for and use it accordingly. If in doubt, check the MSDS. Follow all safety instructions and clean up any surface that came in contact with chemicals.
7. Working near fire or heat requires great care. Heat is especially dangerous because it is often invisible.

8. Be careful when working around animals. Animals can cause many injuries to humans, especially to children. The best way to avoid injury is to understand how animals behave and always use caution around them.
9. Plants can be hazardous. Some plants are poisonous. It is important to know what plants are around you and what plants you should be careful of.

Use WS: G–1A after defining hazard but before discussing where hazards are found. Allow students time to come up with their own ideas of where hazards exist before covering the content of the objective. Use TM: G–1D to review the areas where hazards can be found. After reviewing the areas, have students evaluate their answers on WS: G–1A. Do they have any more hazards to add?

Objective 3: Explain how household products could be hazardous.

Anticipated Problem: How can household products be hazardous?

III. Products we use around the house can be just as dangerous as those found on a farm or in a laboratory. Many household products can hurt your eyes, burn your skin, and even make you sick if they aren't used properly or if the label isn't followed carefully. These products are generally called poisons.

A. A ***poison*** is a substance that, even in small quantities, can cause illness or death. Most poisonous liquids have special words or symbols on their labels that tell us that they could be hazardous. It is important that we look for these special words and symbols and understand their meaning.
   1. ***Caution:*** Indicates care should be taken when using the product.
   2. ***Warning:*** Notifies us in advance that the product presents a danger if directions are not followed.
   3. ***Danger:*** There is a potential exposure to injury.
   4. ***Flammable:*** The product is capable of being easily caught on fire.

B. All poisons should be stored in special places that are out of the reach of children and pets.

C. Any products that the labels have fallen off of should be properly discarded. These are dangerous because you cannot tell what is in them, and you do not know how to properly handle them.

To introduce this objective, have a student come to the front of the room and put on a pair of safety goggles that have Vaseline on the lenses. Ask them to describe to the class what they are able to see. Explain that a common household product could cause this to temporarily or permanently happen to a person's sight. Use TM: G–1E to show students examples of some common warnings that indicate potential danger. Use WS: G–1B to illustrate to students that we can't tell if a substance is safe by simply looking at it. Use WS KEY: G–1B for information on how to set up the activity.

Use WS: G–1C as an additional activity to help students identify important information on products. Use WS KEY: G–1C for information on how to set up the activity.

Objective 4: Identify common personal protective equipment.

Anticipated Problem: What are some common types of personal protective equipment?

IV. Proper protective equipment must always be worn and be worn properly when hazards are involved. ***Personal protective equipment (PPE)*** is equipment that helps protect people from certain kinds of injury.

A. The proper PPE depends on the activity and the hazards involved. Equipment is available for many different purposes: eye, hearing, skin and body, and respiratory protection.

B. Some of the most common types of PPE are as follows:

1. Rubber boots and steel-toed shoes
2. Earmuffs (hearing muffs)
3. Particle mask
4. Face shield
5. Safety glasses
6. Goggles
7. Earplugs (corded or uncorded)
8. Apron
9. Gloves
10. Eyewash bottle

Use TM: G–1F to show students examples of common PPE. Use WS: G–1D to have students identify various PPE items. Bring in some PPE and have students take turns trying on gloves and goggles so they can get a feel for the protection that they provide. Explain to the students that the gloves and goggles don't fit well because only adults should handle chemicals.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: G–1A, WS: G–1B, WS: G–1C, and WS: G–1D. Have students complete WS: G–1E to apply what they have learned by getting hands-on practice at evaluating for safety risk.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. c
2. a
3. d
4. b
5. e

Fill-in-the-Blank

1. danger
2. slowly
3. behave
4. hazard

Short Answer

Answers will vary. Students should list two hazards around their home and tell how the hazards can be eliminated.

Test G–1

Name_____

SAFETY

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. MSDS
b. safety
c. GFCI
d. personal protective equipment
e. poison

_____1. A device that prevents electrical shock.

_____2. A sheet containing information about the safe use of a chemical.

_____3. Equipment that helps protect people from certain kinds of injury.

_____4. The prevention of injury and loss.

_____5. A substance that, even in small quantities, can cause illness or death.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. We can often see _____, but we cannot always avoid it.
2. An SMV emblem indicates that the equipment moves _____.
3. To reduce the danger when dealing with animals, it is important to understand how animals _____.
4. A(n) _____ is a danger.

▶ Short Answer

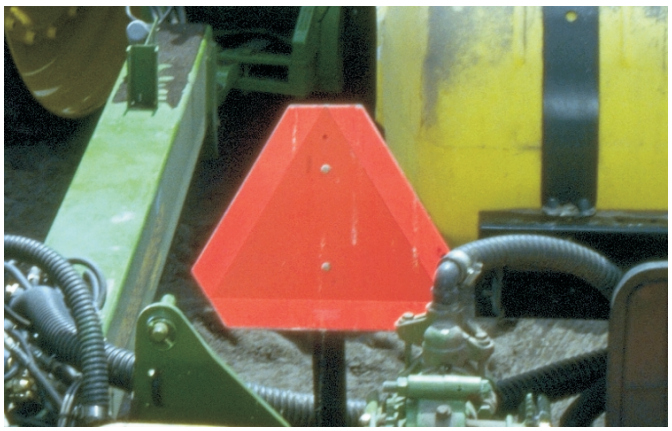
***Instructions*. Answer the following question.**

Describe two hazards around your home, and explain what steps should be taken to eliminate them.

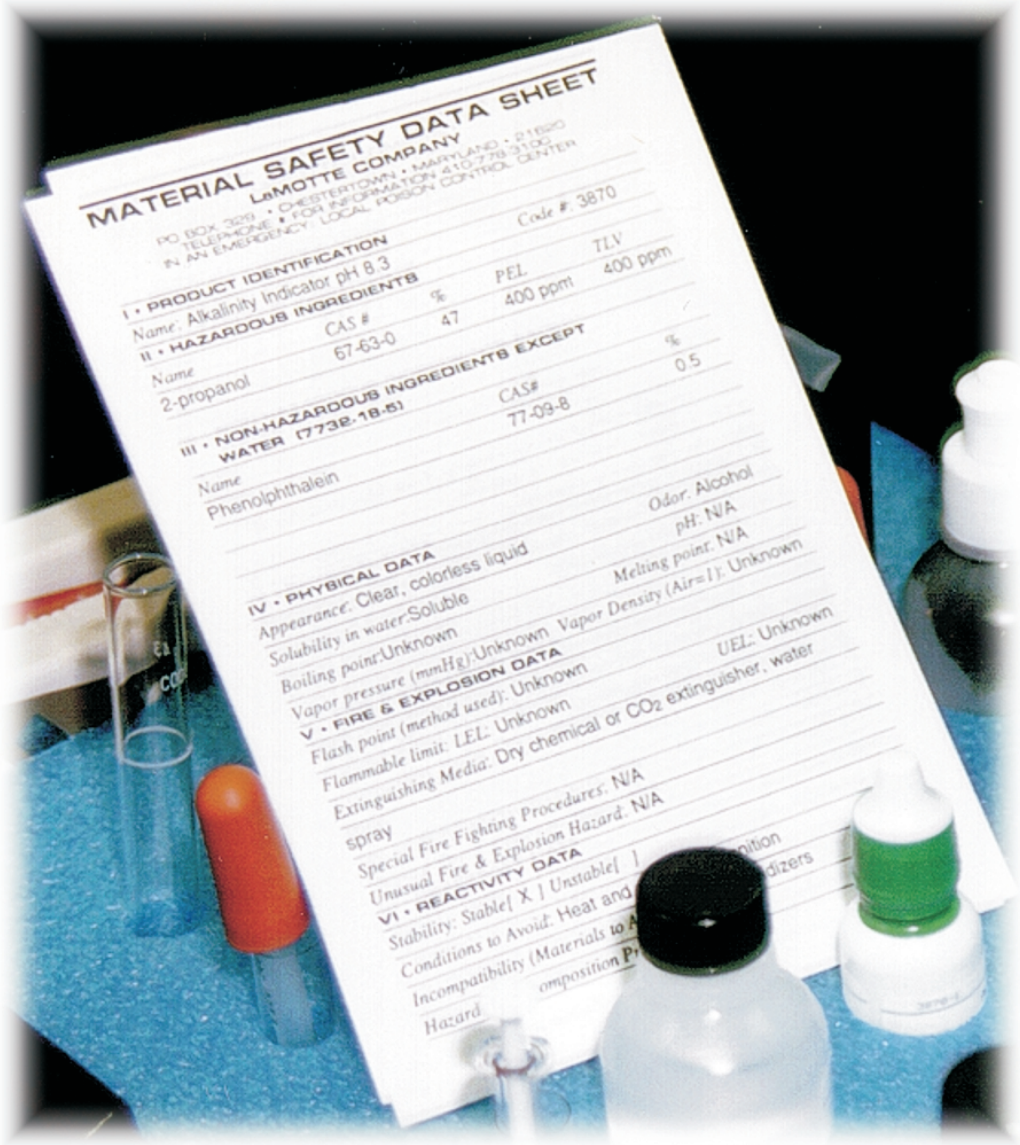
GENERAL SAFETY GUIDELINES

- Be aware of safety at all times.
- Think before you act. Rushing into things can often lead to accidents.
- Learn safe practices and follow them every time.
- Note where dangers are and avoid them.
- If you see a potential safety risk, alert others of the danger.
- Always read and follow directions carefully and completely.
- Keep all tools and equipment in good condition.
- Always use the proper safety equipment.
- Do not take unnecessary risks.
- Follow all safety rules.

SMV EMBLEM



MATERIAL SAFETY DATA SHEET (MSDS)



AREAS OF POTENTIAL HAZARDS

- Hand tools
- Power tools
- Engines and fuel
- Electricity
- Tractors and other equipment
- Chemicals
- Fire and heat
- Animals
- Plants

POTENTIAL HAZARD STATEMENTS

CAUTION: Avoid contact with eyes. Contains surfactants. If contact occurs, rinse immediately and thoroughly with water. If irritation persists, get medical attention.
KEEP OUT OF REACH OF CHILDREN.

DANGER: CORROSIVE, HARMFUL IF SWALLOWED.
KEEP OUT OF REACH OF CHILDREN.

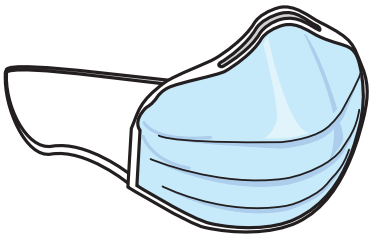
WARNING: EYE IRRITANT. Do not get in eyes.
For sensitive skin or prolonged use, wear gloves.

DANGER! EXTREMELY FLAMMABLE. Do not spray near sparks, heat or open flames. Vapors will accumulate readily and may ignite explosively. Keep area ventilated during use and until all vapors are gone.

COMMON PPE

Rubber Boots and
Steel-Toed Shoes

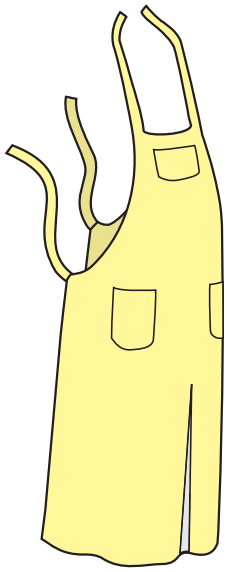
Earmuffs (Hearing Muffs)



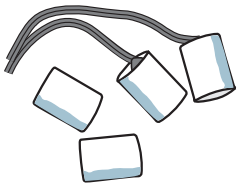
Particle Mask

Goggles
(double lens)

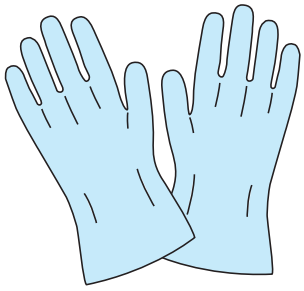
Safety Glasses
with sideshields and brow guard



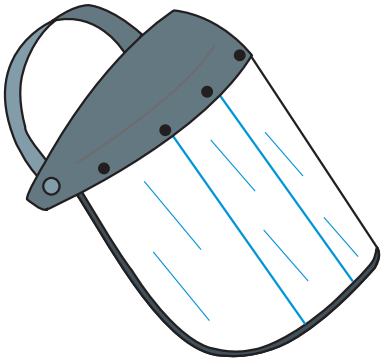
Apron



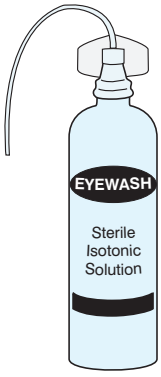
Corded and Uncorded
Earplugs



Gloves



Face Shield



Eyewash Bottle

Name _____

NAME THE HAZARDS

Directions

Below are areas of agriculture that pose hazards. List as many potential hazards for each item as you can think of.

1. Hand tools—

2. Power tools—

3. Engines and fuel—

4. Electricity—

5. Tractors and other equipment—

6. Chemicals—

7. Fire and heat—

8. Animals—

9. Plants—

Name _____

CHEMICAL LOOK-A-LIKES

Directions

You will be shown a small sample of a substance. You will only be allowed to look at it (no touching, shaking, smelling, or tasting). The object is to see if you can tell simply by looking at a substance, if it is safe or hazardous. Record your answers below.

1. Is this something that you would put on pancakes or use in your car's engine?

2. Is this a chemical that would be used to kill weeds in your field or lawn, or would you drink it?

3. Would you use this to wash your windshield or rinse your mouth?

4. Is this powdery substance a farm chemical that needs water added, or is it something you would wash your clothes with?

5. Is this antifreeze for your family's truck or something you would be drinking at a soccer game?

6. Would you fry chicken in this or spray for insects with it?

CHEMICAL LOOK-A-LIKES KEY

Directions for Teacher

Show the students samples of the different substances listed below, and see if they can tell if they are hazardous or not. (All of the substances should be non-hazardous to avoid any accidents.) The point of the activity is to let the students know that they really can't tell if something is hazardous just by looking. Put each of the substances in a clear container with a lid (baby food jars work well) and display them one at a time. Allow the students to look at the samples and record their answers on WS: G–1B. Do not allow the students to touch, smell, or taste the substances. After students have recorded all their answers, reveal to them that all of the substances were safe in this case, but remind them that they can never really know for sure.

Substances

1. Pancake syrup (motor oil)—Is this something that you would put on pancakes or use in your car's engine?
2. Apple juice (herbicide)—Is this a chemical that would be used to kill weeds in your field or lawn, or would you drink it?
3. Blue mouthwash (windshield washer fluid)—Would you use this to wash your windshield or rinse your mouth?
4. Powder laundry soap (lime)—Is this powdery substance a farm chemical that needs water added, or is it something you would wash your clothes with?
5. Green juice drink (antifreeze)—Is this antifreeze for your dad's truck or something you would be drinking at a soccer game?
6. Cooking oil (pesticide)—Would you fry chicken in this or spray for insects with it?

Name _____

LABEL READING

Directions

You will be given a box of seven empty household products. Go through the box and check the labels on each of the products. Use the information to fill in the inventory below.

Container 1

1. Product Name:
2. Safety Word:
3. Safety Instructions:

Container 2

1. Product Name:
2. Safety Word:
3. Safety Instructions:

Container 3

1. Product Name:
2. Safety Word:
3. Safety Instructions:

Container 4

1. Product Name:

2. Safety Word:

3. Safety Instructions:

Container 5

1. Product Name:

2. Safety Word:

3. Safety Instructions:

Container 6

1. Product Name:

2. Safety Word:

3. Safety Instructions:

Container 7

1. Product Name:

2. Safety Word:

3. Safety Instructions:

LABEL READING KEY

Directions for Teacher

1. Divide the students into small groups of four or five.
2. Give each group a box of seven **empty** household product containers.
3. Have the students use WS: G–1C to complete an inventory of the box by answering the questions on the worksheet.
4. This activity will give students the opportunity to get a good look at common products and read the labels for safety information. Not all of the products need to be hazardous.

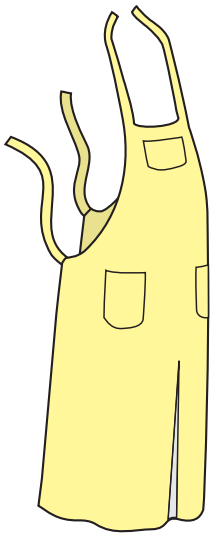
WS: G–1D

Name _____

PERSONAL PROTECTIVE EQUIPMENT

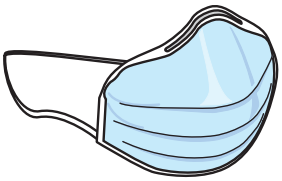
▶ Directions

Identify each of the PPE items below. Write the name of each item on the line provided.

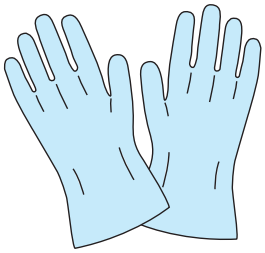


1. _____

2. _____



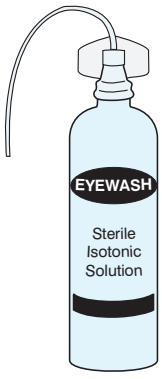
3. _____



5. _____

6. _____

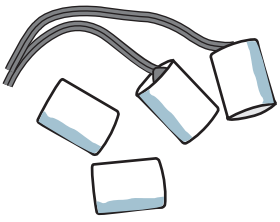
4. _____



7. _____

8. _____

9. _____



10. _____

WS KEY: G–1D

PERSONAL PROTECTIVE EQUIPMENT KEY

1. Apron
2. Face shield
3. Particle mask
4. Rubber boots and steel-toed shoes
5. Gloves
6. Safety glasses (with sideshields and brow guard)
7. Eyewash bottle
8. Earmuffs (hearing muffs)
9. Goggles (double lens)
10. Corded and uncorded earplugs

WS: G–1E

Name _____

HOME SAFETY ASSESSMENT

Select an area around your home, and sketch a drawing of the area in the space below.

Identify safety hazards found in the selected area of your home.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

What can you do to rid your home of these safety hazards?

Lesson G–2

BASIC CARPENTRY

Indiana Agricultural Literacy Lesson Plan Library

Unit G. Agricultural Mechanics

Lesson 2. Basic Carpentry

Indiana's Academic Standard. **Science:** 4.1.5 — Demonstrate how measuring instruments, such as microscopes, telescopes, and cameras, can be used to gather accurate information for making scientific comparisons of objects and events. Note that measuring instruments, such as rulers, can also be used for designing and constructing things that will work properly.

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Describe a safe woodworking area.
2. Identify common tools used in woodworking.
3. Discuss the qualities of wood and identify the parts of a piece of lumber.
4. Demonstrate skills necessary to work with wood.

Recommended Resources: One of the following resources should be selected to accompany the lesson:

4-H — www.4-H.org

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Lowe's Home Improvement — www.lowes.com

Home Depot — www.homedepot.com

Shopnotes Magazine — www.shopnotes.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Edge
- End
- Face
- Grain
- Hand tool
- Knot
- Length
- Power tool
- Thickness
- Tool
- Width
- Wood

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Use WS: G–2A and WS: G–2B to have the students play Carpentry Bingo. This fun activity will introduce students to terms for this lesson and get them acquainted with tools associated with carpentry. Give the students a copy of WS: G–2A and WS: G–2B. Have the students cut out the squares on WS: G–2B and paste them on WS: G–2A in a random order. This gives each student a different playing card. Use

playing chips, squares of colored paper, or wood chips to mark each square as it is called. Use the sheets provided at the end of this lesson as transparencies that you can place on the overhead projector in random order. Call out the term, point out the illustration, and read the description to the students. The students will all have the same terms, but they will not be in the same order on their bingo cards. The illustrations and descriptions will give the students some idea of what they will be learning about.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe a safe woodworking area.

Anticipated Problem: What makes a safe woodworking area?

I. Safety is a major concern when considering a workspace for woodworking. Having permission to work in the area is also very important. All woodworkers should have basic safety equipment and follow general safety rules.

A. Clothing—Always wear appropriate clothing in the woodworking area.

B. Clutter—Keep all work surfaces free of clutter.

C. Fire safety—Always have an all-purpose fire extinguisher on hand and know how to use it properly.

D. First aid—Always have an adequate first aid kit in your work area and make sure it is properly stocked.

E. Space—Make sure you have adequate space to work safely and comfortably.

F. Light—You need to be able to see well in your workspace to avoid accidents.

G. Ventilation—Woodworking can create large amounts of dust so good ventilation is necessary in the work area.

H. Work bench or sturdy table—You will need a safe, sturdy place to do your work.

I. Storage area—It is important to keep tools and materials in their place unless in use.

J. Protected outlets—A GFCI is a necessary safety precaution when using power tools in woodworking.

K. Electrical cords—Keep all electrical cords in good repair.

L. Easy to clean—Sweep sawdust and wood shavings often to avoid accidents caused by slick floors. Always clean up the workspace before leaving.

Use TM: G–2A to discuss the general safety rules associated with a woodworking area. Use WS: G–2C to have students create informative posters about the general safety rules. Encourage students to each choose a different rule so that all the rules for a safe area are covered. Visit a nearby woodworking shop and let students observe the safety features in place. If possible, set up a "staged" work area that violates many of the safety rules discussed. Allow students to enter the work area and have them point out and write down as many safety violations as they can find.

Objective 2: Identify common tools used in woodworking.

Anticipated Problem: What tools are used in woodworking?

II. A ***tool*** is any implement used to do a job with mechanics. It is important to be able to identify tools by their common name and also know how they are supposed to be used.

A. A ***hand tool*** is a small, powerless tool used to do a task or job that could not be done with the bare hand or without the tool. Some common hand tools used in woodworking include the following:

1. Screwdriver (standard and Philips screwdriver)—used to turn screws in wood, attach fasteners, and other things.
2. Hammer (claw hammer, shop hammer, mallet)—used for driving nails, removing nails, and other things.
3. Wrench (adjustable wrench)—used for gripping and turning bolts, nuts, and other fasteners and materials.
4. Saw (handsaw, coping saw)—used for cutting materials.
5. Measuring device (tape measurer, ruler, zig-zag ruler)—used for measuring materials to make sure everything is cut and assembled correctly.
6. Square (framing square, combination square)—used for getting proper angles, drawing lines for making straight cuts, and other things.
7. Level—used to make sure the surface is flat (horizontal).
8. Plane—used for smoothing surfaces and changing the size or shape of wood materials.

B. A ***power tool*** is any tool that has power for its operation from a source other than human force. Some common power tools used in woodworking include the following:

1. Saw (circular saw, sabre saw, reciprocating saw)—used for cutting wood and other materials.
2. Power drill—used to drill holes in wood and other materials.
3. Grinder/sander—used to remove rough edges and to smooth and shape materials.

Use TM: G–2B to illustrate common hand tools that are used in woodworking. Use TM: G–2C, TM: G–2D, TM: G–2E, TM: G–2F, and TM: G–2G to show students illustrations of a circular saw, sabre saw, reciprocating saw, power drill, and grinder/sander. Use WS: G–2D to reinforce the names of common hand tools used in woodworking.

Objective 3: Discuss the qualities of wood and identify the parts of a piece of lumber.

Anticipated Problem: What are the qualities of wood, and what are the parts of a piece of lumber?

III. ***Wood*** is a fibrous material that comes from under the bark of a tree or shrub. Sawn wood is called lumber or stock.

A. All wood feels hard to the touch, but wood is actually classified as hardwood or softwood.

1. You can generally tell if wood is hard or soft by using your fingernail. If you can make an indention with your fingernail, the wood is usually softwood. Likewise, if you cannot make a mark, it is most likely hardwood.
2. Most softwood lumber comes from trees that have needles (evergreens).
3. Most hardwood lumber comes from trees with broad leaves that are shed in the fall.
4. Hardwood is denser and harder to penetrate than softwood.
5. Hardwoods are not necessarily harder than softwoods, depending on the species of the tree. Some softwoods are hard and some hardwoods are fairly soft.
6. One way you can tell hardness is by how much a piece of wood weighs. Generally, the heavier the wood, the harder it is.
7. Hardwoods have large, open cells called pores.
8. Softwoods don't have pores.
9. Softwoods are usually used in home and building construction.
10. Hardwoods are used for a variety of purposes, including furniture, flooring, and cabinets.

B. Just like the human body has many parts, a piece of lumber also has many parts.

1. The ***edge*** is the side of the board.
2. The ***face*** is the top or bottom of the board.
3. The ***end*** is the cut-off edge of the board.
4. The ***grain*** is the direction of wood fibers on a piece of lumber.
5. The ***length*** is how long the board is.
6. A ***knot*** is a place on a piece of lumber where a branch was attached to the tree. A knot can also form from old wounds on trees.

Use TM: G–2H to discuss the differences and qualities of hardwoods and softwoods. Use TM: G–2I to discuss the parts of a piece of lumber. Use WS: G–2E to allow students to explore different types of wood in and around their own home. Use the activity as a discussion tool and also have students look for different types of wood around the classroom. As an extension to this activity, visit a furniture store, cabinet company, or home improvement store and have the students examine different types of lumber to determine the type of wood (hard or soft). Use WS: G–2F to have students label the parts of a piece of lumber.

Objective 4: Demonstrate the skills that are necessary when working with wood.

Anticipated Problem: What skills are necessary to work with wood?

IV. Working with wood requires basic skills in measuring, hammering, and cutting.

A. Before you begin working with wood, it is vital that you are able to measure correctly.

1. Measuring tools include rulers, tape measures, yardsticks, and squares. These tools help you measure the correct length, width, and thickness of a piece of lumber.
   a. The length is how long the face of the piece of lumber is.
   b. The ***width*** is how wide the face of a piece of lumber is.
   c. The ***thickness*** is a measure of the edge of a piece of lumber.
2. There are some symbols related to measuring that you must know. The following symbols represent inch and foot: inch = " and foot = '.
3. A measuring tool should be marked every ¼ inch, which means there will be 4 quarters marked per inch. Two quarters equals ½ inch, so there will also be a ½ inch mark. Most tape measures will be marked in increments of $^1/_8$", $^1/_{16}$", and $^1/_{32}$", which makes them more precise.
4. Always use a sharp pencil point when marking measurements. A sharp point will help insure a precise measurement. A dull point can make your measurement slightly off.

B. It is important to learn to use a hammer properly.

1. A hammer is a tool used for driving nails, removing nails, and other things. A hammer can be used to join two pieces of lumber together or to drive nails into building materials.
2. There are many different sizes and types of hammers, but they all have similar parts: head, check, poll, handle, neck, claw, and face.
3. When using a hammer to drive nails, you should always wear safety goggles to protect your eyes from debris.
4. It is a good idea to wear hearing protection when hammering.
5. When connecting two pieces of lumber, use a vise to hold one of the pieces of lumber. A vise is a tool with two jaws that close by a lever or screw that is used to hold an object immobile so that it can be worked on.
6. When hammering a nail, hold the nail with pliers to prevent smashing your fingers.
7. When nailing into hardwood, rub the nail with beeswax, paraffin, or dish soap before starting to make the nail drive more easily. You can also ask an adult to drill a small hole before driving the nail to help get the nail started.
8. When hammering, hold the hammer at the end of the handle, bend your wrist, and hold your arm still.
9. Continue hitting the nail until its head is flat with the board. Be careful not to make a dent in the wood with the last blow.
10. When pulling nails from a piece of lumber, use a block of wood under the head of the hammer. This will give you better leverage and also help avoid damaging the piece of lumber.

11. Make sure the claw of the hammer is tight against the nail you are removing to avoid stripping the nail's head.

C. At some point in your woodworking, you will need to cut a piece of lumber to a desired length. To do that, you will need to know about handsaws.
   1. A handsaw is used to cut lumber to a specific length.
   2. It takes practice to make a straight cut using a handsaw.
   3. The main parts of a saw are back, blade, end pieces, frame, handle, heel, teeth, and toe.
   4. Handsaws are generally called either crosscut saws or rip saws. The teeth of the saw determine what type of saw it is.
      a. A crosscut saw is made to cut across the fibers found in the wood. It has more teeth per inch than a rip saw. Crosscut saw teeth are like knife points. A crosscut saw should be held at a 45° angle when cutting.
      b. A rip saw is used to cut with the fibers of the wood. The teeth of a rip saw are like a series of chisels placed in a row. A rip saw should be held at a 60° angle.
   5. Always wear safety goggles when sawing to avoid getting sawdust or other materials in your eyes.
   6. Because sawing creates dust, it is important to wear a particle mask when sawing.
   7. Handle and use handsaws carefully to avoid harm from the very sharp edges.
   8. Never wear loose clothing when sawing.
   9. When making cuts using a handsaw, always use a sturdy work surface.
   10. Rub a small amount of oil on the saw blade to make it slide easily through the wood. Too much oil on the blade might stain the wood.
   11. Use short, gentle back strokes with the saw until a good mark is made on the lumber.
   12. If your saw binds and catches, check the angle you're holding the saw at. It may need to be adjusted.

Use TM: G–2J to illustrate different types of measuring tools. Use TM: G–2K to discuss the parts of a hammer. Use TM: G–2L to show students some examples of different types of vises. Use TM: G–2M to discuss the parts of a saw. Use WS: G–2G to have students demonstrate measuring skills. Bring in some different types of hammers and saws and allow students to look them over and identify all the various parts. Use WS: G–2H and WS: G–2I to have students label the parts of a hammer and a saw.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: G–2A, WS: G–2B, WS: G–2C, WS: G–2D, WS: G–2E, WS: G–2F, WS: G–2G, WS: G–2H, and WS: G–2I. Use WS: G–2J and WS: G–2K as supervised activities that will allow students to apply what they have learned by getting hands-on practice at using a hammer.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. e
2. d
3. c
4. a
5. b

Fill-in-the-Blank

1. power tool
2. ", '
3. knot
4. grain

Short Answer

Answers will vary. Students should list three of the safety factors discussed in Objective 1.

Test G–2

Name_____

BASIC CARPENTRY

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. thickness
b. hand tool
c. wood
d. end
e. tool

_____1. Any implement used to do a job with mechanics.

_____2. The cut-off edge of a board.

_____3. A fibrous material that comes from under the bark of a tree or shrub.

_____4. A measure of the edge of a piece of lumber.

_____5. A small, powerless tool used to do a task or job that could not be done with the bare hand or without the tool.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A(n) _____ _____ is any tool that has power for its operation from a source other than human force.
2. The symbol for inch is _____. The symbol for foot is _____.
3. A(n) _____ is a place on a piece of lumber where a branch was attached to the tree.
4. The _____ is the direction of wood fibers on a piece of lumber.

▶ Short Answer

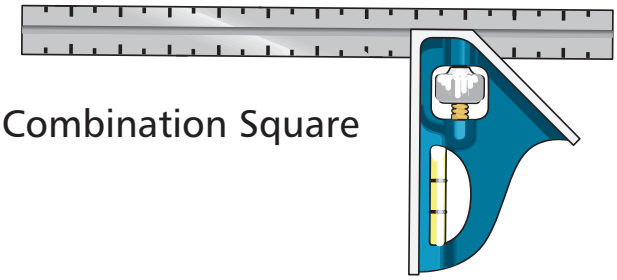
***Instructions*. Answer the following question.**

List and describe three factors that make a safe woodworking area.

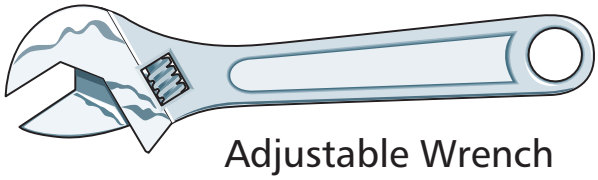
SAFE WOODWORKING AREA

- Clothing—Always wear appropriate clothing in the woodworking area.
- Clutter—Keep all work surfaces free of clutter.
- Fire safety—Always have an all-purpose fire extinguisher on hand and know how to use it properly.
- First aid—Always have an adequate first aid kit in your work area and make sure it is properly stocked.
- Space—Make sure you have adequate space to work safely and comfortably.
- Light—You need to be able to see well in your workspace to avoid accidents.
- Ventilation—Woodworking can create large amounts of dust so good ventilation is necessary in the work area.
- Work bench or sturdy table—You will need a safe, sturdy place to do your work.
- Storage area—It is important to keep tools and materials in their place unless in use.
- Protected outlets—A GFCI is a necessary safety precaution when using power tools in woodworking.
- Electrical cords—Keep all electrical cords in good repair.
- Easy to clean—Sweep sawdust and wood shavings often to avoid accidents caused by slick floors. Always clean up the workspace before leaving.

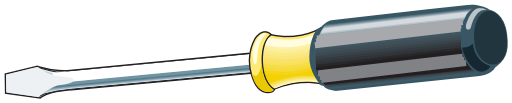
COMMON HAND TOOLS



Combination Square



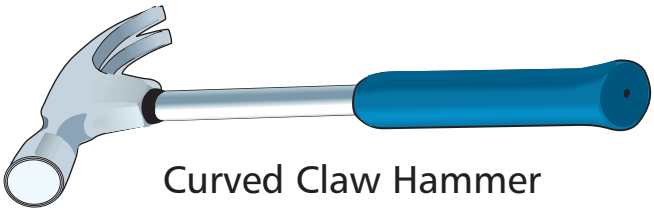
Adjustable Wrench



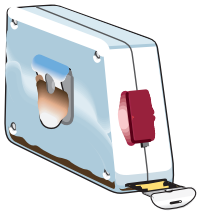
Standard Screwdriver

Ripping Straight Claw Hammer

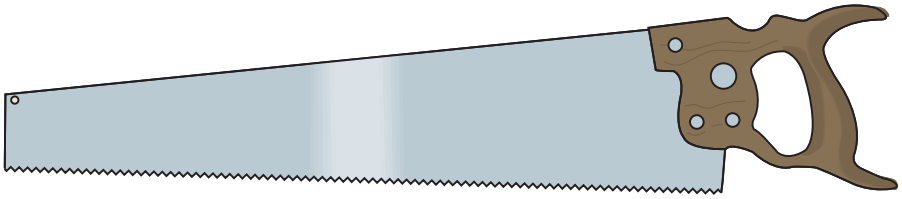
Philips Screwdriver



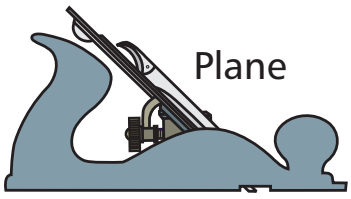
Curved Claw Hammer



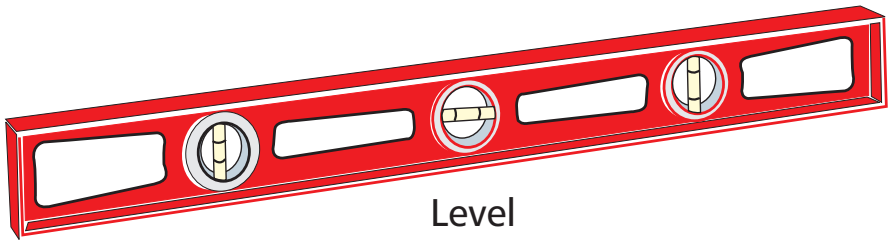
Steel Tape Measure



Handsaw



Plane



Level

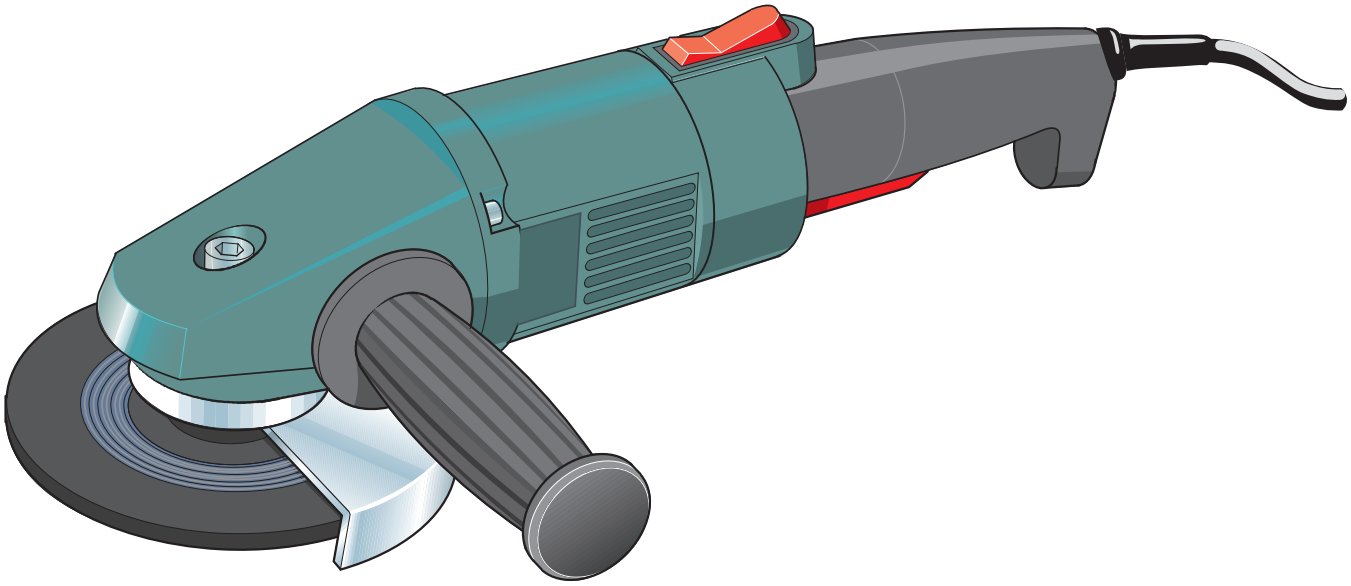
CIRCULAR SAW

SABRE SAW

RECIPROCATING SAW

POWER DRILL

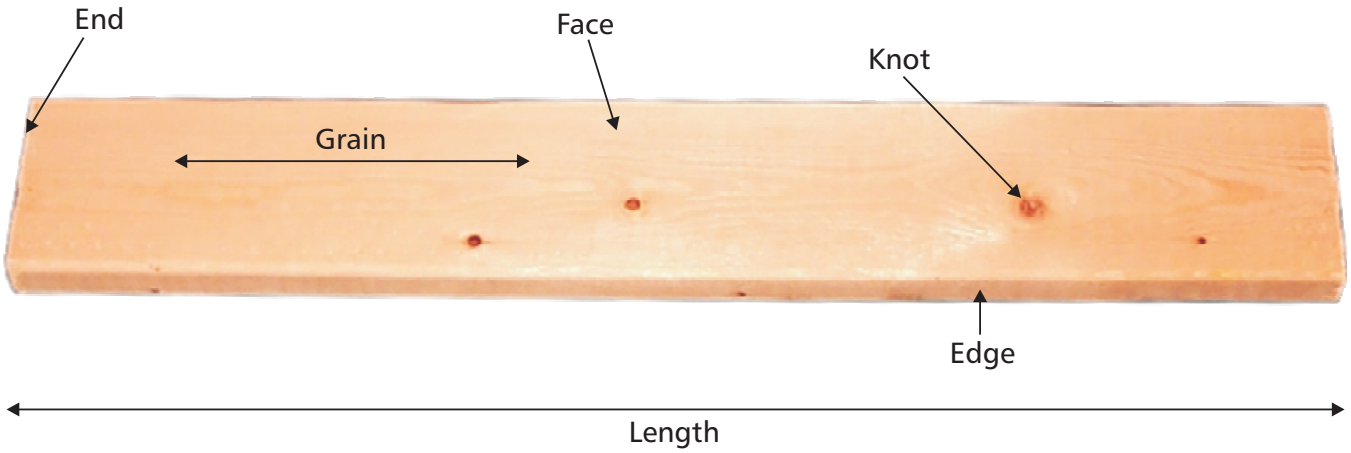
GRINDER/SANDER



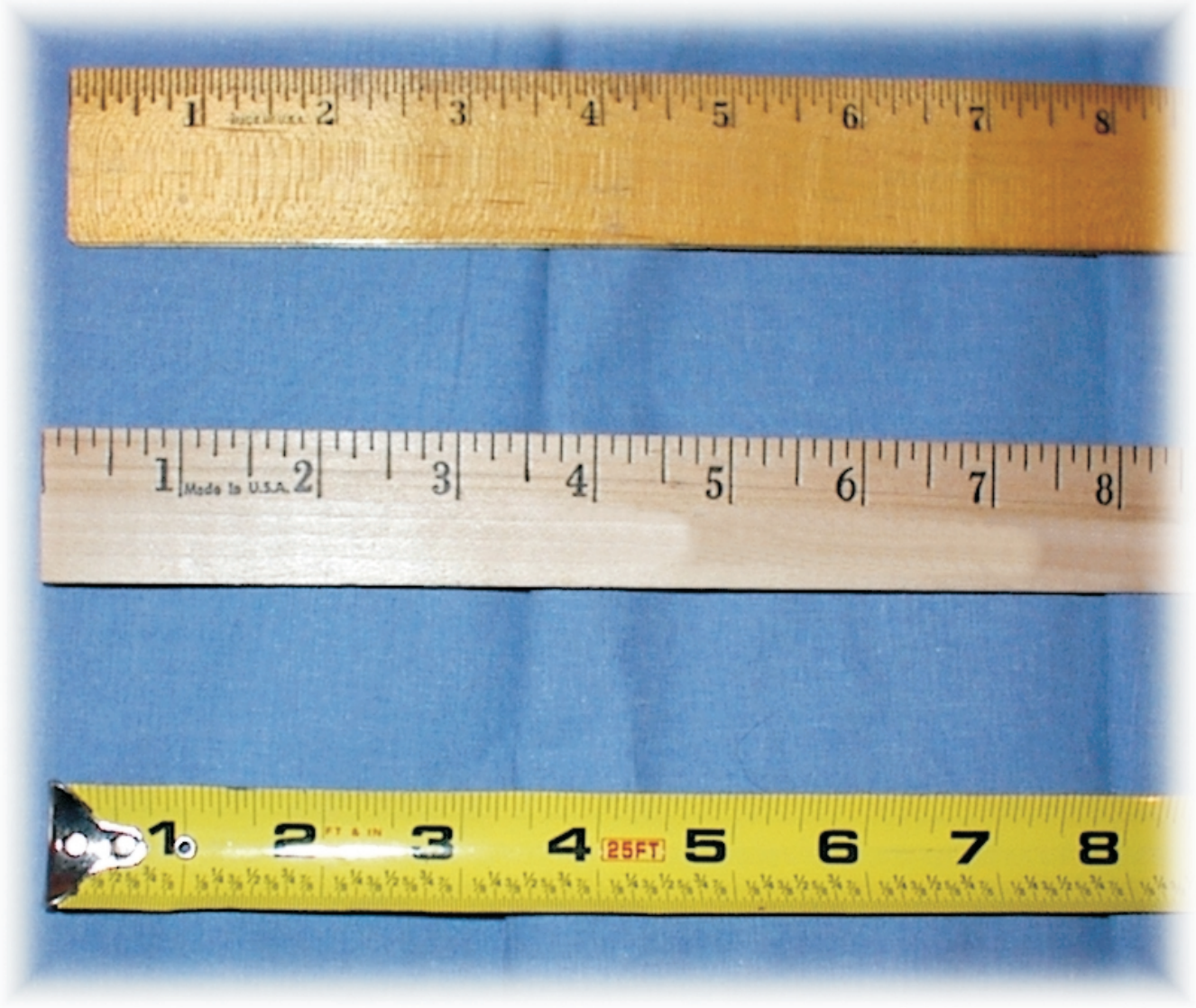
HARDWOOD VS. SOFTWOOD

- You can generally tell if wood is hard or soft by using your fingernail. If you can make an indention with your fingernail, the wood is usually softwood. Likewise, if you cannot make a mark, it is most likely hardwood.
- Most softwood lumber comes from trees that have needles (evergreens).
- Most hardwood lumber comes from trees with broad leaves that are shed in the fall.
- Hardwood is denser and harder to penetrate than softwood.
- Hardwoods are not necessarily harder than softwoods, depending on the species of the tree. Some softwoods are hard and some hardwoods are fairly soft.
- One way you can tell hardness is by how much a piece of wood weighs. Generally, the heavier the wood, the harder it is.
- Hardwoods have large, open cells called pores.
- Softwoods don't have pores.
- Softwoods are usually used in home and building construction.
- Hardwoods are used for a variety of purposes, including furniture, flooring, and cabinets.

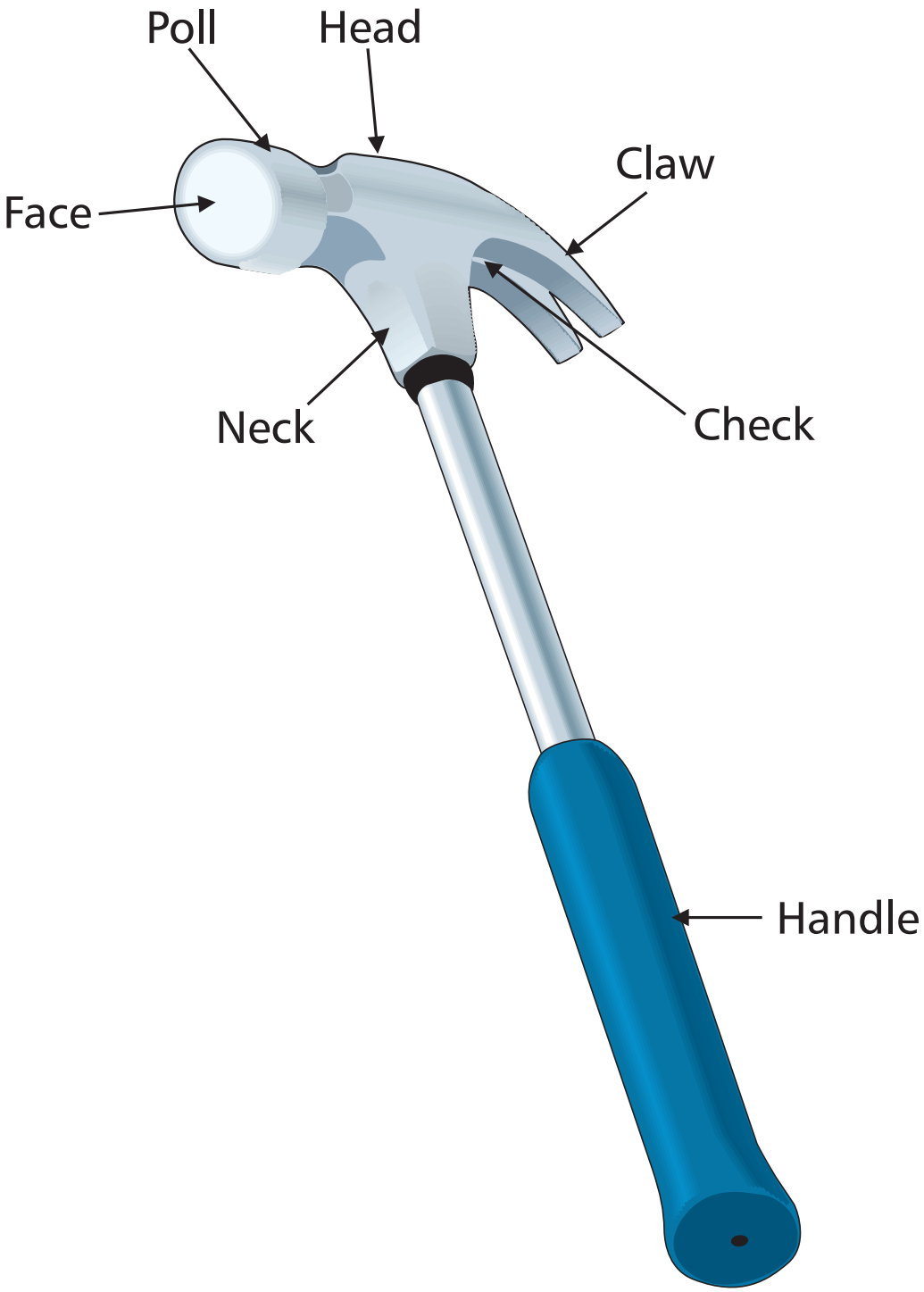
LUMBER PARTS



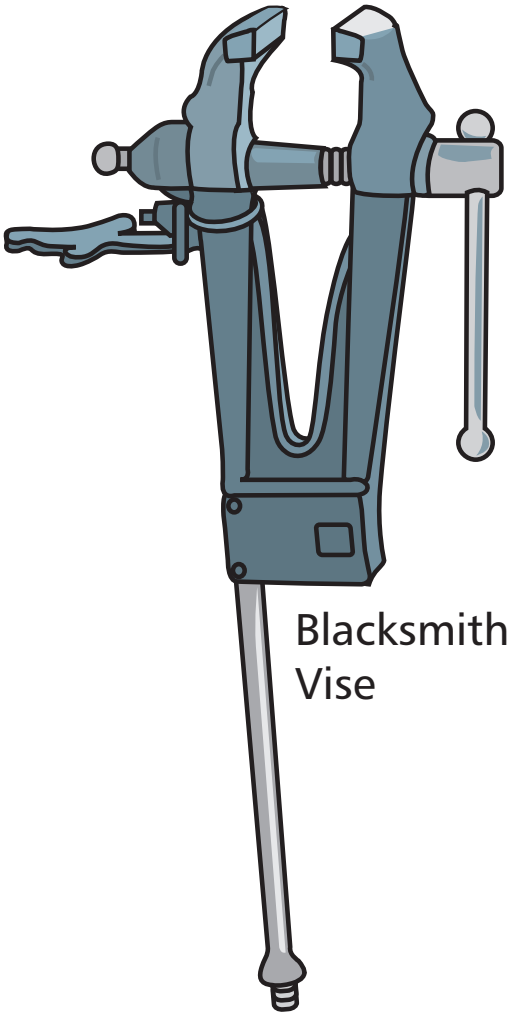
MEASURING TOOLS—RULER, YARD STICK, AND TAPE MEASURE



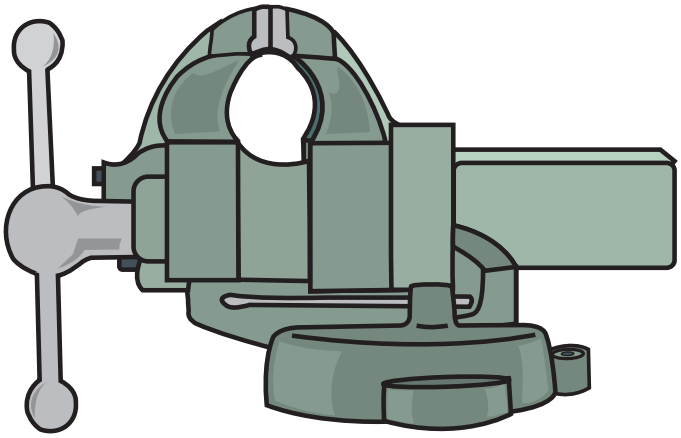
PARTS OF A HAMMER



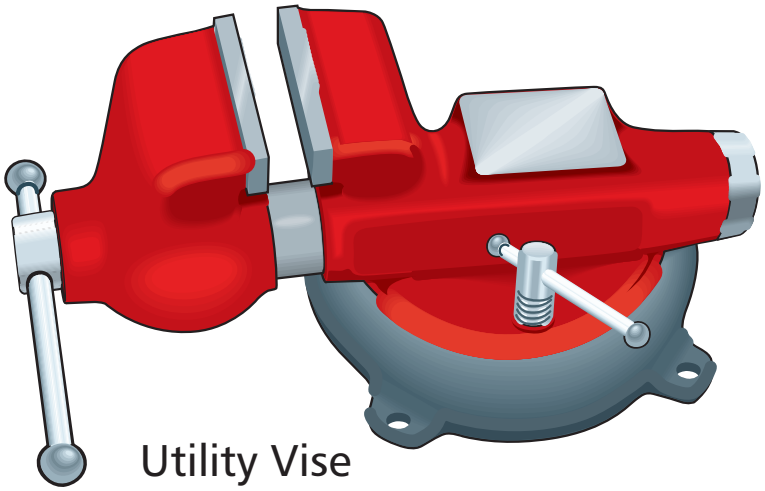
COMMON VISES



Blacksmith's Vise

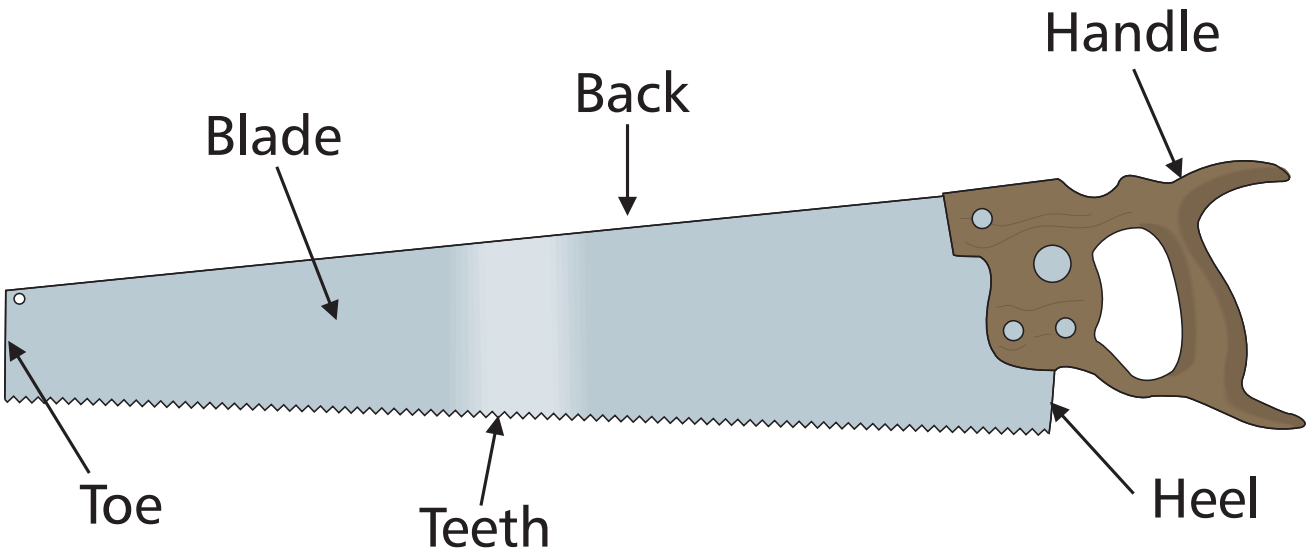


Machinist's Vise



Utility Vise

PARTS OF A SAW



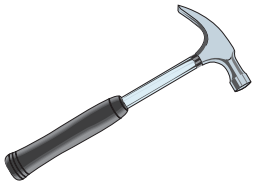
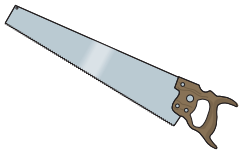
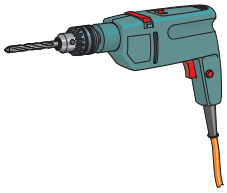
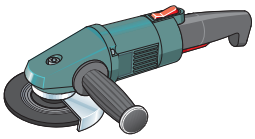
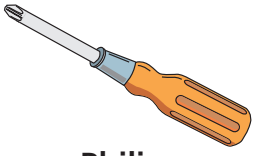
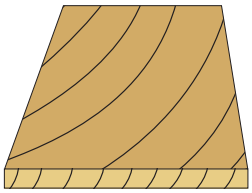
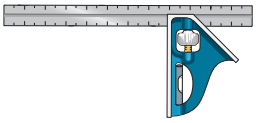
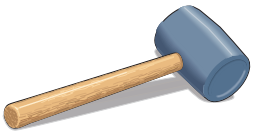
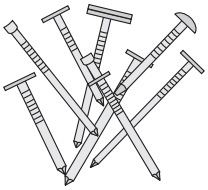
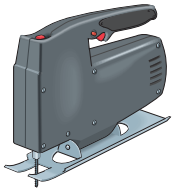
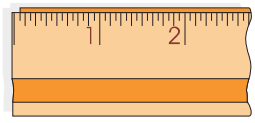
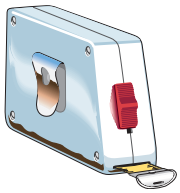
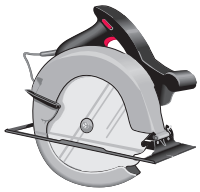
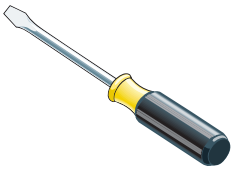
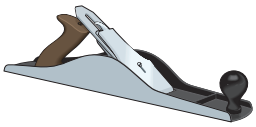
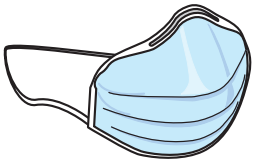
Name _____

CARPENTRY BINGO CARD

		FREE SPACE		

Name _____

CARPENTRY BINGO SQUARES

 Hammer	 Handsaw	 Level	 Power Drill	 First Aid Kit
 Grinder/Sander	 Philips Screwdriver	 Wood	 Combination Square	 Rubber Mallet
 Nail	 Safety Goggles	 Sabre Saw	 Ruler	 Safety Glasses
 Reciprocating Saw	 Tape Measure	 Circular Saw	 Fire Extinguisher	 Standard Screwdriver
 Adjustable Wrench	 Plane	 Particle Mask	 Pencil	

Name _____

SAFETY IS THE RULE!

Materials

- ✓ Posterboard
- ✓ Magazines
- ✓ Scissors
- ✓ Glue
- ✓ Markers

Directions

1. Select one of the safety rules you have learned about.
2. Create a poster that explains your safety rule.
3. Your poster should:
   a. clearly identify your safety rule
   b. include pictures (hand-drawn or clipped from a magazine) that illustrate your safety rule
   c. be neat and easy to read
4. Share your poster with the other students. Create a classroom bulletin board to display all the posters.

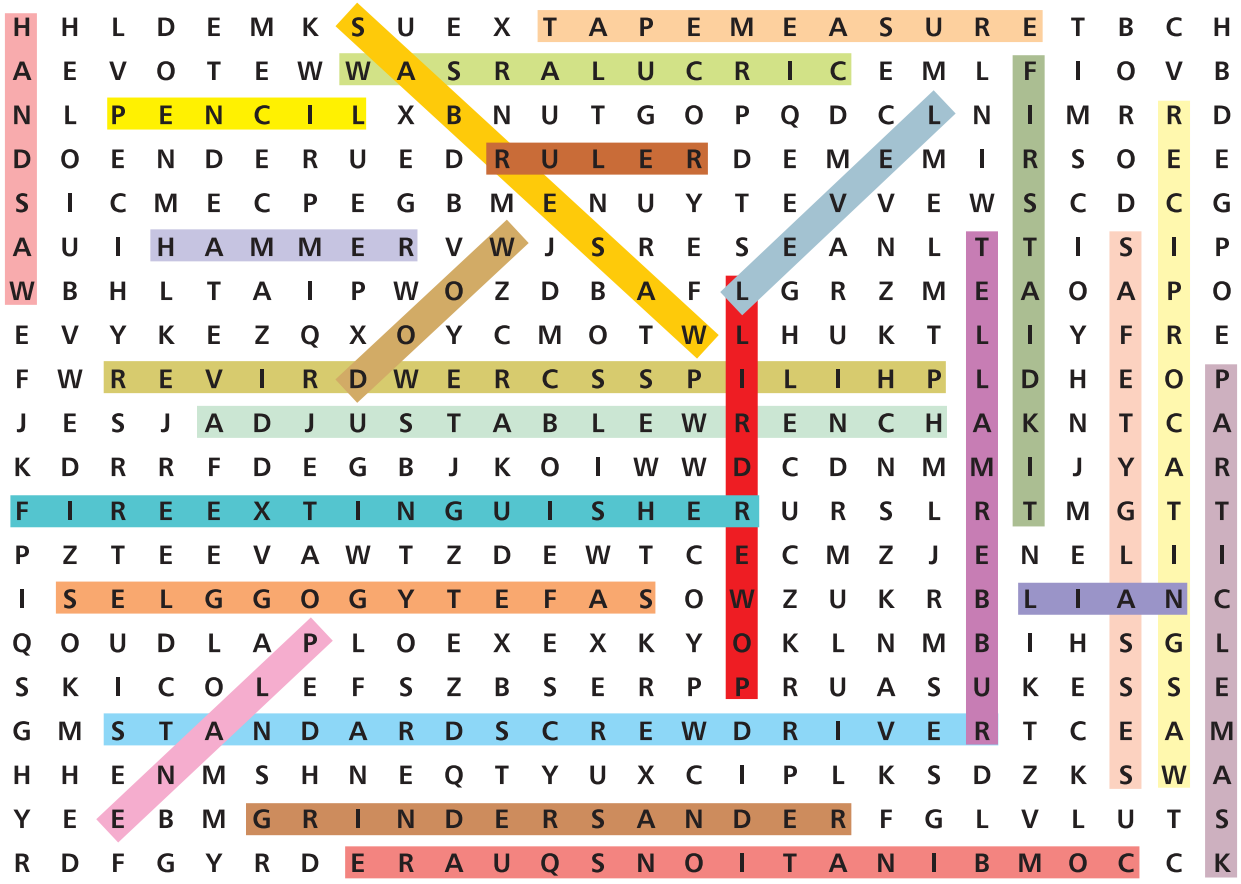
Name _____

WOODWORKING WORD SEARCH

H H L D E M K S U E X T A P E M E A S U R E T B C H
A E V O T E W W A S R A L U C R I C E M L F I O V B
N L P E N C I L X B N U T G O P Q D C L N I M R R D
D O E N D E R U E D R U L E R D E M E M I R S O E E
S I C M E C P E G B M E N U Y T E V V E W S C D C G
A U I H A M M E R V W J S R E S E A N L T T I S I P
W B H L T A I P W O Z D B A F L G R Z M E A O A P O
E V Y K E Z Q X O Y C M O T W L H U K T L I Y F R E
F W R E V I R D W E R C S S P I L I H P L D H E O P
J E S J A D J U S T A B L E W R E N C H A K N T C A
K D R R F D E G B J K O I W W D C D N M M I J Y A R
F I R E E X T I N G U I S H E R U R S L R T M G T T
P Z T E E V A W T Z D E W T C E C M Z J E N E L I I
I S E L G G O G Y T E F A S O W Z U K R B L I A N C
Q O U D L A P L O E X E X K Y O K L N M B I H S G L
S K I C O L E F S Z B S E R P P R U A S U K E S S E
G M S T A N D A R D S C R E W D R I V E R T C E A M
H H E N M S H N E Q T Y U X C I P L K S D Z K S W A
Y E E B M G R I N D E R S A N D E R F G L V L U T S
R D F G Y R D E R A U Q S N O I T A N I B M O C C K

HAMMER
POWER DRILL
PHILIPS SCREWDRIVER
RUBBER MALLET
SABRE SAW
RECIPROCATING SAW
FIRE EXTINGUISHER
PLANE
HANDSAW
FIRST AID KIT
WOOD
NAIL
RULER
TAPE MEASURE
STANDARD SCREWDRIVER
PARTICLE MASK
LEVEL
GRINDER/SANDER
COMBINATION SQUARE
SAFETY GOGGLES
SAFETY GLASSES
CIRCULAR SAW
ADJUSTABLE WRENCH
PENCIL

WOODWORKING WORD SEARCH KEY



Name _____

IDENTIFYING WOODS

Directions

1. Find at least five pieces of lumber in or around your house.
2. See if you can identify the wood as softwood or hardwood with the fingernail test.
3. Try the fingernail test on wood that has not been painted or finished in any way.
4. Record your results below.

Results

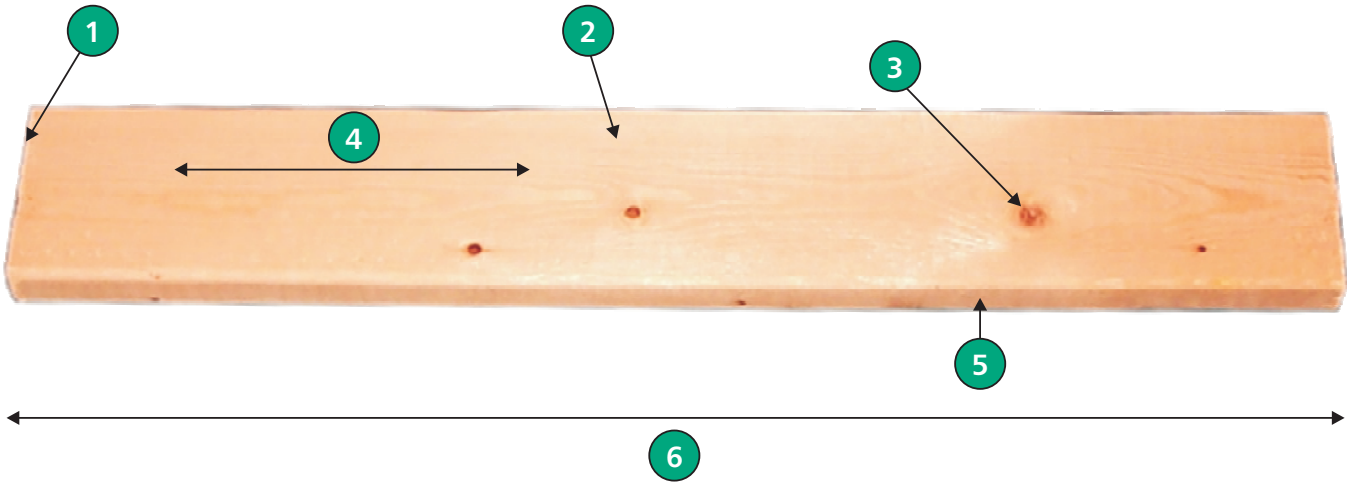
Location of Wood	Choose One	
	Hardwood	Softwood
1.		
2.		
3.		
4.		
5.		
Describe the difference:		

Name _____

LABEL THE LUMBER

Directions

Label the parts of the piece of lumber below.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

LABEL THE LUMBER KEY

1. End
2. Face
3. Knot
4. Grain
5. Edge
6. Length

Name _____

MEASURE THE MARK

Materials

- ✓ Measuring tool
- ✓ Three pieces of scrap lumber
- ✓ Writing utensil

Directions

Answer the following questions.

1. Use your measuring tool to measure the lines below. Write the measurement in the blank provided.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

2. Measure the length, face, and edge of three pieces of scrap lumber and write the measurements below.

   a. Length: _____
      Face: _____
      Edge: _____

   b. Length: _____
      Face: _____
      Edge: _____

   c. Length: _____
      Face: _____
      Edge: _____

MEASURE THE MARK KEY

1. a. 1.5" (1½")
   b. 2"
   c. 1.25" (1¼")
   d. 3.75" (3¾")
   e. 0.5" (½")
2. Answers will vary depending on scraps of lumber used.

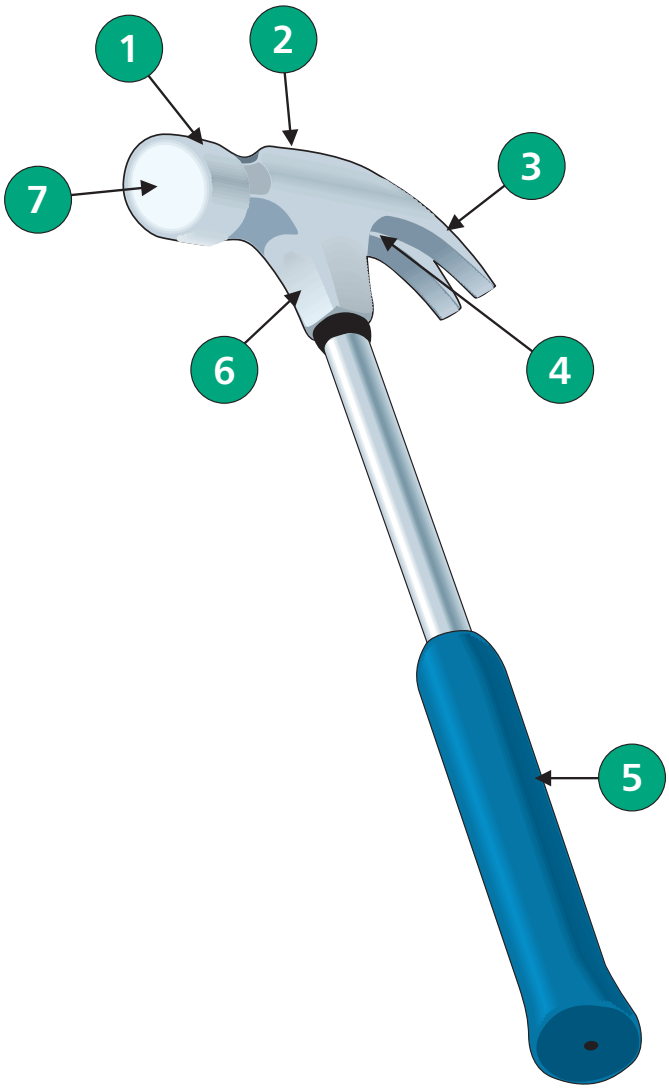
Name _____

PARTS OF A HAMMER

Directions

Label the parts of the hammer below.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____



WS KEY: G–2H

PARTS OF A HAMMER KEY

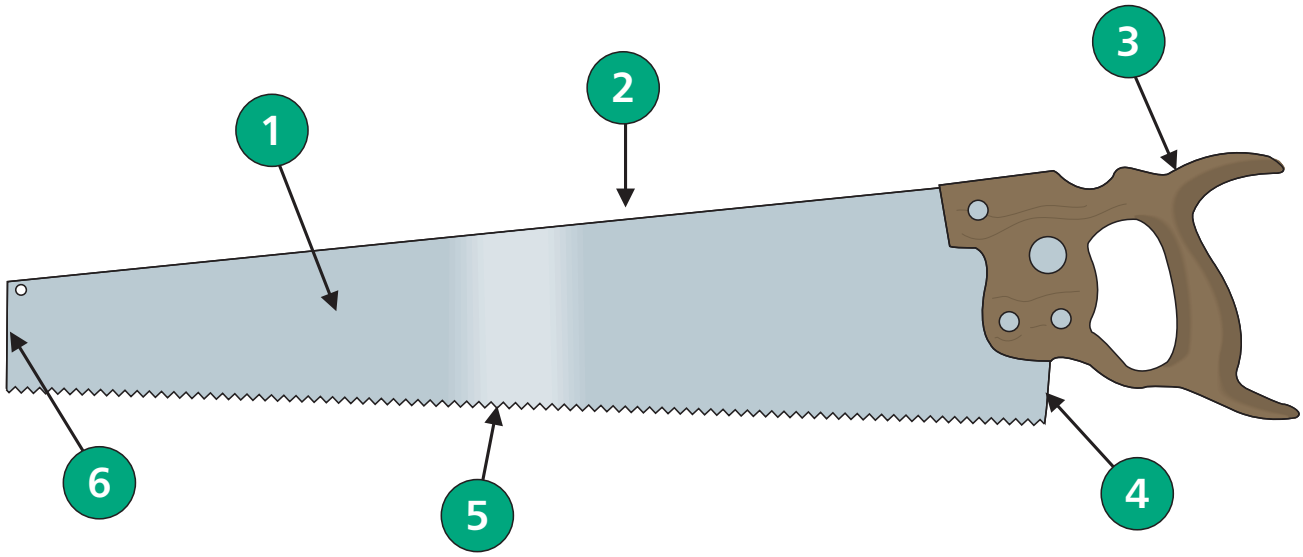
1. Poll
2. Head
3. Claw
4. Check
5. Handle
6. Neck
7. Face

Name _____

PARTS OF A SAW

Directions

Label the parts of the saw below.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

PARTS OF A SAW KEY

1. Blade
2. Back
3. Handle
4. Heel
5. Teeth
6. Toe

Name _____

NAIL LAB

Materials

- ✓ Hammer
- ✓ Two each of five different types of nails
- ✓ One piece of scrap lumber
- ✓ Pliers
- ✓ Measuring tool
- ✓ Safety goggles

Directions

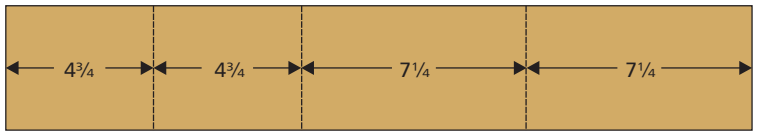
1. Before you begin, use your measuring skills to measure the length of each of the different types of nails. Record the lengths in the Data Table below.
2. Put on your safety goggles.
3. Using the pliers to hold the nail in place, see how many hits it takes you to drive one of each type of the nails into a piece of lumber with the hammer. Record the number of hits in the Data Table. Place a check mark by those you bend.
4. Evaluate your results. Review the tips for hammering you learned about in this lesson and see if you can improve.
5. See how many hits it takes you to drive the second set of nails into the lumber. Record the results in the Data Table. Place a check mark by those you bend. Did you improve?
6. Pull any of the nails that you bent. Try not to damage the wood.

DATA TABLE			
	Length	Number of Hits	
		First Try	Second Try
Nail Type 1			
Nail Type 2			
Nail Type 3			
Nail Type 4			
Nail Type 5			

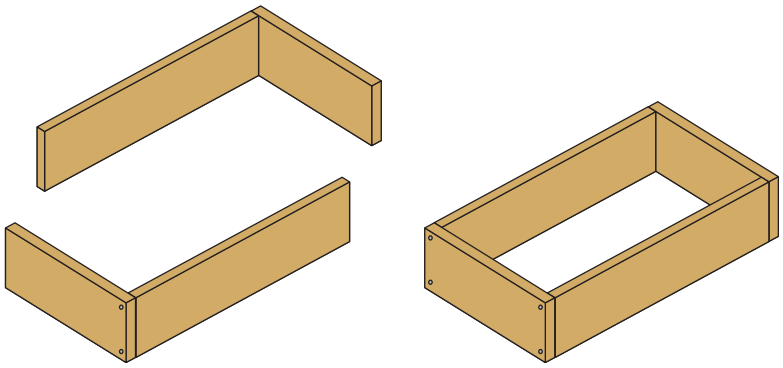
Name _____

PUTTING IT ALL TOGETHER

Materials



- ✓ Hammer
- ✓ Handsaw
- ✓ 8 common nails (approximately 1½" in length)
- ✓ One piece of lumber (1" × 4" × 24")
- ✓ Vise
- ✓ Pliers
- ✓ Pencil
- ✓ Safety goggles

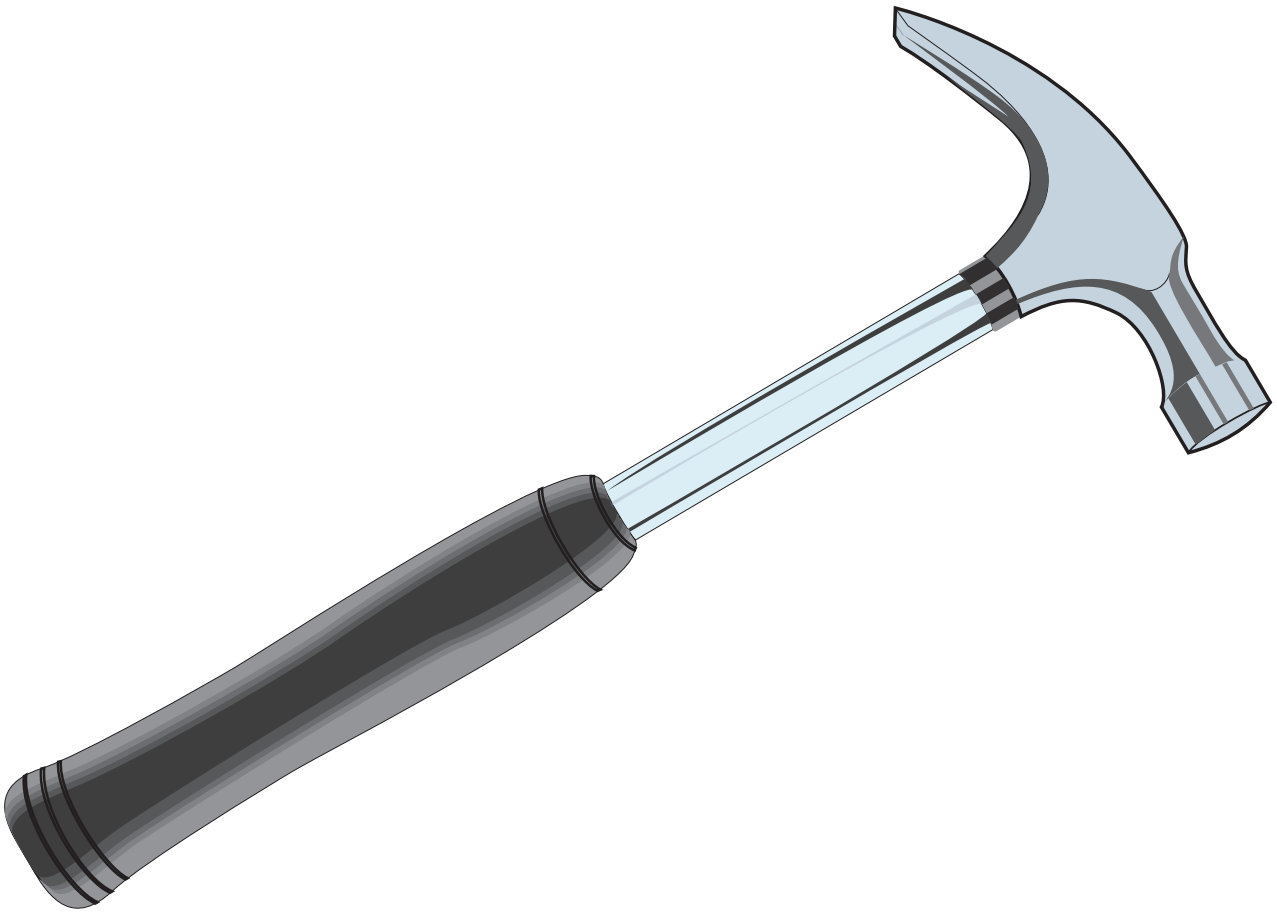


Procedure

1. Put on your safety goggles.
2. Measure and mark off a 4¾" long board on the piece of lumber.
3. Use a handsaw to cut the lumber to the required length. (Use a sturdy work surface to make your cut.)
4. Measure and mark off a second 4¾" long board on the piece of lumber.
5. Use a handsaw to cut the lumber to the required length.
6. Measure the remaining lumber and divide it in half to get two pieces equal in length.
7. After you have measured, marked, and cut your lumber to length, you should have two 4¾" long boards and two approximately 7¼" long boards.
8. Insert one of the longer boards into the vise lengthwise. Leave about 2 inches above the vise.
9. Take one of the shorter boards and place its face on the edge of the piece already in the vise.
10. Use two nails to attach the two boards. Remember to use the pliers to hold the nails while hammering.
11. Attach the remaining boards the same way. You should have two L-shaped sections.
12. Attach the two L-shaped sections to create a frame.
13. You have demonstrated the skills necessary to work with wood!

WOODWORKING BINGO

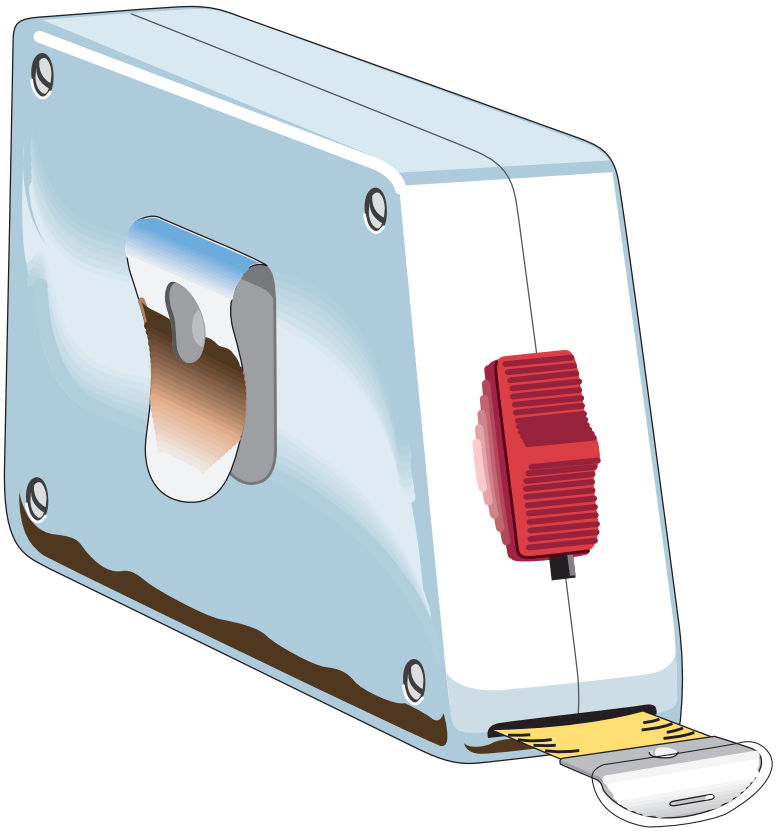
HAMMER



A hand tool consisting of a shaft with a metal head at right angles to it, used mainly for driving in nails.

WOODWORKING BINGO

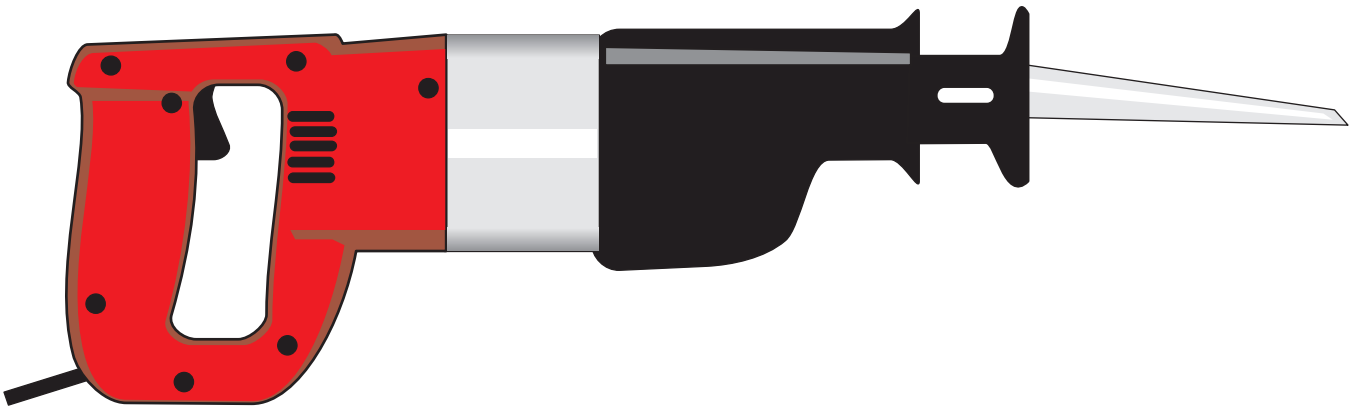
TAPE MEASURE



A long roll or strip of fabric, plastic, paper, or thin metal that is marked off in inches or centimeters and used for measuring.

WOODWORKING BINGO

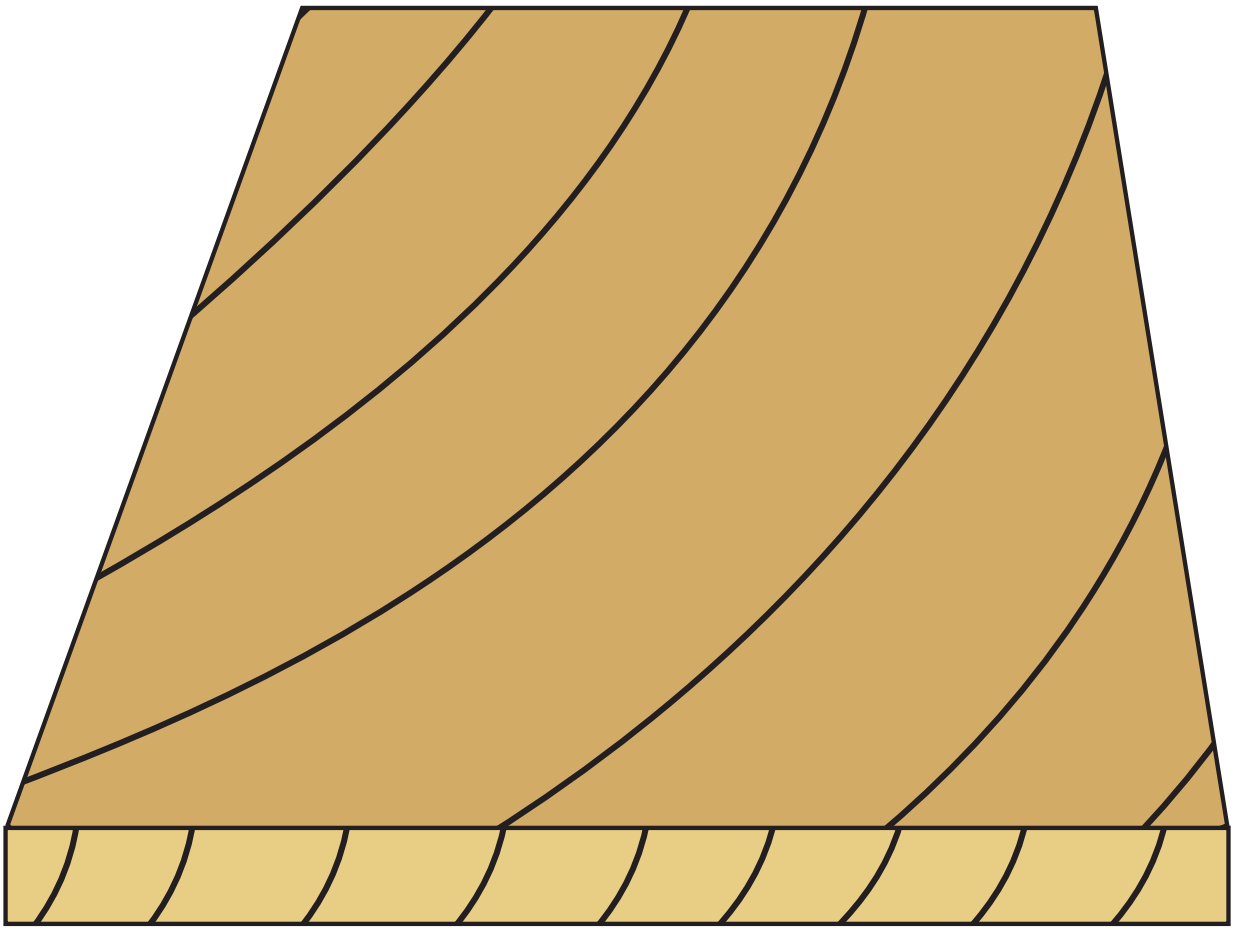
RECIPROCATING SAW



A power tool with a short flat blade at the end of the saw that moves back and forth to quickly cut wood and other materials.

WOODWORKING BINGO

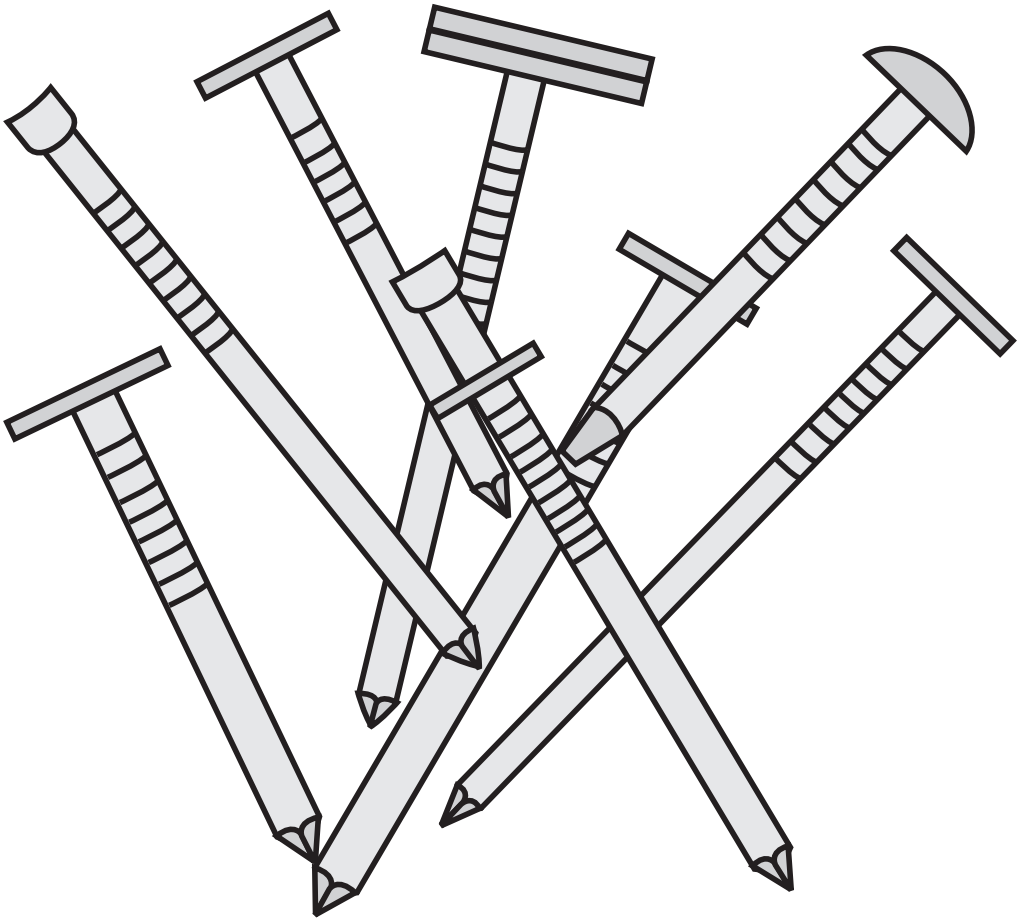
WOOD



A product from trees that can be used to build things.

WOODWORKING BINGO

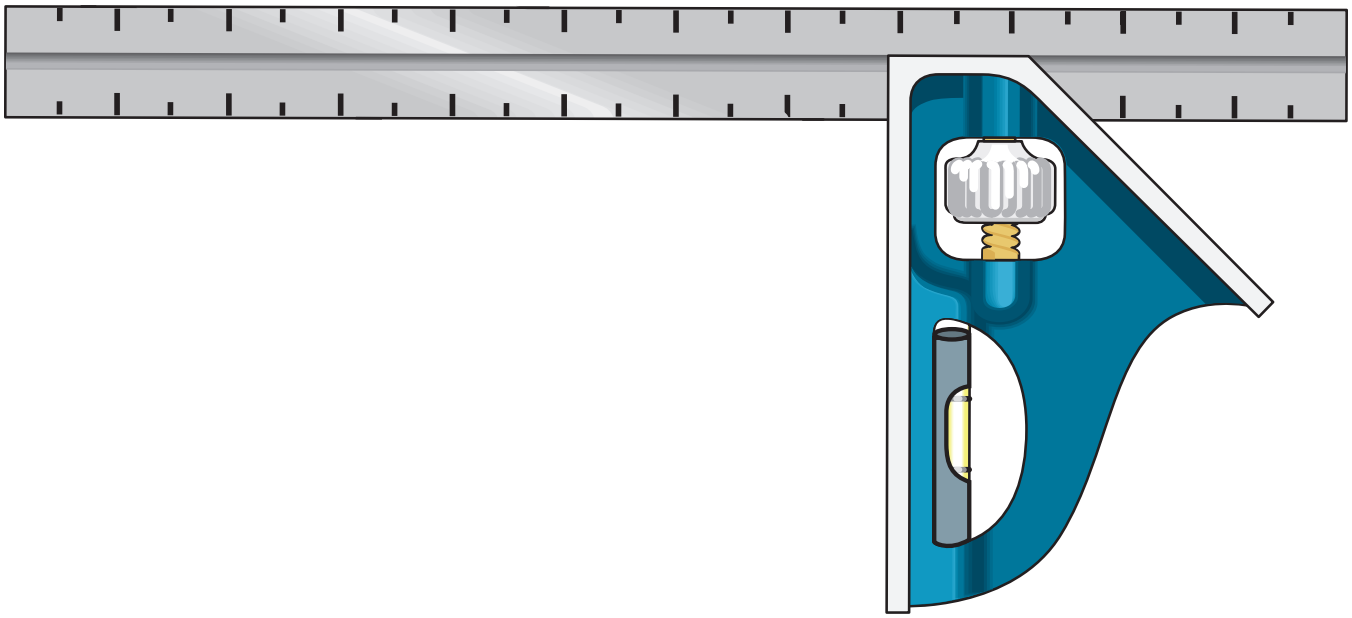
NAIL



A strong metal pin with a flat round head and a pointed end that is hammered into wood and used to fasten objects together.

WOODWORKING BINGO

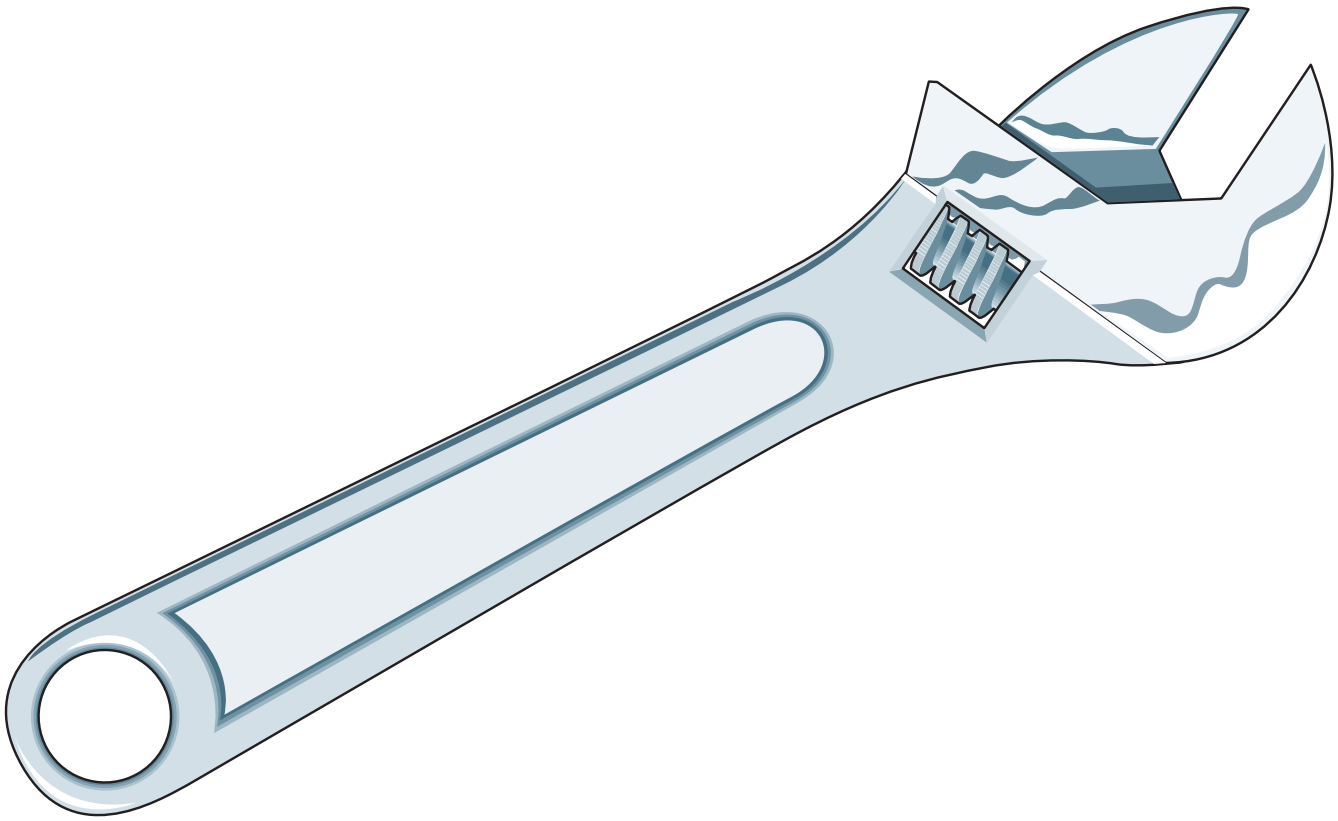
COMBINATION SQUARE



A woodworking tool used to test and mark proper angles, draw lines for making straight cuts, and other things.

WOODWORKING BINGO

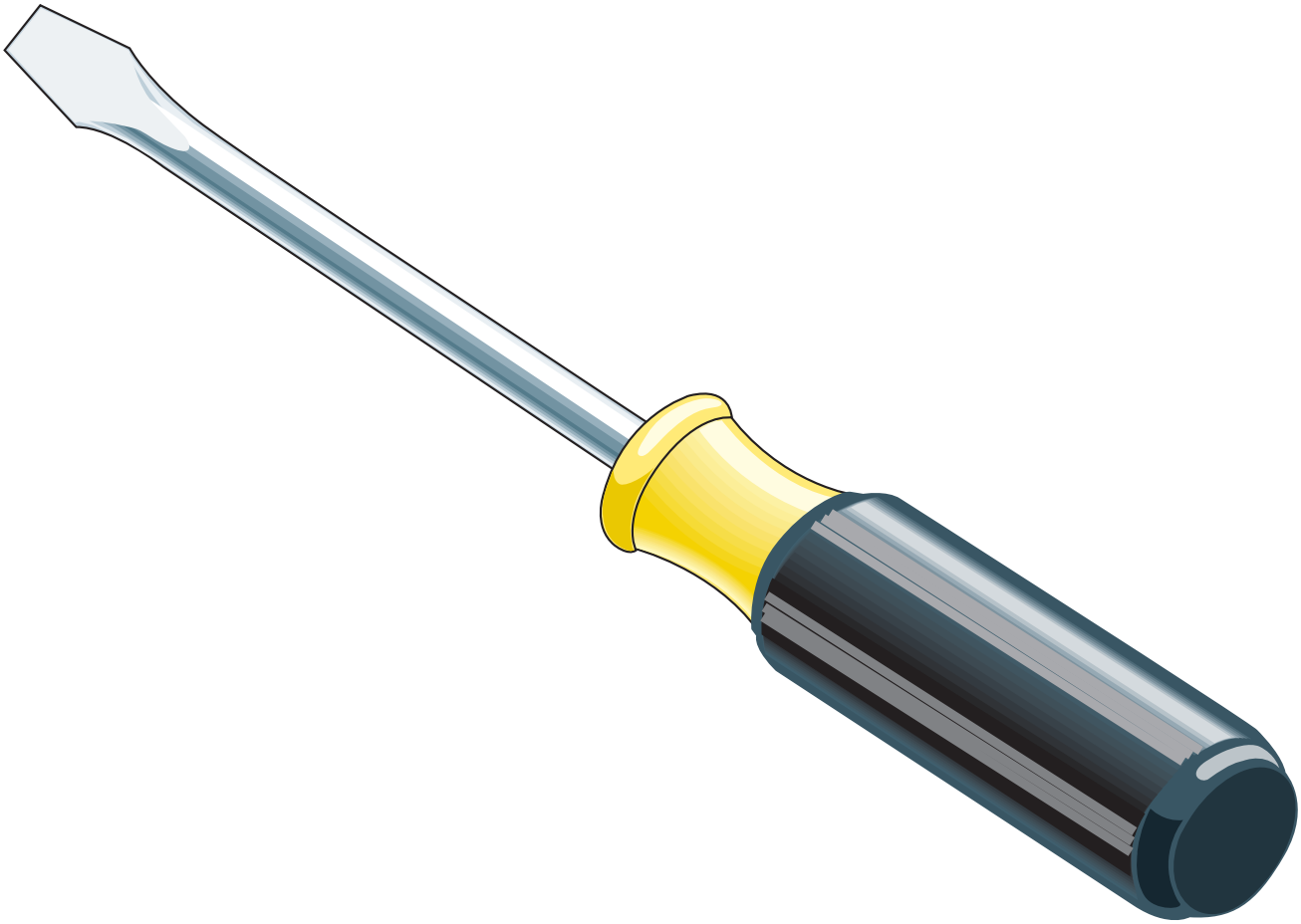
ADJUSTABLE WRENCH



A tool used to grip, turn, or twist objects such as nuts and bolts.

WOODWORKING BINGO

STANDARD SCREWDRIVER



A tool used to turn standard-head screws.

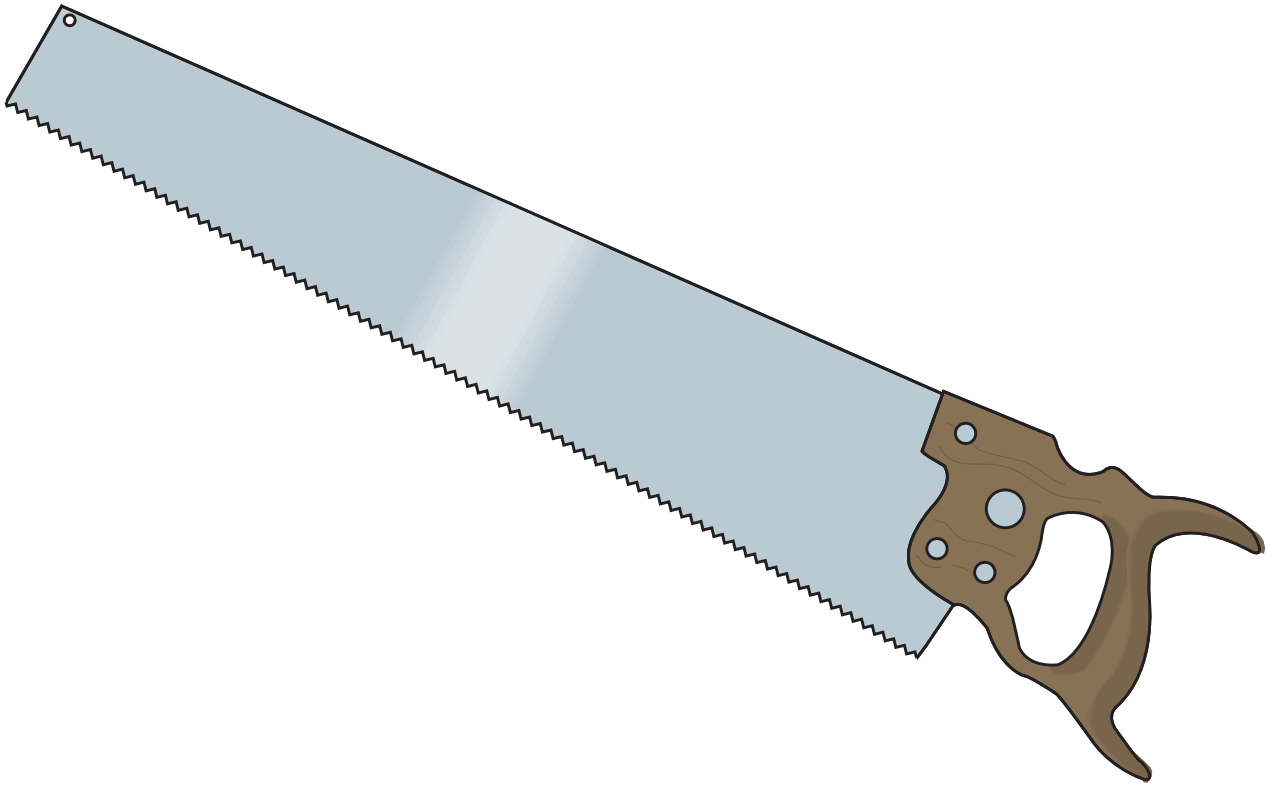
WOODWORKING BINGO

FIRE EXTINGUISHER

A fire extinguisher should always be kept in the work area.

WOODWORKING BINGO

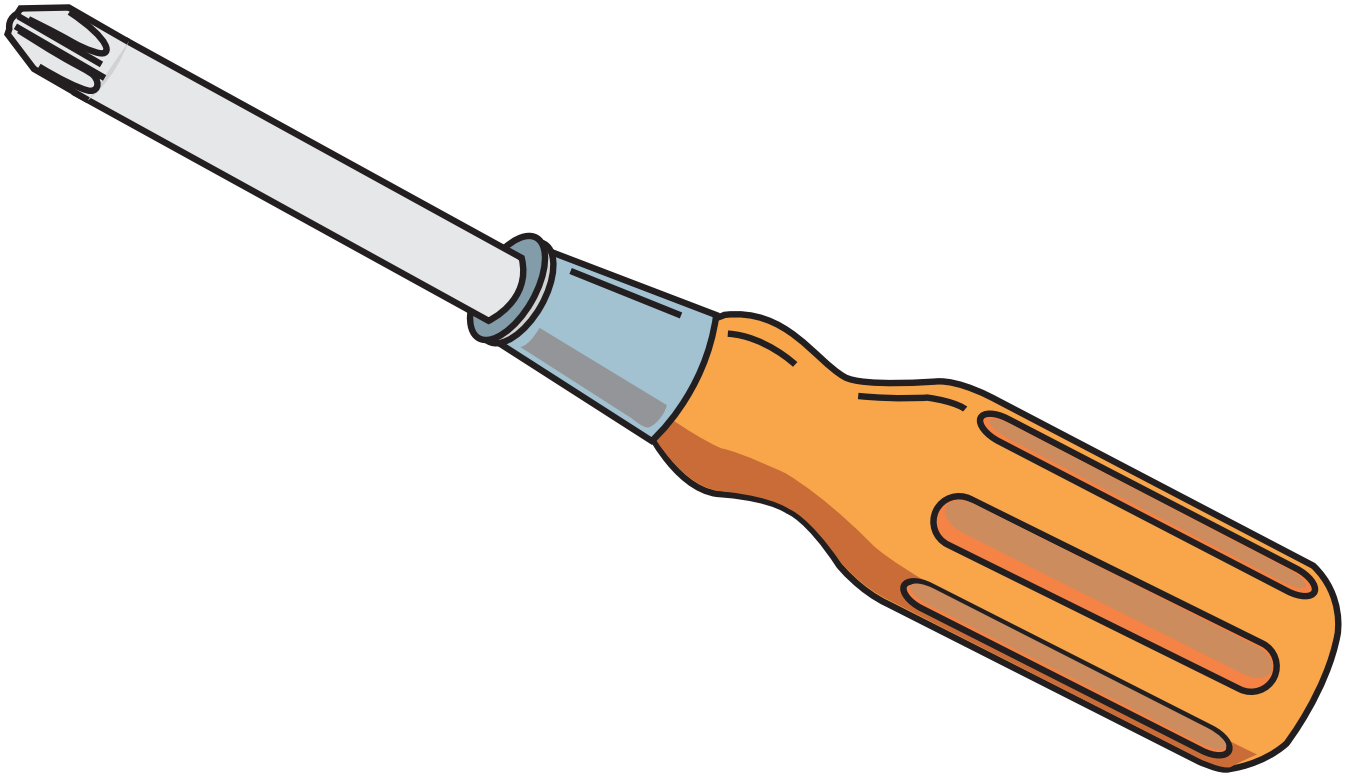
HANDSAW



A tool used for cutting materials.

WOODWORKING BINGO

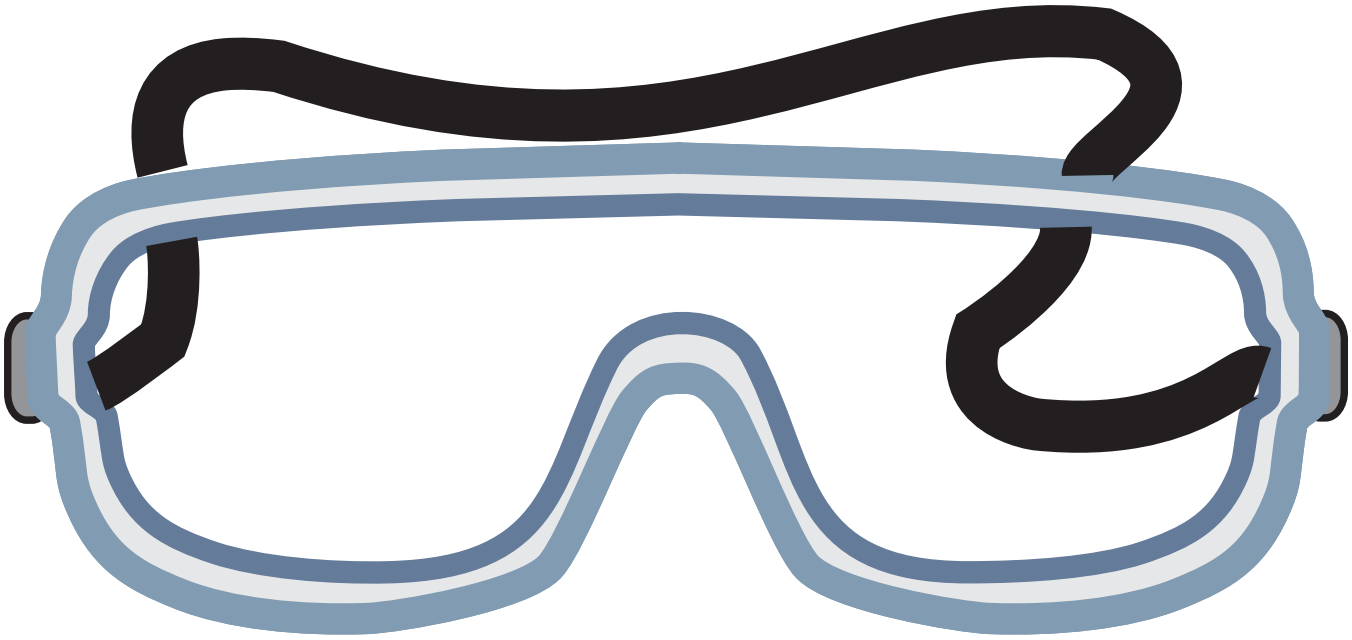
PHILIPS SCREWDRIVER



A tool used to turn Philips-head screws.

WOODWORKING BINGO

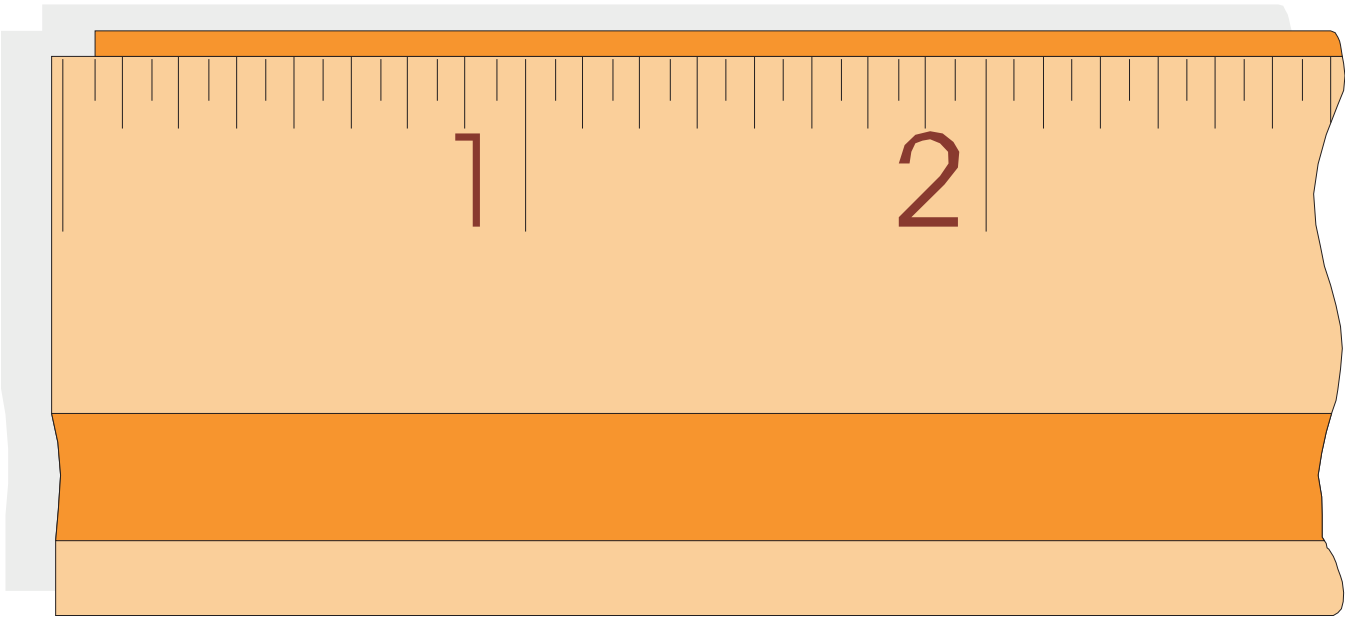
SAFETY GOGGLES



Eye protection that seals tightly around the face and protects the eyes from flying objects.

WOODWORKING BINGO

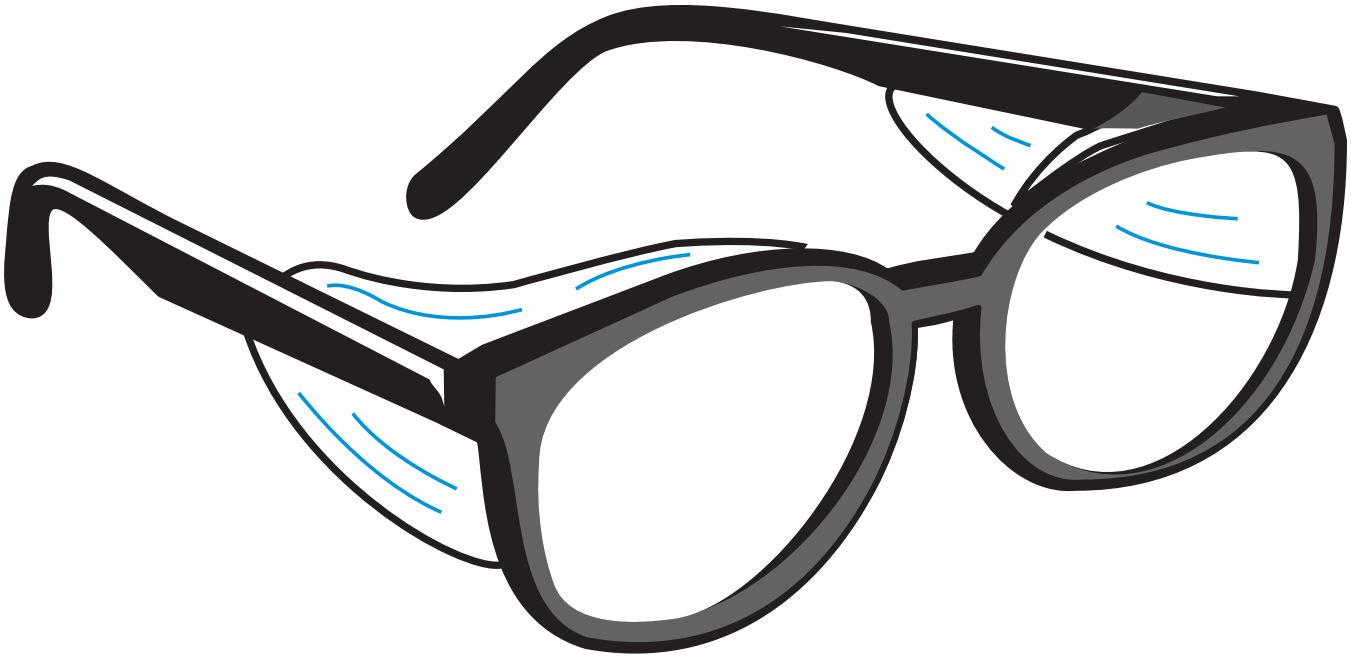
RULER



A strip of plastic, wood, or metal with at least one straight edge and units of length marked on it.

WOODWORKING BINGO

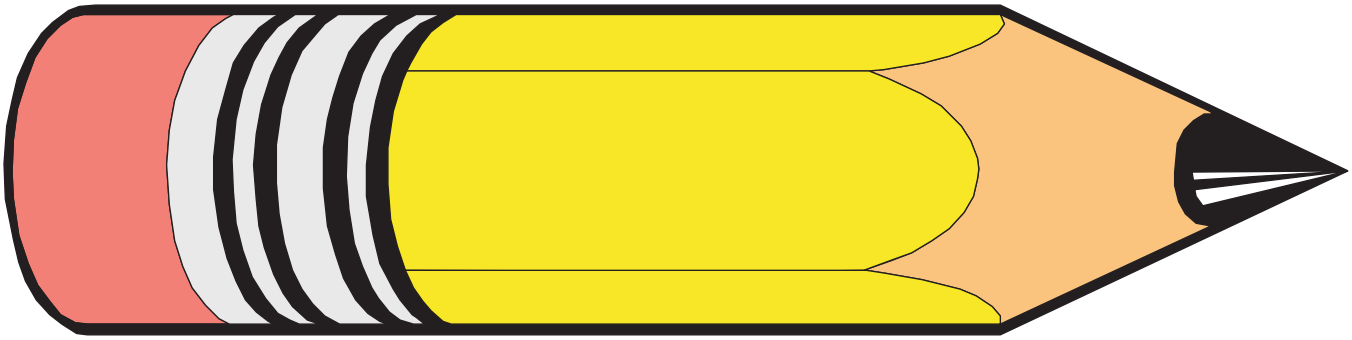
SAFETY GLASSES



Glasses worn to protect the eyes from flying objects.

WOODWORKING BINGO

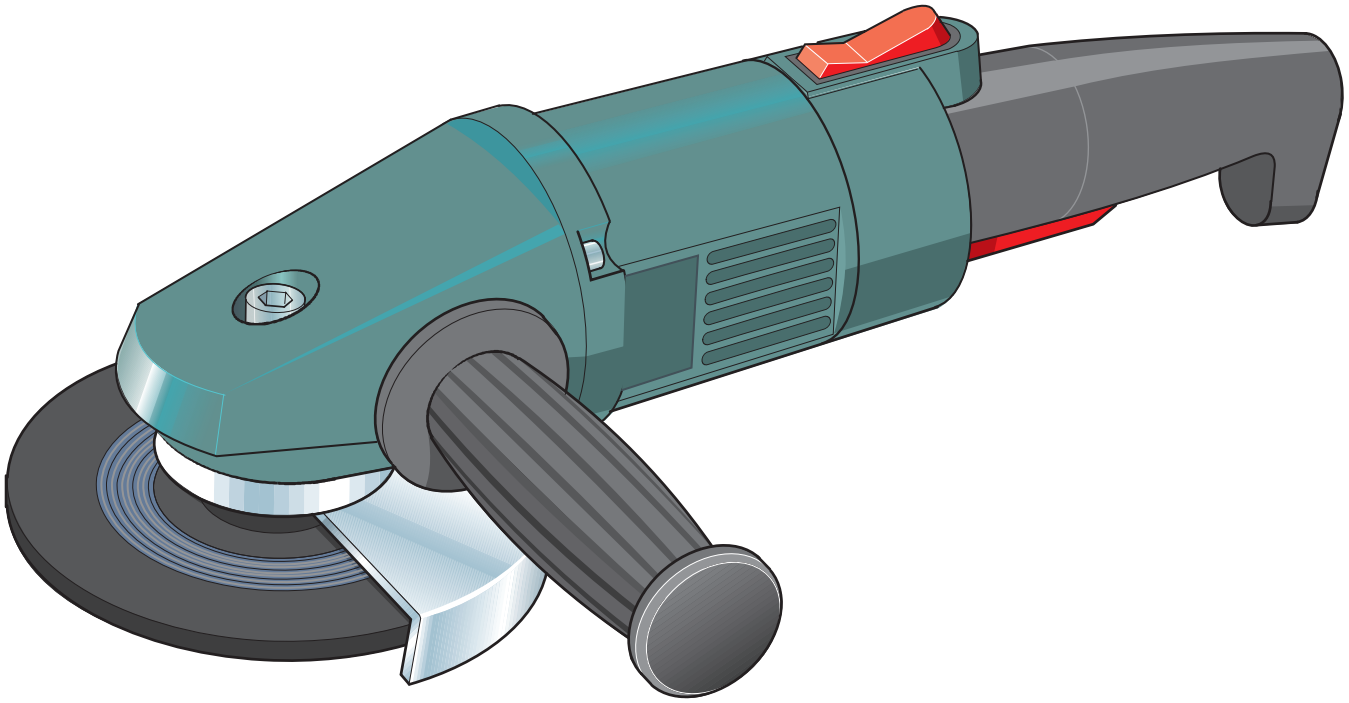
PENCIL



A thin cylindrical instrument used for drawing, marking, or writing.

WOODWORKING BINGO

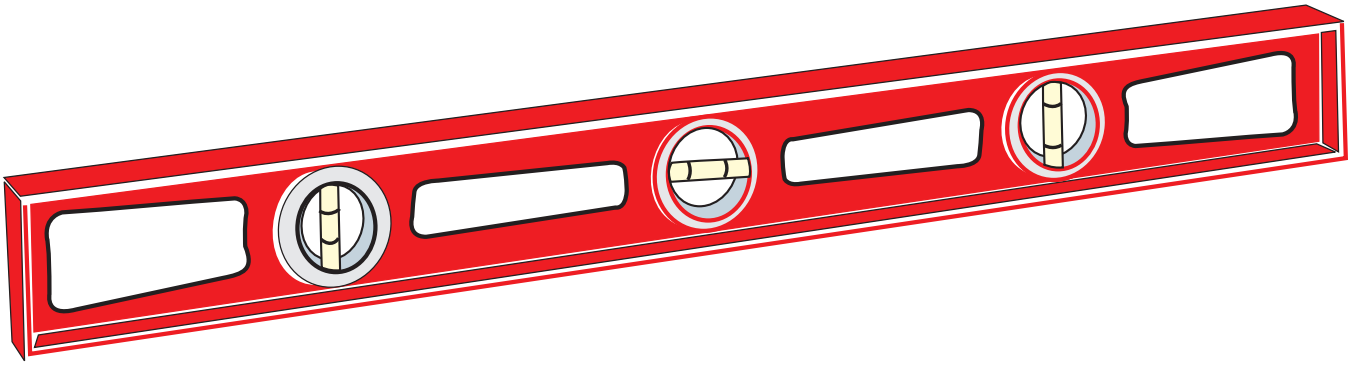
GRINDER/SANDER



A power tool used to remove rough edges and to smooth and shape materials.

WOODWORKING BINGO

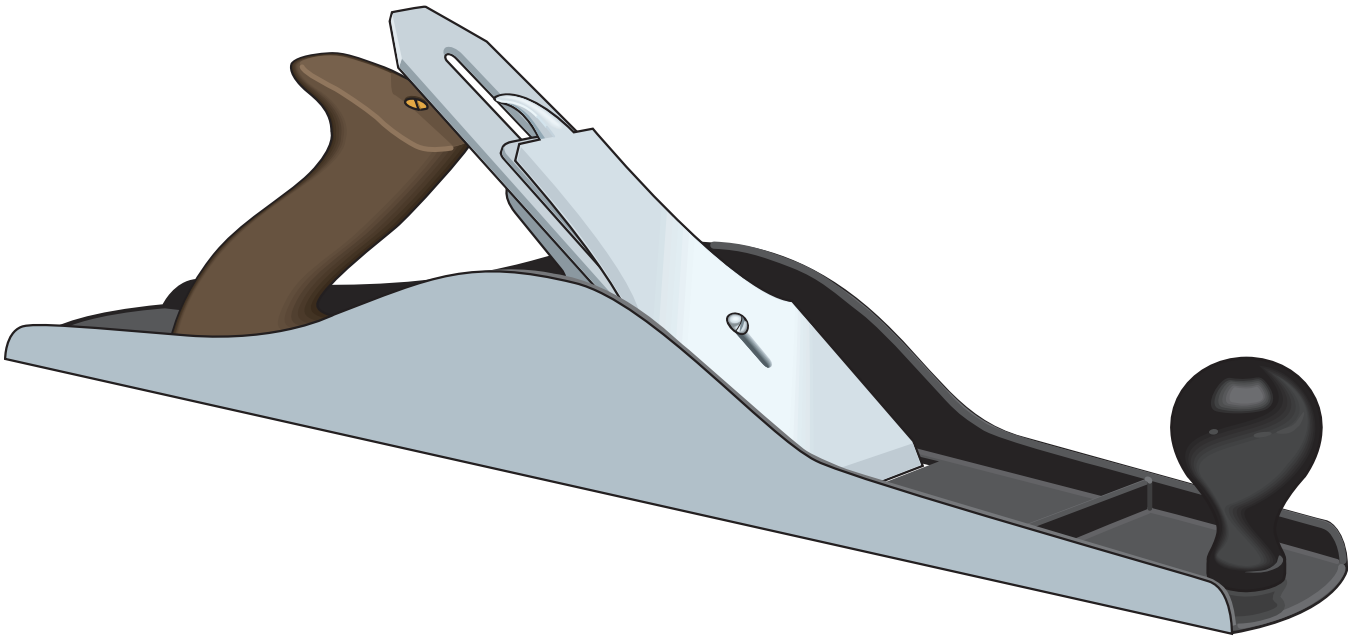
LEVEL



A tool used to make sure a surface is flat (horizontal).

WOODWORKING BINGO

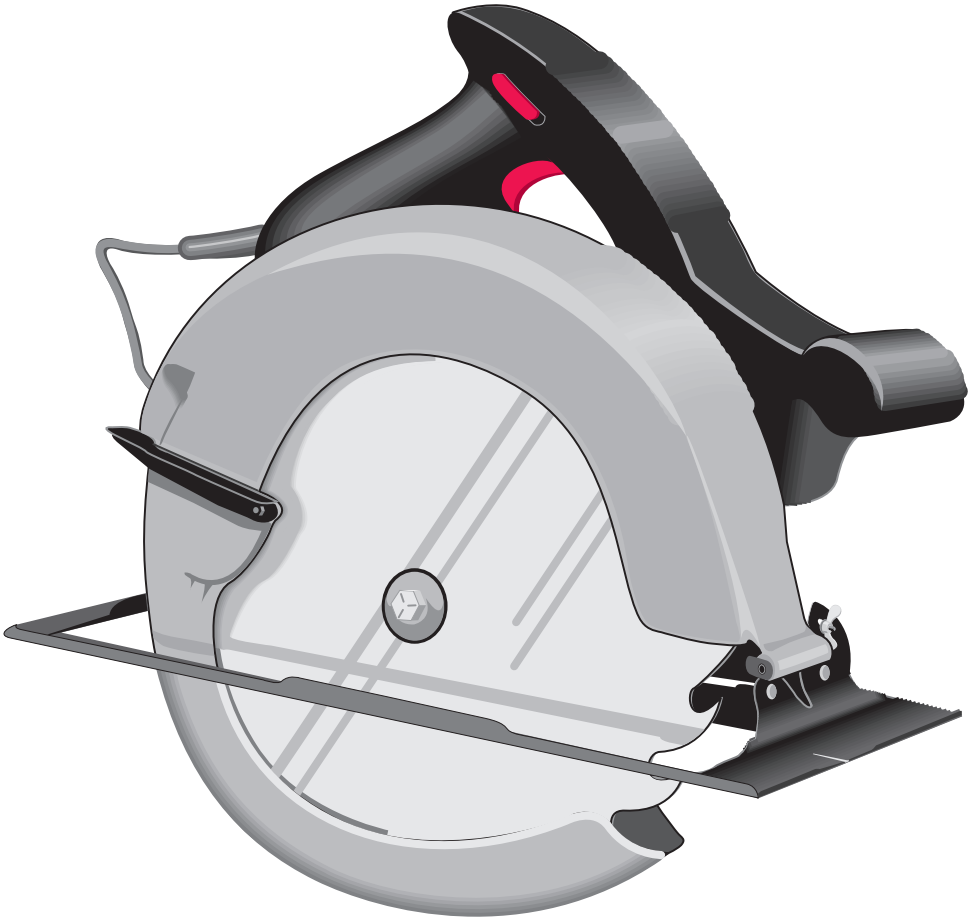
PLANE



A tool used to smooth surfaces and change the size or shape of wood materials.

WOODWORKING BINGO

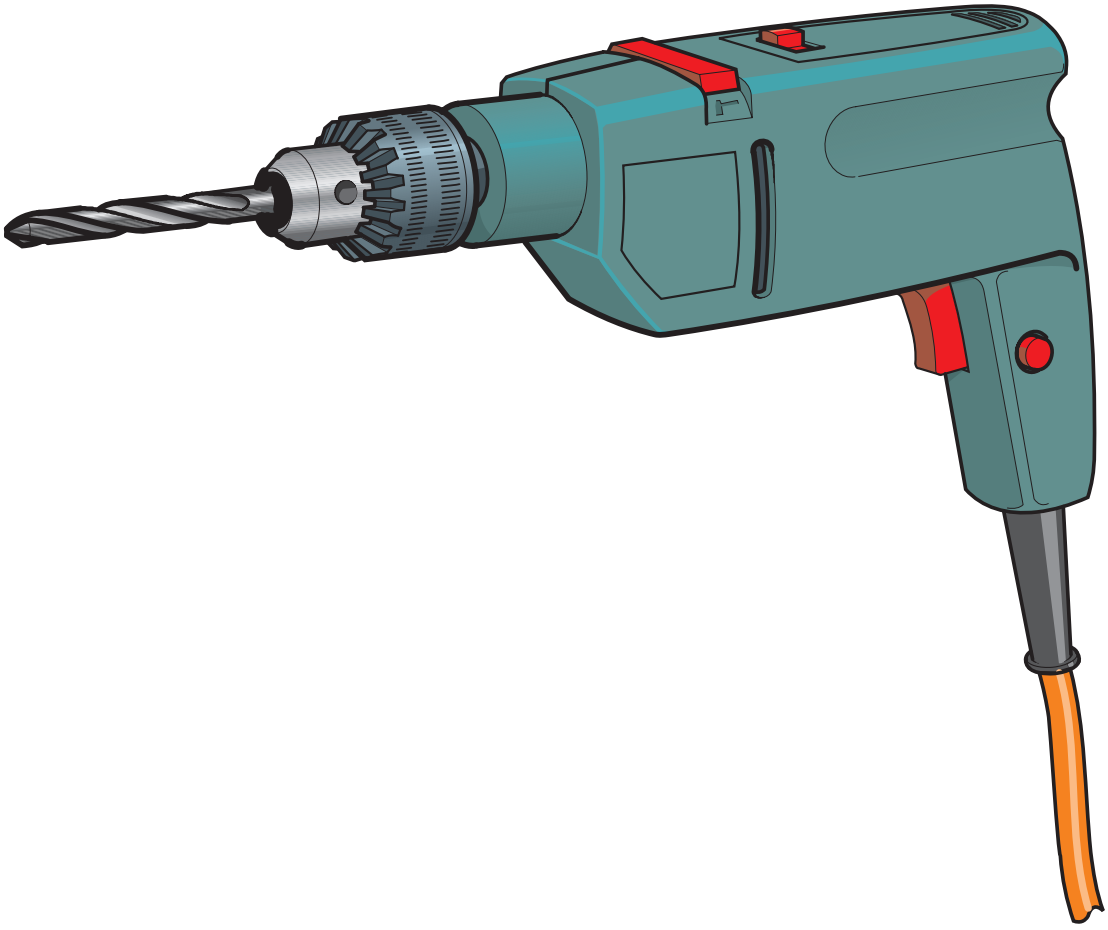
CIRCULAR SAW



A power tool with a round blade used for cutting wood and other materials.

WOODWORKING BINGO

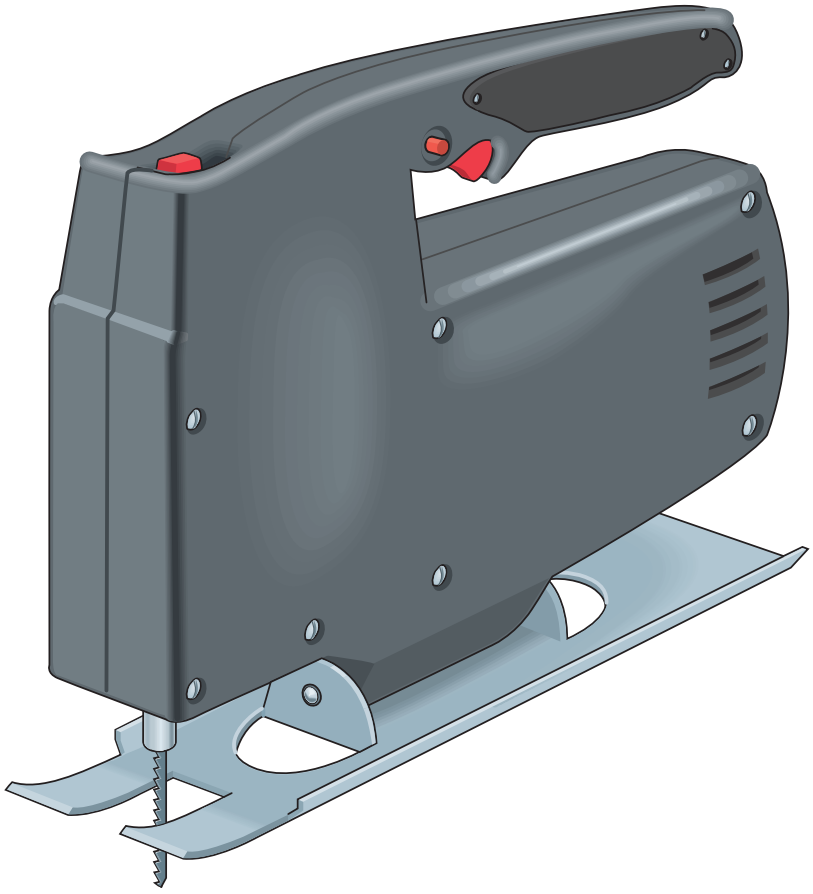
POWER DRILL



A power tool used to drill holes in wood and other materials.

WOODWORKING BINGO

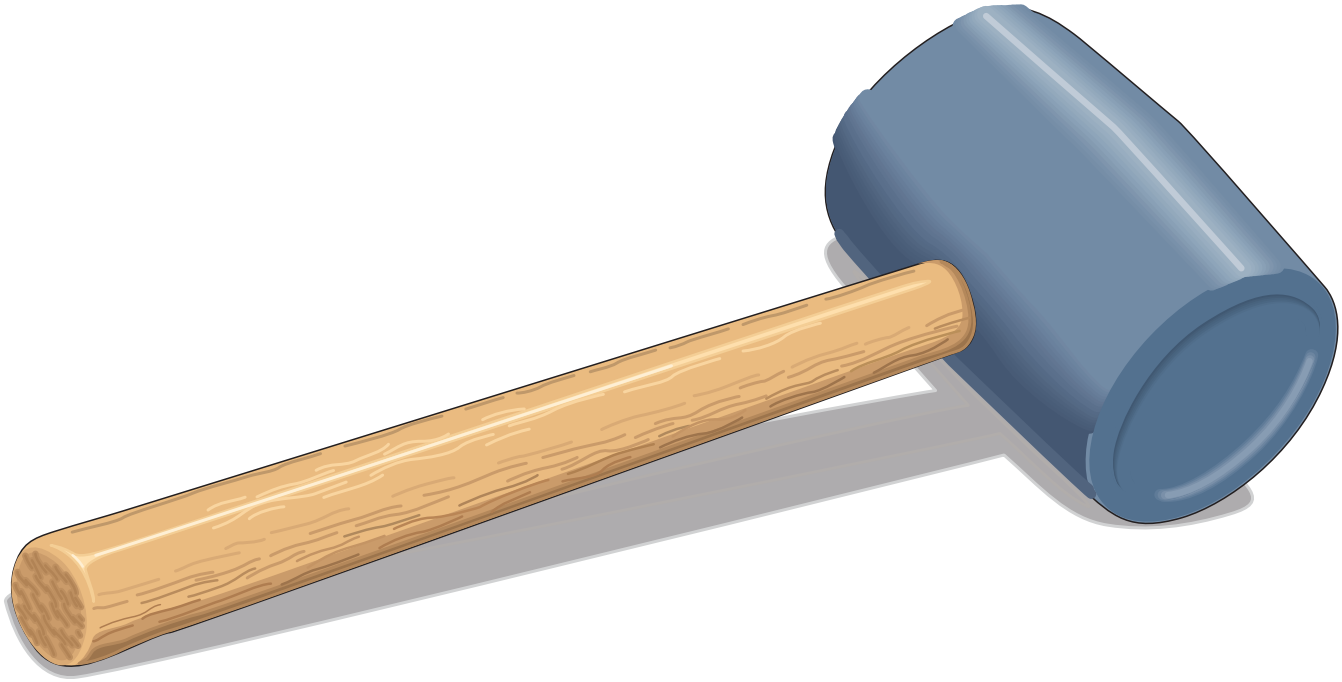
SABRE SAW



A power tool with the blade located underneath the saw body used to cut circles, curves, and holes in wood and other materials.

WOODWORKING BINGO

RUBBER MALLET



A tool used for driving when there is concern for damaging the material.

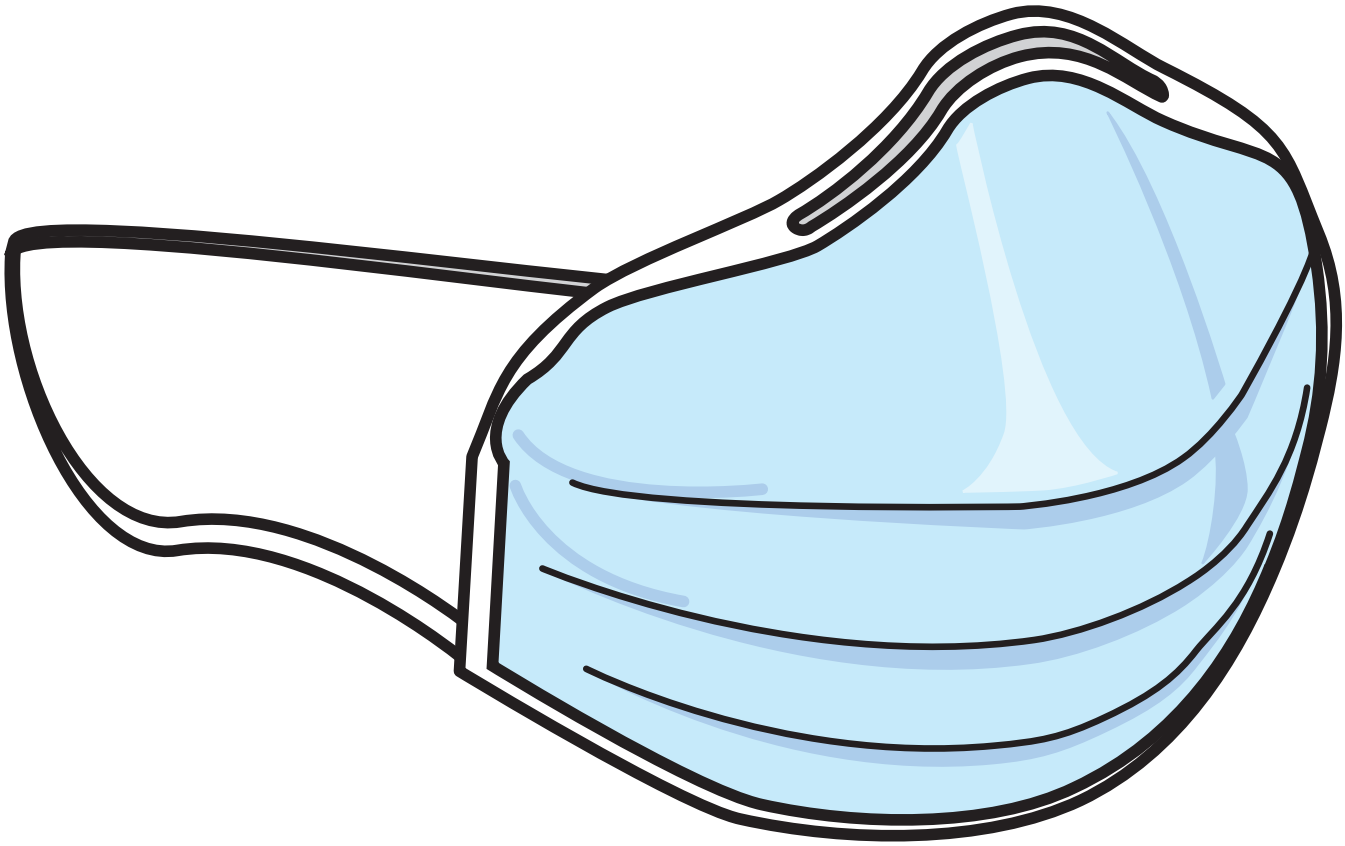
WOODWORKING BINGO

FIRST AID KIT

Always keep a first aid kit in the work area.

WOODWORKING BINGO

PARTICLE MASK



A covering for the mouth and nose that prevents dust and other particles from being inhaled.

Lesson G–3

BASIC ELECTRICITY

Indiana Agricultural Literacy Lesson Plan Library

Unit G. Agricultural Mechanics

Lesson 3. Basic Electricity

Indiana's Academic Standard. **Science:** 4.3.11 — Investigate, observe, and explain that things that give off light often also give off heat.

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Define electricity, and explain different types of electricity.
2. Explain how electricity is produced.
3. Explain how electricity travels.
4. Explain the difference between conductors and insulators.
5. Explain circuits, and describe the difference between an open circuit and a closed circuit.
6. Identify basic electrical safety tips.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

"Magic of Electricity." National 4-H Curriculum. www.n4hccs.org (4-H-BU-6848-2000)

www.cleco.com

www.electrical-safety.org

www.safeelectricity.org

www.safetylink.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Circuit
- Closed circuit
- Conductor
- Current
- Electricity
- Electron
- Insulator
- Matter
- Neutron
- Open circuit
- Proton
- Speed of light
- Transformer
- Voltage

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Have students make a list of their 10 favorite things to do. After they are finished with their list, have them circle the things that involve electricity. Remind them that batteries are also a source of electrical energy. This will get students thinking about the role electricity plays in their everyday lives and how important it is to them.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define electricity, and explain different types of electricity.

Anticipated Problem: What is electricity? What are the different types of electricity?

I. Electricity is a part of nature. It is all around us. We cannot see electricity, but we can see its effect, such as light and heat. Electricity plays a vital role in the lives of people. It is a necessary tool in our modern agricultural industry. Electricity allows those who work in the agricultural industry to become more efficient in many ways, such as mechanized chores, motorized vehicles and equipment, computerized systems for crop and livestock production, computerized records, and satellites for precision farming.

A. ***Electricity*** is a form of energy produced by the movement of electrons.

1. ***Matter*** is anything that takes up space or has mass. Everything you can touch is made of matter. All matter is made up of atoms.
2. An atom has a center, called a nucleus. The nucleus has at least one proton and one neutron. At least one electron travels around the nucleus at a fast rate of speed.
   a. A ***proton*** is a particle with a positive (+) charge.
   b. A ***neutron*** is an uncharged, neutral particle.
   c. An ***electron*** is a particle with a negative (–) charge.
3. The negative charge of an electron is equal to the positive charge of a proton. Because objects generally have an equal number of protons and electrons, they have a neutral charge.
4. When the balance of protons and electrons is changed by an outside force, an atom may gain or lose an electrical charge. This movement of charge is what we refer to as electricity.

B. There are two basic types of electricity: static and current.
   1. Static electricity stays in one place and doesn't move like current electricity. An example of static electricity is the tiny spark or shock between two people after they walk or rub their feet across the carpet.
   2. Current electricity is a flow of electrical charge through a substance that conducts electricity. Two kinds of current electricity are used: direct and alternating.
      a. In direct current (DC) electricity, the electrons flow in one direction. This type of current is usually produced by batteries.
      b. In alternating current (AC) electricity, the electrons flow in alternating directions and the direction of the current is reversed many times each second. AC electricity comes from power lines.

Use TM: G–3A to begin a discussion about electricity with the students. Use TM: G–3B to show students an illustration of a basic atom. Use TM: G–3C to discuss the different types of electricity. Use WS: G–3A to have students label the different parts of a basic atom.

Objective 2: Explain how electricity is produced.

Anticipated Problem: How is electricity produced?

II. Electric utility power stations use turbines, water wheels, or some other similar machine to generate electricity. Power stations must have a source of energy to run the machinery they use to generate electricity. Most of the electricity in the United States is produced in turbines driven by steam.

A. Coal can be burned in large furnaces to heat water to make steam that pushes the blades of a turbine. More than half (51%) of the electricity generated in the United States in 2001 used coal as its source of energy.

B. Nuclear power is used to create steam by heating water through a process called nuclear fission. Nuclear power generated 21% of the nation's electricity in 2001.

C. Natural gas can be burned to heat water for steam, or it can be burned to produce gases that directly operate a turbine. Natural gas was used to generate 17% of our electricity in 2001.

D. Hydropower is a method that uses flowing water to spin a turbine. Hydropower provided the source for 6% of our electricity in 2001. The most famous hydropower facility is the Hoover Dam.

E. Petroleum can be burned to make steam to turn a turbine. Only 3% of the electricity generated in 2001 used petroleum as its source of energy.

F. Geothermal power uses steam from groundwater to operate a turbine. The groundwater is warmed by the heat from beneath the earth's surface. Geothermal power generated less than 1% of our electricity in 2001.

G. Solar power uses energy from the sun to produce steam to drive a turbine. Solar power was used to generate less than 1% of the nation's electricity in 2001.

H. Wind power is used to turn a wind turbine to generate electricity. Wind power is growing in popularity, but it provided only 1% of the country's electricity in 2001.

I. Biomass can be burned to heat water to make steam to turn a turbine. Biomass includes wood, garbage, and agricultural wastes (corn cobs, wheat straw). Biomass accounted for less than 1% of the electricity generated in 2001.

Use TM: G–3D and TM: G–3E to lead the class in a discussion of the different sources that electricity can be produced from. Use TM: G–3F to show students a chart of how electricity was generated in the United States in 2001. Use WS: G–3B as a fun activity to help students become more familiar with the concepts presented in this objective.

Objective 3: Explain how electricity travels.

Anticipated Problem: How does electricity travel?

III. Before we can use electricity, it must travel to the place where we need it.

A. Electricity leaves the power station and is sent over lines on tall towers. The very strong current from a power plant must travel long distances to get where it is needed. ***Current*** is the flow of electricity through a cable.

B. Electricity loses some of its strength as it travels. It must be helped along by transformers, which boost or "step up" its power. A ***transformer*** is a device that transfers electrical energy from one circuit to another with a change in voltage, current, phase, or impedance.

C. Before electricity is usable to us, its voltage must be decreased. ***Voltage*** is the strength of the electricity. Different kinds of transformers are responsible for "stepping down" electricity's power.

D. Electricity comes into our neighborhoods and towns by traveling on overhead or underground wires.

E. When the electricity reaches our homes, another transformer reduces the electricity down to just the right level to be used in our appliances, lights, and other household items.

F. A cable carries the electricity into the house through a meter that measures how much electricity is being used.

G. From the meter, electricity runs through a meter box throughout the walls into outlets in the home. The electricity is always waiting in the wires to be used when something is turned on.

H. Electricity travels at the ***speed of light*** (186,000 miles per second).

Use TM: G–3G to illustrate and discuss the path electricity takes to get to our homes. Plan a visit to a local power plant to allow students to tour the facility. On the return

trip, have students try to trace the path of electricity from the power station back to the school.

Objective 4: Explain circuits, and describe the difference between an open circuit and a closed circuit.

Anticipated Problem: What is a circuit? What is the difference between an open circuit and a closed circuit?

IV. Electricity travels in a circuit. A ***circuit*** is a route around which an electrical current can flow, beginning and ending at the same point. The word circuit comes from the word *circle*.

A. Circuits are formed by wires, appliances, and other devices.

B. A circuit requires at least two wires to handle the flow of the current.

1. One wire (known as "hot") carries the current from the source to where it is used.
2. The other wire (neutral) carries the current back.
3. Most electrical circuits also have a third wire called a ground wire. Ground wires prevent shock in case the other wires fail, a short occurs, or excess charge builds up. Ground wires are attached to metal rods driven into the ground several feet.

C. An ***open circuit*** is a circuit that has been disconnected by a switch or another open in the line. When you turn a light switch off, you are opening the circuit.

D. A ***closed circuit*** is a circuit that is continuously providing a complete path for the flow of electricity. When you turn a light switch on, you are closing, or completing, the circuit.

Use TM: G–3H to discuss with students the difference between an open circuit and a closed circuit. Use WS: G–3C to allow students to make a circuit that they can open and close with a switch. This will give them hands-on experience at constructing a simple electrical device.

Objective 5: Explain the difference between conductors and insulators.

Anticipated Problem: What is the difference between conductors and insulators?

V. Some materials conduct electricity and other materials insulate electricity.

A. A ***conductor*** is a material that allows electricity to easily pass along it or through it.

1. Metals are good conductors because of the high concentration of free electrons they contain.
2. Wires used for electrical work are frequently copper or aluminum because they are good conductors of electricity.
3. Water is a conductor of electricity. Things that contain water (people, animals, trees, etc.) are also conductors.

B. An ***insulator*** is a material that prevents or reduces the passage of electricity.
   1. Insulators do not allow electrons to flow.
   2. Rubber, porcelain, and glass are all good electrical insulators.
   3. Electric wires are generally covered with a layer of plastic insulation. A conductor (wire) without insulation (plastic) is dangerous.
   4. Tools that are commonly used when working with electricity generally have a layer of plastic insulation on their handles to prevent a shock.

Use TM: G–3I to discuss the differences between conductors and insulators. Use WS: G–3D to give students a chance to test different materials and determine whether they are conductors or insulators. You can have students build a new circuit or use the circuits created with WS: G–3C to test the materials. If you use the existing circuits, you only need to remove the paperclip switch. Students will use the paper fasteners to test different materials.

Objective 6: Identify basic electrical safety tips.

Anticipated Problem: What are some basic electrical safety tips?

VI. Electricity can be dangerous to people and property. It can cause injury or fire damage when used improperly. The following are some basic electrical safety tips that will help prevent injury and property damage:

A. Fix or replace loose-fitting plugs and missing or broken wall plates. These can overheat and cause a fire.

B. Use safety covers in all unused outlets to prevent children from sticking anything into the outlet.

C. Do not work with electricity in damp areas. Never handle electrical equipment with wet hands or while standing in a wet or damp place.

D. To help prevent electrocution, a ground fault circuit interrupter (GFCI) should be used in any area where water and electricity may come in contact.

E. Do not try to fix electrical devices that are not functioning properly. Let a professional fix them.

F. Extension cords and electrical appliance cords with cracks, frays, exposed wires, faulty plugs, poor insulation, and loose connections should be immediately replaced or fixed by a qualified person.

G. Never pull a plug from an outlet while the equipment is in operation. This creates an arc and will eventually foul the plug or the outlet, which can cause electrical shock or a possible fire.

H. Always unplug items by firmly grasping the plug itself. Never yank the cord.

I. Do not hang electrical cords on nails, staple them to walls or other objects, run them under carpet or rugs, rest furniture on them, or run them around pipes.

J. Do not use extension cords as permanent wiring installations.
K. Do not overload outlets or power strips.
L. Do not leave something plugged in when it is not in use, unless it is designed for continuous operation.
M. Never force a plug into an outlet if it doesn't fit.
N. Never let anyone stick anything but a plug or a cover into an outlet.
O. Use the correct wattage of light bulb for the fixture.
P. Make sure light bulbs are screwed in securely. Loose bulbs may overheat.
Q. Never leave a plugged-in appliance where it might fall into water. If a plugged-in appliance does fall into the water, NEVER reach in to pull it out even if it is turned off.

Use TM: G–3J to discuss the common electrical safety tips with students. Use WS: G–3E to have students evaluate their homes for safety violations. The students should make a list of the violations they find and share their list with the rest of the class. Students can then work together to create an informative poster or flyer to display somewhere in the school.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: G–3A, WS: G–3B, WS: G–3C, WS: G–3D, and WS: G–3E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. c
2. d
3. a
4. b
5. e

Fill-in-the-Blank

1. proton

2. neutron
3. electron
4. Matter

Short Answer

1. Answers will vary. A conductor is a material that allows electricity to easily pass along it or through it. An insulator is a material that prevents or reduces the passage of electricity.
2. Answers will vary. An open circuit is a circuit that has been disconnected by a switch or another open in the line. A closed circuit is a circuit that is continuously providing a complete path for the flow of electricity.

Test G–3

Name_____

BASIC ELECTRICITY

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. current
b. voltage
c. electricity
d. transformer
e. circuit

_____1. A form of energy produced by the movement of electrons.

_____2. A device that transfers electrical energy from one circuit to another with a change in voltage, current, phase, or impedance.

_____3. The flow of electricity through a cable.

_____4. The strength of the electricity.

_____5. A route around which an electrical current can flow, beginning and ending at the same point.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A(n) _____ is a particle with a positive (+) charge.
2. A(n) _____ is an uncharged, neutral, particle.
3. A(n) _____ is a particle with a negative (–) charge.
4. _____ is anything that takes up space or has mass.

▶ Short Answer

***Instructions*. Answer the following questions.**

1. What is the difference between a conductor and an insulator?

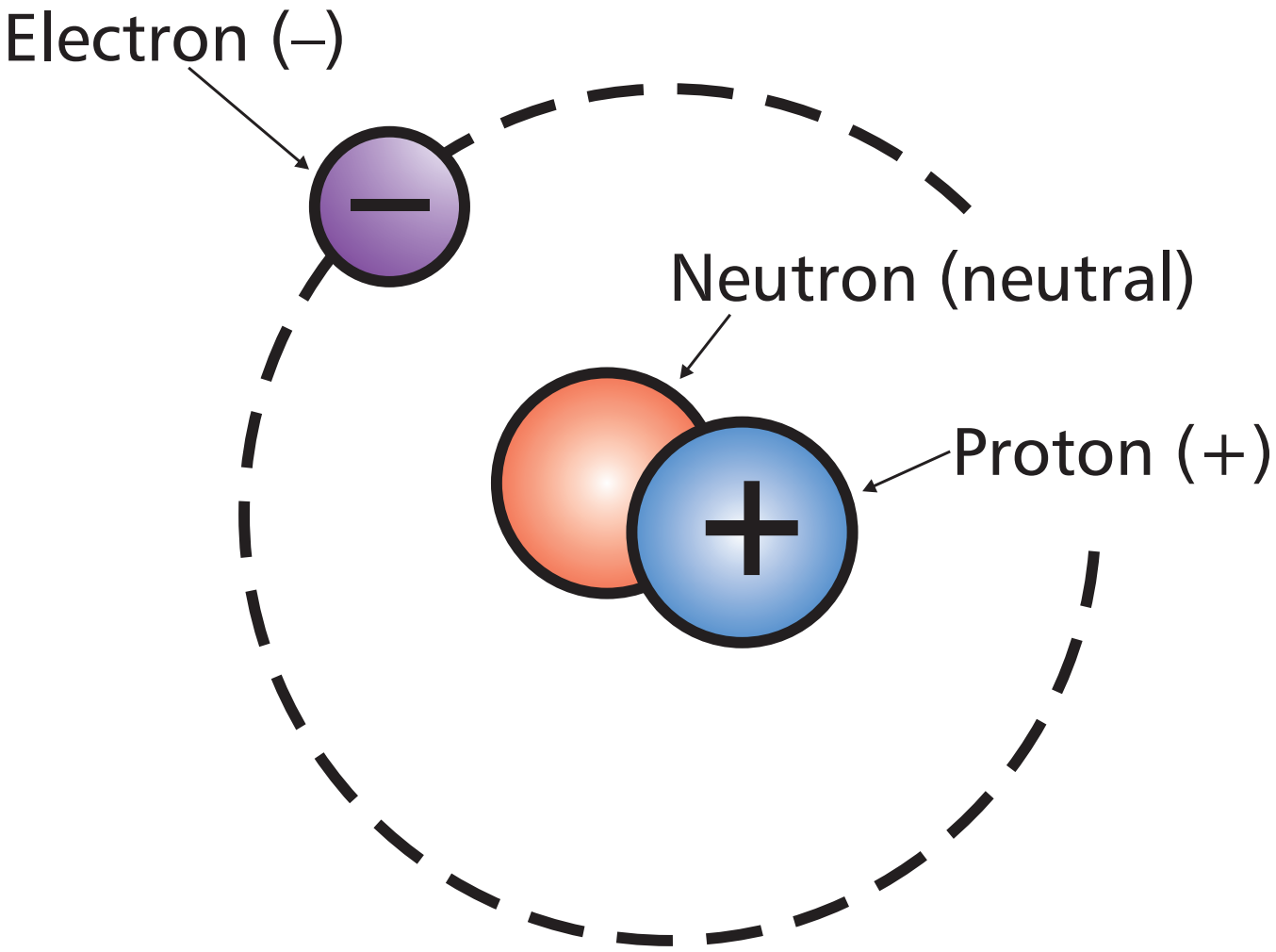
2. What is the difference between an open circuit and a closed circuit?

ELECTRICITY

Electricity is a form of energy produced by the movement of electrons.

- Matter is anything that takes up space or has mass.
- An atom has at least one proton and one neutron. At least one electron travels around the nucleus at a fast rate of speed.
  - ➔ A proton is a particle with a positive (+) charge.
  - ➔ A neutron is an uncharged, neutral, particle.
  - ➔ An electron is a particle with a negative (–) charge.
- The negative charge of an electron is equal to the positive charge of a proton.
- When the balance of protons and electrons is changed by an outside force, an atom may gain or lose an electrical charge. This movement of charge is what we refer to as electricity.

DIAGRAM OF A BASIC ATOM



TYPES OF ELECTRICITY

There are two basic types of electricity: static and current.

- Static electricity stays in one place and doesn't move like current electricity.
- Current electricity is a flow of electrical charge through a substance that conducts electricity. Two kinds of current electricity are used: direct and alternating.
  - ➔ In direct current (DC) electricity, the electrons flow in one direction.
  - ➔ In alternating current (AC) electricity, the electrons flow in alternating directions and the direction of the current is reversed many times each second.

SOURCES OF ENERGY FOR GENERATING ELECTRICITY

- Coal
- Nuclear power
- Natural gas
- Hydropower
- Petroleum
- Geothermal power
- Solar power
- Wind power
- Biomass

POWER STATIONS


Nuclear


Solar

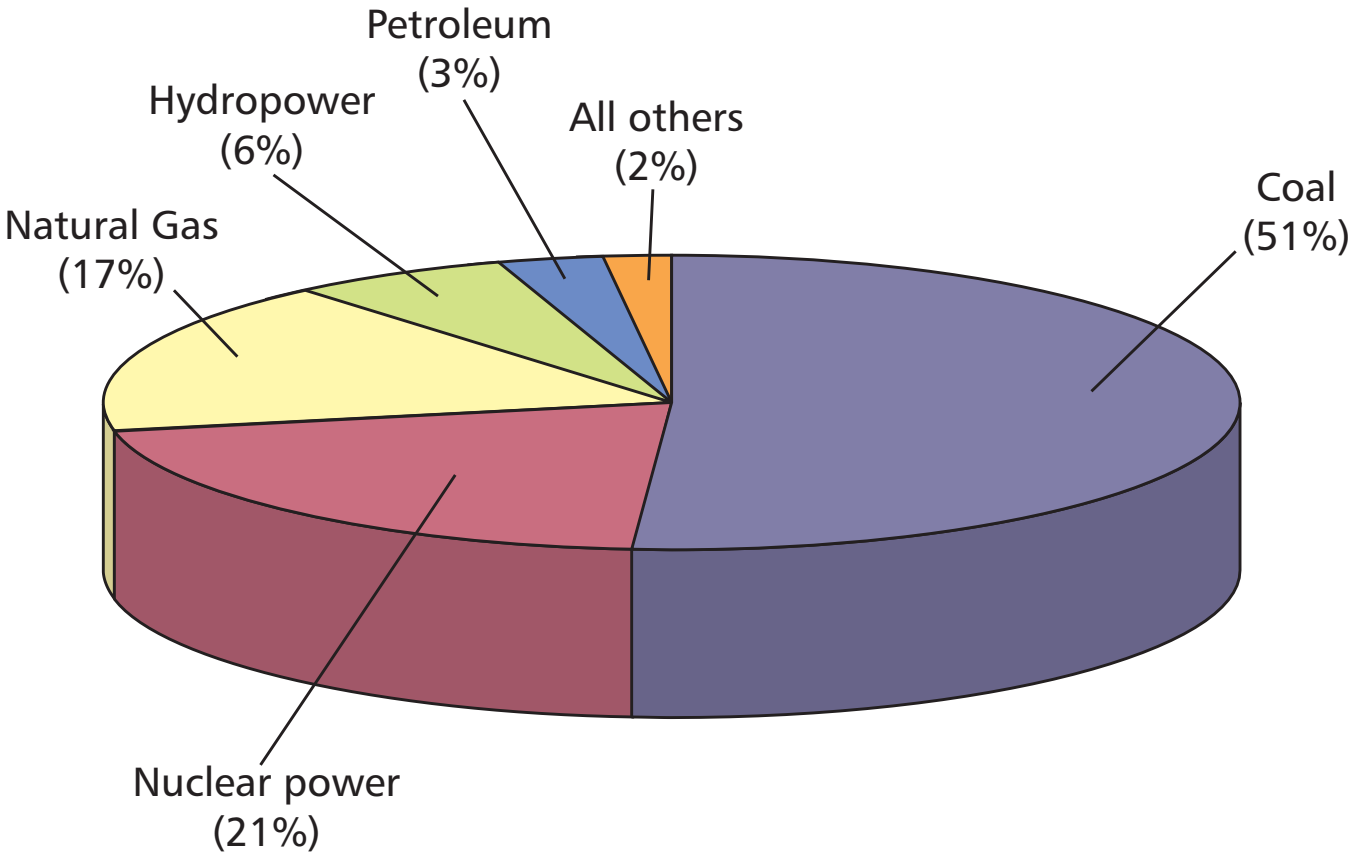

Hydro


Coal

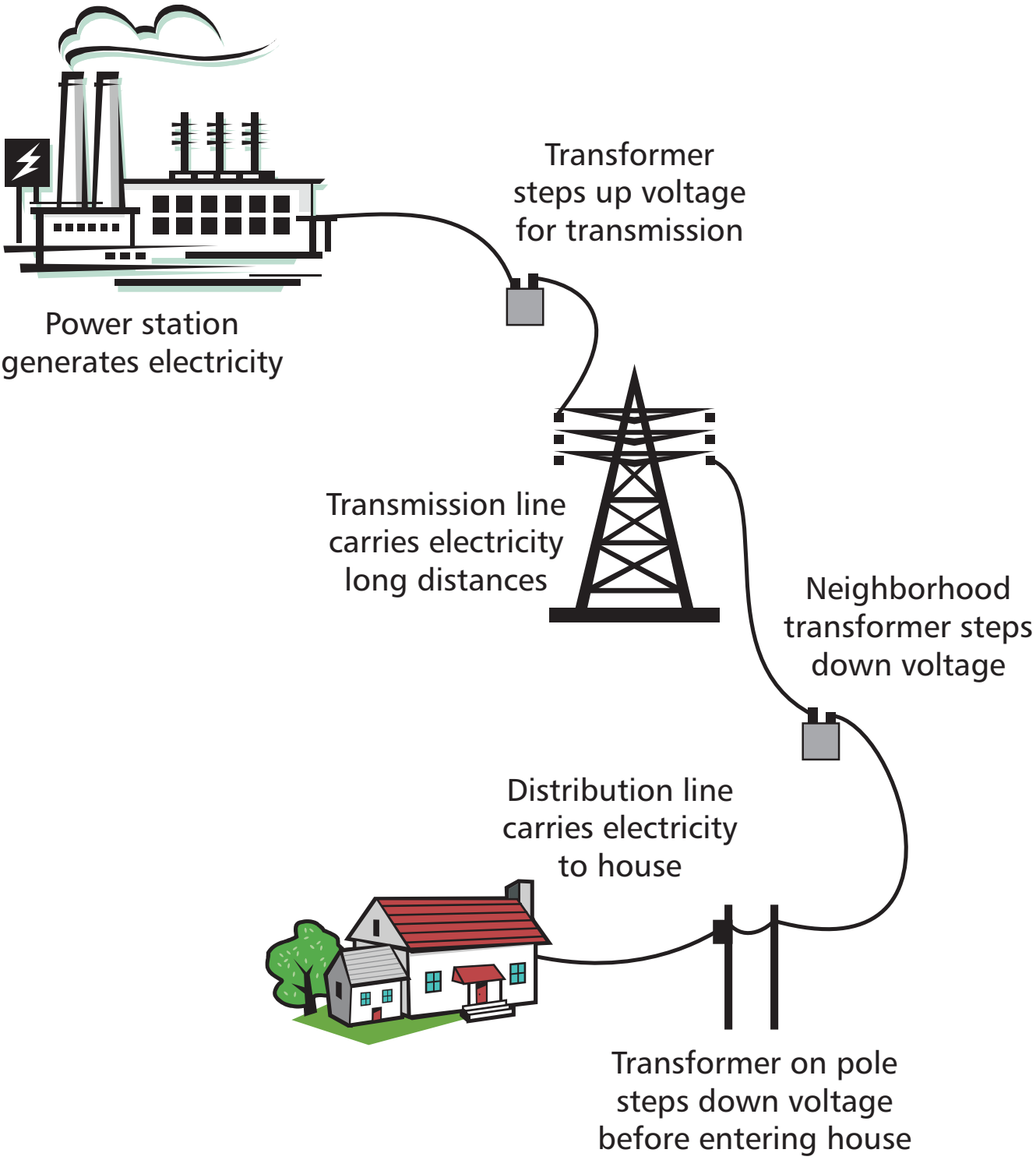

Wind


Geothermal

SOURCES OF ENERGY FOR GENERATING ELECTRICITY IN THE UNITED STATES IN 2001

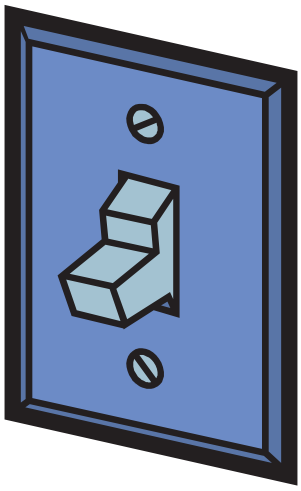


HOW ELECTRICITY TRAVELS

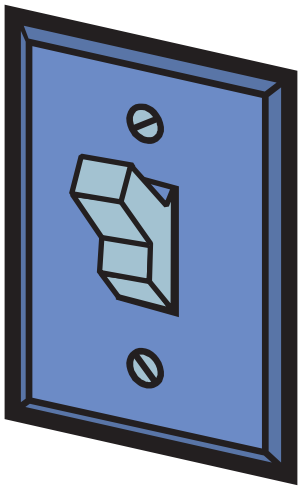


CIRCUITS

- An open circuit is a circuit that has been disconnected by a switch or another open in the line.



- A closed circuit is a circuit that is continuously providing a complete path for the flow of electricity.



CONDUCTORS AND INSULATORS

- A conductor is a material that allows electricity to easily pass along it or through it.
  - ➔ Metals are good conductors.
  - ➔ Copper or aluminum wires are generally used for electrical work.
  - ➔ Water is a conductor of electricity.
- An insulator is a material that prevents or reduces the passage of electricity.
  - ➔ Insulators do not allow electrons to flow.
  - ➔ Rubber, porcelain, and glass are all good electrical insulators.
  - ➔ Electric wires are generally covered with a layer of plastic insulation.
  - ➔ Electrical tools generally have plastic insulation on their handles.

ELECTRICAL SAFETY

- Fix or replace loose-fitting plugs and missing or broken wall plates.
- Use safety covers in all unused outlets.
- Do not work with electricity in damp areas.
- A ground fault circuit interrupter (GFCI) should be used in any area where water and electricity may come in contact.
- Do not try to fix electrical devices that are not functioning properly. Let a professional fix them.
- Extension cords and electrical appliance cords with cracks, frays, exposed wires, faulty plugs, poor insulation, and loose connections should be immediately replaced or fixed by a qualified person.
- Never pull a plug from an outlet while the equipment is in operation.
- Always unplug items by firmly grasping the plug itself.

ELECTRICAL SAFETY (CONTINUED)

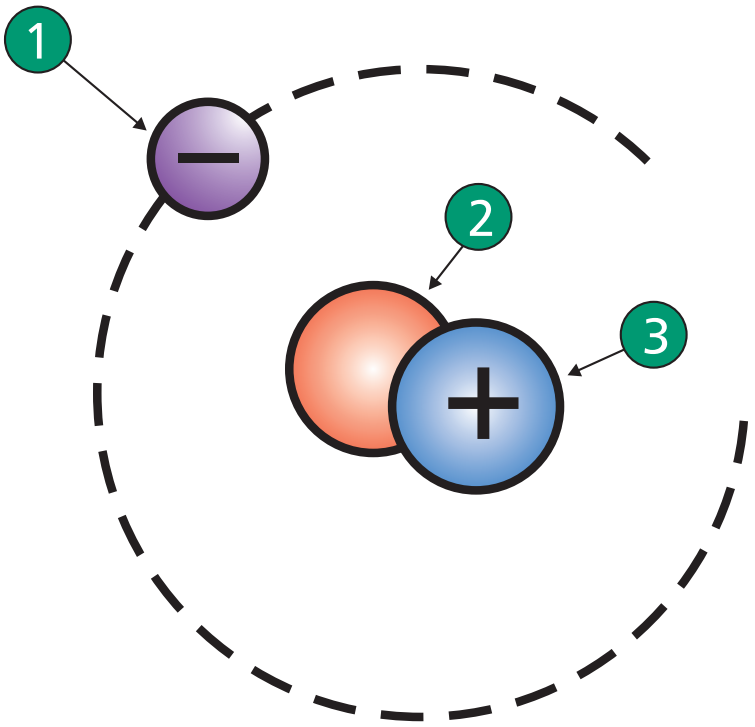
- Do not hang electrical cords on nails, staple them to walls or other objects, run them under carpet or rugs, rest furniture on them, or run them around pipes.
- Do not use extension cords as permanent wiring installations.
- Do not overload outlets or power strips.
- Do not leave something plugged in when it is not in use, unless it is designed for continuous operation.
- Never force a plug into an outlet if it doesn't fit.
- Never let anyone stick anything but a plug or a cover into an outlet.
- Use the correct wattage of light bulb for the fixture.
- Make sure light bulbs are screwed in securely.
- Never leave a plugged-in appliance where it might fall into water. If a plugged-in appliance does fall into the water, NEVER reach in to pull it out even if it is turned off.

Name _____

LABEL THE ATOM

Directions

Label the parts of a basic atom below.



1. _____
2. _____
3. _____

LABEL THE ATOM KEY

1. Electron
2. Neutron
3. Proton

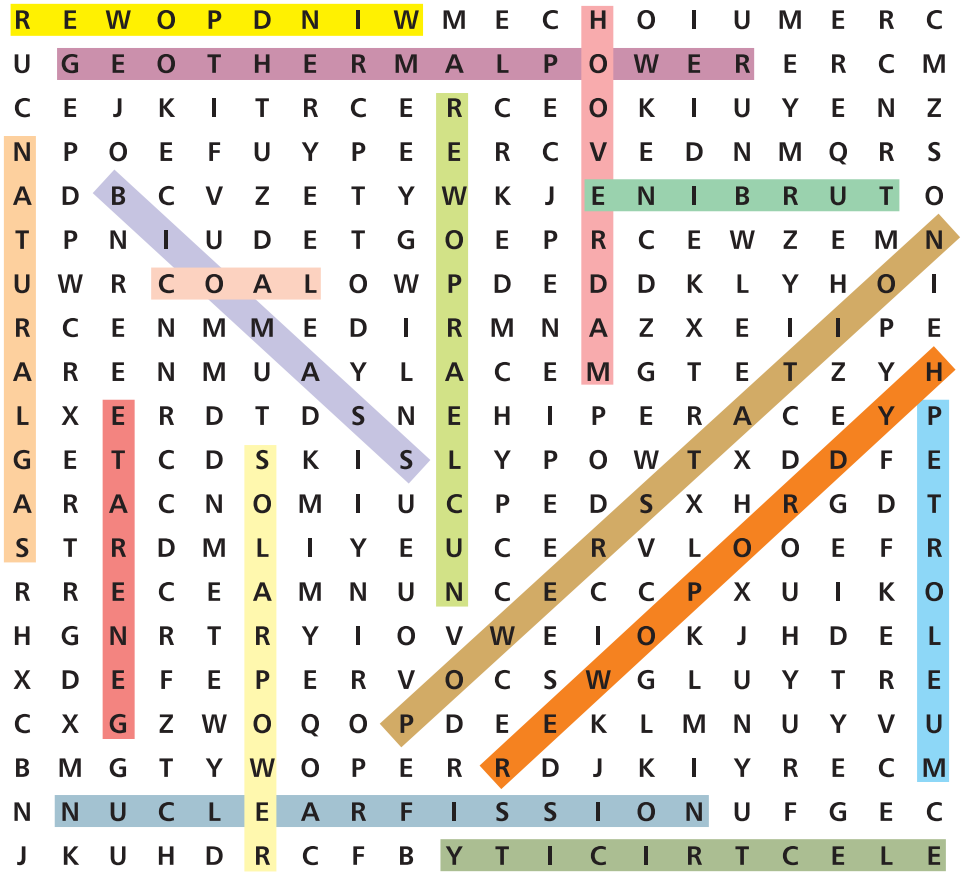
Name _____

ELECTRICITY WORD SEARCH

R E W O P D N I W M E C H O I U M E R C
U G E O T H E R M A L P O W E R E R C M
C E J K I T R C E R C E O K I U Y E N Z
N P O E F U Y P E E R C V E D N M Q R S
A D B C V Z E T Y W K J E N I B R U T O
T P N I U D E T G O E P R C E W Z E M N
U W R C O A L O W P D E D D K L Y H O I
R C E N M M E D I R M N A Z X E I I P E
A R E N M U A Y L A C E M G T E T Z Y H
L X E R D T D S N E H I P E R A C E Y P
G E T C D S K I S L Y P O W T X D D F E
A R A C N O M I U C P E D S X H R G D T
S T R D M L I Y E U C E R V L O O E F R
R R E C E A M N U N C E C C P X U I K O
H G N R T R Y I O V W E I O K J H D E L
X D E F E P E R V O C S W G L U Y T R E
C X G Z W O Q O P D E E K L M N U Y V U
B M G T Y W O P E R R D J K I Y R E C M
N N U C L E A R F I S S I O N U F G E C
J K U H D R C F B Y T I C I R T C E L E

BIOMASS
COAL
ELECTRICITY
GENERATE
GEOTHERMAL POWER
HOOVER DAM
HYDROPOWER
NATURAL GAS
NUCLEAR FISSION
NUCLEAR POWER
PETROLEUM
POWER STATION
SOLAR POWER
TURBINE
WIND POWER

ELECTRICITY WORD SEARCH KEY



Name _____

CREATE A CIRCUIT WITH A SWITCH

Materials

- ✓ One D-cell flashlight battery and holder
- ✓ Scotch tape
- ✓ Three sections of insulated wire with 1 inch of insulation removed at each end
- ✓ Paperclip
- ✓ Light bulb and holder
- ✓ Brass paper fasteners
- ✓ Thick piece of cardboard
- ✓ Pencil

Directions

1. Use a pencil to punch two holes in the cardboard slightly less than the length of the paper clip apart.
2. Bend the smaller loop of the paper clip down.
3. Put the small side down on the cardboard.
4. Fasten the end down with the paper fastener through one of the punched holes.
5. Fasten the other paper fastener in the other hole. The large loop of the paper clip should stay up and should contact the second paper fastener when pushed down.
6. Attach one wire to each of the paper fasteners.
7. Use scotch tape to hold the small loop of the paper clip in place. Tape the folded ends of the fasteners to hold them in place and keep them from touching.
8. Attach one of the wires from the fastener to one end of the battery holder.
9. Attach the other wire from the fastener to one side of the bulb holder.
10. Use the separate piece of wire to connect the other end of the battery holder to the other end of the bulb holder.
11. The paper clip acts as a switch. When the paper clip is up, the bulb will not light because the circuit is open (incomplete). If you push down on the paper clip, the bulb will light up because the circuit is closed (complete).

WS: G–3D

Name _____

TEST CONDUCTIVITY

Directions

1. Using a circuit with a switch, test a variety of materials to see if they conduct or insulate electricity.
2. Place each item on the switch to close (complete) the circuit. If the light bulb lights up, the item is a conductor. If the bulb does not light up, the item is an insulator.
3. Write your prediction for each item in the Data Table below. After testing each item, record your results.
4. Some materials you could test include rubber bands, aluminum foil, pencils, pennies, plastic, toothpicks, potatoes, fruits, etc.

DATA TABLE		
Item Being Tested	Prediction—Conductor (C) or Insulator (I)	Results—Conductor (C) or Insulator (I)

Name _____

ELECTRICAL SAFETY EVALUATION

Directions

Evaluate the electrical safety of your home. Look around your house for anything that you think might be unsafe. Keep in mind the safety tips you learned about. Make a list of what you find. Share your findings with your family. Compare your list with the rest of your class. Find the most common safety violations and create a poster or flyer for your school that informs others about the importance of using electricity safely.

Lesson G–4

MACHINERY AND EQUIPMENT

Indiana Agricultural Literacy Lesson Plan Library

Unit G. Agricultural Mechanics

Lesson 4. Machinery and Equipment

Indiana's Academic Standard. **Science:** 4.1.7 — Discuss and give examples of how technology, such as computers and medicines, has improved the lives of many people, although the benefits are not equally available to all.

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain why agricultural machinery and equipment are important.
2. Identify different areas of agriculture where machinery and equipment are used.
3. Describe some of the different types of agricultural machinery and equipment used for crop production.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Ag Mag, Issue 21, "Technology." Illinois Agricultural Association.

Kids, Crops, and Critters in the Classroom. Illinois Agricultural Association—www.agintheclassroom.org

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

List of Equipment, Tools, Supplies, and Facilities:

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Application equipment
- Baler
- Combine
- Crawler tractor
- Cultivator
- Drill
- Duster
- Geographic Information System (GIS)
- Global Positioning System (GPS)
- Harrow
- Harvesting equipment
- Implement
- Mower
- Picker
- Planter
- Planting equipment
- Plow
- Sprayer
- Tillage equipment
- Tractor
- Wheeled tractor

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask students to name ways that machinery can help them in their lives. (For example, how many students rode the bus to school? How long would it have taken them to walk to school instead? What would they do if they didn't have a lawn mower to mow their yard? How much more difficult would it be to grow a vegetable garden if they had to dig the soil by hand rather than using a tiller?) Just as we use different types of machinery, farmers also need the right tools to get their work done quickly and efficiently. Without the proper machinery and equipment, farmers wouldn't be able to produce enough to provide for our needs. Move from this discussion into the content of the lesson.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Explain why agricultural machinery and equipment are important.

Anticipated Problem: Why are agricultural machinery and equipment important?

I. Agricultural machinery and equipment help farmers produce the goods that consumers want and need. Without the proper machinery and equipment, farmers would not be efficient enough to provide the food, clothing, and shelter that we need.

A. When our nation was founded, the population was made up of approximately 85 percent farmers and ranchers. Now, only 1 to 2 percent of the population is responsible for producing the food and fiber used today. Machinery and equipment allow this to be possible.

B. Because of high tech machinery and equipment, one American farmer produces enough food to feed 129 people. Using power only from humans or horses would not produce nearly this amount.

C. Machinery and equipment reduce the amount of hard labor needed for farmers to do their work. Jobs are easier and take less time when machinery and equipment are used.

D. Machinery and equipment also help farmers produce larger amounts of higher quality livestock and grain products.

> *Use TM: G–4A to cover the content of the objective. Use WS: G–4A as a simple activity that demonstrates to students the importance of machinery and equipment in agricultural efficiency.*

Objective 2: Identify different areas of agriculture where machinery and equipment are used.

Anticipated Problem: Where are machinery and equipment used in agriculture?

II. Different machinery and equipment are used in every area of the agricultural industry.

A. Livestock production—Machinery and equipment can be used to help producers care for and manage their livestock. Milking machines, automated feeding and watering systems, incubators, egg candlers, tractors, computers, and many other types of machinery and equipment can be used by the producer to improve efficiency and quality of products.

B. Horticulture—Machinery and equipment are very important in the horticulture industry. Lawnmowers, tillers, sprayers, spreaders, irrigation systems, wood chippers, lawn rollers, leaf blowers, computers, and tractors are all vital pieces of machinery and equipment used by horticulturalists.

C. Forestry—The forestry industry relies on machinery and equipment to function. Log trucks, skidders, loaders, cutters, harvesters, chainsaws, computers, and surveying equipment are all necessary for efficient forestry operations.

D. Crop production—Without the proper machinery and equipment, large-scale crop production would be impossible. Tilling, planting, applying pesticides and fertilizers, and harvesting all require specialized machinery and equipment. Plows, planters, drills, sprayers, spreaders, combines, balers, computers, tractors, grain trucks, and many other types of machinery and equipment are necessary to produce crops effectively.

Use TM: G–4B through TM: G–4E to cover the content of the objective. Use WS: G–4B to have students keep track of the machinery and equipment they see around them. Discuss with students the many different areas where machinery and equipment make our daily activities easier. Relate this to the use and importance of machinery and equipment in the agricultural industry. Stress to students that without the proper machinery and equipment, agricultural producers would not be able to provide all that we need and want.

Objective 3: Describe some of the different types of agricultural machinery and equipment used for crop production.

Anticipated Problem: What are some of the different types of machinery and equipment used for crop production?

III. Many different types of machinery and equipment are used in producing crops.

A. A ***tractor*** is a motorized vehicle that is used to pull heavy loads and to provide power to operate implements. A tractor can be used for many different jobs.

1. The first types of tractors ran on steam and were hard to maneuver.

2. Before tractors were invented, farmers would have to use horses to pull heavy equipment.
3. Because of their powerful engines and large tires, tractors are able to pull other pieces of machinery through fields.
4. Tractors can be used to pull and power some implements. An ***implement*** is a tool or piece of equipment used to do work.
5. There are two main types of tractors—wheeled and crawler.
    a. A ***wheeled tractor*** is a tractor that usually has four or more wheels that turn and move the tractor.
    b. A ***crawler tractor*** is a tractor that has steel or rubber tracks fitted around the wheels that make the tractor move.

B. ***Tillage equipment*** is equipment used to plow or till the soil. It slices, breaks, or cuts the soil in order to prepare the ground, control weeds, or create mulch. The tillage equipment used depends on the type of soil and the crop that is to be grown. Tillage equipment includes plows, harrows, and cultivators.
    1. A ***plow*** is an implement used to cut, lift, and turn over soil. It is commonly used to prepare the soil for planting.
    2. A ***harrow*** is an implement with spikes or disks that is used to cultivate the soil by pulverizing and smoothing it.
    3. A ***cultivator*** is an implement used to loosen the soil and control weeds between rows of growing crops.

C. ***Planting equipment*** is equipment used to place seed in the soil for germination. It must be properly adjusted so the right amount of seed is planted at the proper depth in the soil. Planting equipment includes planters and drills.
    1. A ***planter*** is an implement used to place seeds in the soil at the proper rate, depth, and spacing.
        a. The planter opens a small furrow, drops and covers the seeds, and lightly compacts the soil over the seeds.
        b. Corn, cotton, and many vegetable crops are planted with planters.
        c. Before this machine was invented, farmers would have to dig rows and plant the seeds by hand.
    2. A ***drill*** is an implement used to plant seeds for germination.
        a. The drill opens the soil, places the seeds, and covers the seeds.
        b. Drills can be used to plant seeds in plowed or unplowed land.
        c. Soybeans, wheat, oats, and rye grass are example of crops that are commonly planted with drills.

D. ***Application equipment*** is equipment used to apply fertilizer, pesticides, growth regulators, and other materials to crops. It must be properly calibrated and operated so the right amount of material is delivered. The equipment may use dry or liquid materials. Application equipment includes sprayers and dusters.
    1. A ***sprayer*** is a piece of equipment that uses tanks, pumps, and nozzles to apply liquid materials.

2. A ***duster*** is a piece of equipment used to apply dry powder materials.

E. ***Harvesting equipment*** is equipment used to pick, reap, or otherwise gather crops. Different types of crops require different types of equipment. Harvesting equipment includes combines, pickers, balers, and mowers.

1. A ***combine*** is a machine used to harvest crops as it moves across a field.
   a. The head of the combine runs through the crop rows and cuts the stalks of the plants. The plants are then pulled through the machine and the grain is separated from the plant material.
   b. Corn, soybeans, wheat, barley, and rice are typically harvested with combines.
2. A ***picker*** is a machine used to harvest crops by picking. Cotton is the most common crop harvested with a picker.
3. A ***mower*** is a piece of equipment used to cut standing vegetation. Mowers are used to harvest forage crops, such as grass and alfalfa. After mowing, the crop may be left in rows to dry and be picked up by a baler.
4. A ***baler*** is a piece of equipment used to harvest forage crops that have been cut, dried, and placed in rows. The baler is pulled behind a tractor and picks the dried vegetation up off the ground. Inside the baler, the material is tightly packed or wound into round or rectangular bales. When the bale reaches the proper size, the machine wraps the bale with wire or twine to secure it.

F. A ***Global Positioning System (GPS)*** is a system that uses satellites and computers to tell a farmer his or her exact location in a field.

1. The earth is continually circled by 24 GPS satellites. At least four of the satellites are visible from any one point on Earth.
2. GPS uses three satellites that are connected by an electronic signal with a receiver on the ground. (A fourth satellite is used to verify that the information is accurate.)
3. Distances from satellites to the receiver can be quickly measured. Computers calculate the exact location of the receiver.
4. GPS receivers are generally located on equipment that moves over a field.
5. GPS systems can precisely guide tractors and equipment through a field and program computers to deliver precise amounts of seed, fertilizer, or herbicide to plants in variable amounts.

G. A ***Geographic Information System (GIS)*** is a system used with GPS to make maps or grids of a field. These maps give a farmer data about soil conditions, crop yield, and other information so he or she can make decisions needed to improve the crops in the field.

Use TM: G–4F through TM: G–4S to discuss the different types of machinery and equipment used for crop production. Use WS: G–4C as an activity to help students become more familiar with some of the different types of machinery and equipment. Plan a visit to a local farm machinery dealer to allow students to see different types of machinery and equipment close up.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: G–4A, WS: G–4B, and WS: G–4C.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. a
3. e
4. b
5. c
6. f

Fill-in-the-Blank

1. labor
2. combine
3. Tillage equipment
4. mower
5. Application equipment

Short Answer

Answers will vary. Use Objective 2 to score this statement.

Test G–4

Name_____

MACHINERY AND EQUIPMENT

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. implement
b. harvesting equipment
c. Global Positioning System (GPS)
d. cultivator
e. tractor
f. sprayer

_____1. An implement used to loosen the soil and control weeds between rows of growing crops.

_____2. A tool or piece of equipment used to do work.

_____3. A motorized vehicle that is used to pull heavy loads and to provide power to operate implements.

_____4. Equipment used to pick, reap, or otherwise gather crops.

_____5. A system that uses satellites and computers to tell a farmer his or her exact location in a field.

_____6. A piece of equipment that uses tanks, pumps, and nozzles to apply liquid materials.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. Machinery and equipment reduce the amount of hard _____ needed for farmers to do their work.
2. A(n) _____ is a machine used to harvest crops as it moves across a field.
3. _____ _____ is equipment used to plow or till the soil.
4. A(n) _____ is a piece of equipment used to cut standing vegetation.
5. _____ _____ is equipment used to apply fertilizer, pesticides, growth regulators, and other materials to crops.

Short Answer

***Instructions*. Answer the following statement.**

List three examples of machinery and equipment that can be used in each of the following areas of agriculture:

Livestock production—

Horticulture—

Forestry—

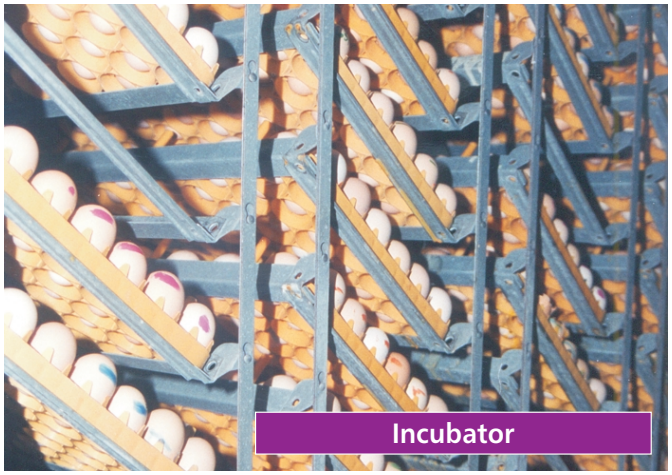
Crop production—

IMPORTANCE OF AGRICULTURAL MACHINERY AND EQUIPMENT

- Because of machinery and equipment, only 1 to 2 percent of the population is able to produce all of the food and fiber used today.
- Because of high-tech machinery and equipment, one American farmer produces enough food to feed 129 people. Using power only from humans or horses would not produce nearly this amount.
- Machinery and equipment reduce the amount of hard labor needed for farmers to do their work. Jobs are easier and take less time when machinery and equipment are used.
- Machinery and equipment also help farmers produce larger amounts of higher quality livestock and grain products.

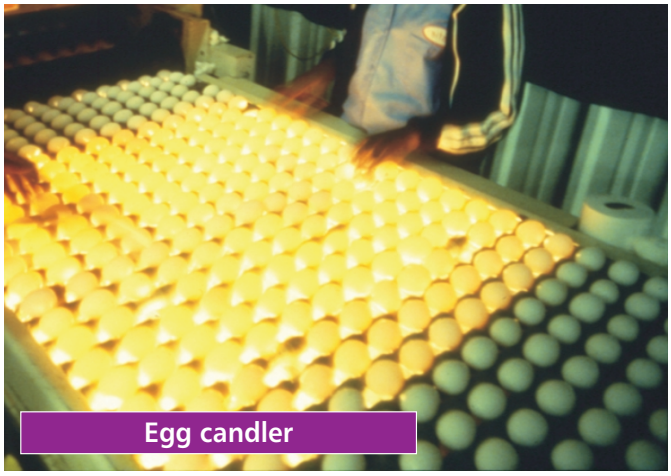
LIVESTOCK PRODUCTION


Automated feeding system


Incubator


Milking machines


Loader (hauling manure)


Egg candler


Automated watering system

HORTICULTURE


Pesticide sprayer


Lawnmower with utility cart


Greenhouse irrigation system

Wood chipper


Rotary tiller


Rotary spreader

FORESTRY


Log truck


Harvester

(Courtesy, Heikki Suomala, Partek Forest LLC, Gladstone, Michigan)


Loader

(Courtesy, U.S. Department of Agriculture)


Skidder

Chainsaw


Cutter

(Courtesy, U.S. Fish and Wildlife Service)

CROP PRODUCTION


Tractors

(Courtesy, Deere and Company)


Planter

(Courtesy, Deere and Company)


GPS receiver

(Courtesy, Deere and Company)


Spreader

(Courtesy, AGCO Corporation)


Combine

(Courtesy, Deere and Company)


Plow

(Courtesy, Deere and Company)

TRACTOR

(Courtesy, Deere and Company)

A tractor is a motorized vehicle that is used to pull heavy loads and to provide power to operate implements.

PLOW

(Courtesy, Deere and Company)

A plow is an implement used to cut, lift, and turn over soil.

HARROW

(Courtesy, Case Corporation)

A harrow is an implement with spikes or disks that is used to cultivate the soil by pulverizing and smoothing it.

CULTIVATOR

(Courtesy, Case Corporation)

A cultivator is an implement used to loosen the soil and control weeds between rows of growing crops.

PLANTER

(Courtesy, Deere and Company)

A planter is an implement used to place seeds in the soil at the proper rate, depth, and spacing.

DRILL

(Courtesy, Case Corporation)

A drill is an implement used to plant seeds for germination.

SPRAYER

(Courtesy, AGCO Corporation)

A sprayer is a piece of equipment that uses tanks, pumps, and nozzles to apply liquid materials.

DUSTER

A duster is a piece of equipment used to apply dry powder materials.

COMBINE

(Courtesy, Case Corporation)

A combine is a machine used to harvest crops as it moves across a field.

PICKER

(Courtesy, Deere and Company)

A picker is a machine used to harvest crops by picking.

MOWER

(Courtesy, Deere and Company)

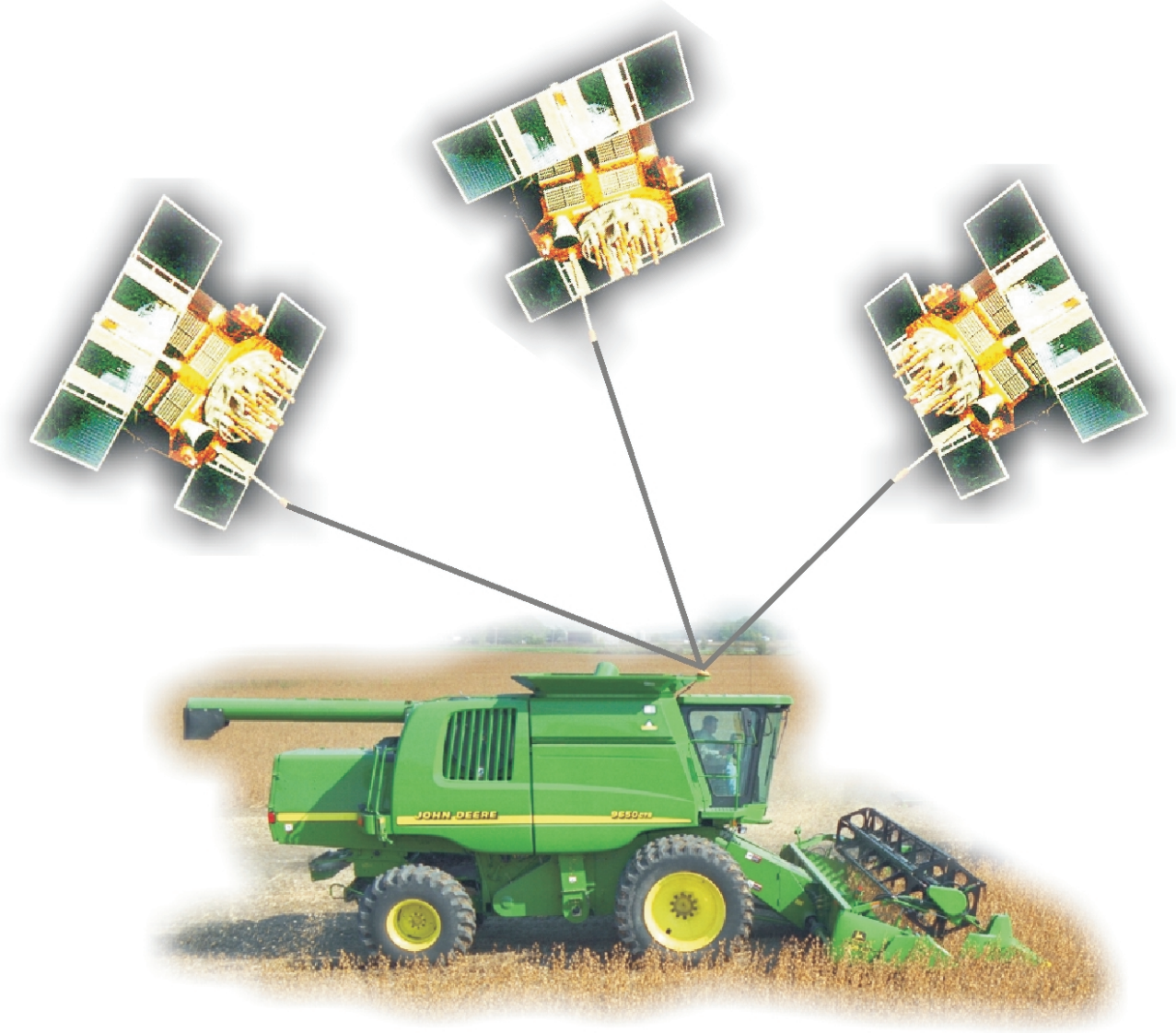
A mower is a piece of equipment used to cut standing vegetation.

BALER

(Courtesy, Deere and Company)

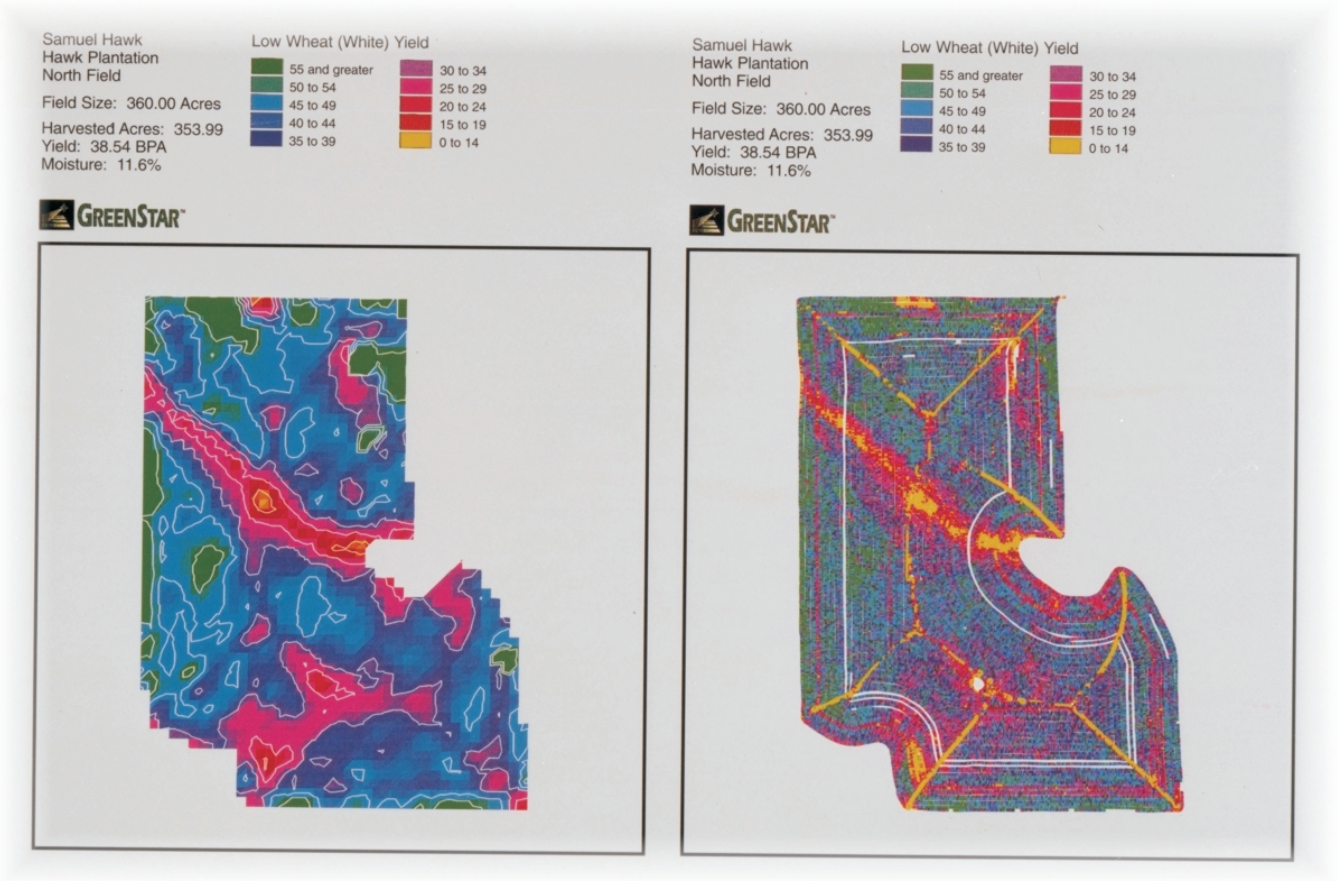
A baler is a piece of equipment used to harvest forage crops that have been cut, dried, and placed in rows.

GLOBAL POSITIONING SYSTEM (GPS)



A Global Positioning System (GPS) is a system that uses satellites and computers to tell a farmer his or her exact location in a field.

GEOGRAPHIC INFORMATION SYSTEM (GIS)



(Courtesy, Deere and Company)

A Geographic Information System (GIS) is a system used with GPS to make maps or grids of a field.

WS: G–4A

Name _____

MANUAL LABOR VERSUS MACHINERY AND EQUIPMENT

Materials

- ✓ 100 pieces of red construction paper (about 2 inches square)
- ✓ 100 pieces of green construction paper (about 2 inches square)
- ✓ Tweezers
- ✓ Plastic toy shovel
- ✓ Two containers (large enough to hold 100 pieces of construction paper)

Directions

1. Place the red construction paper in a pile next to one of the containers. Place the green construction paper in a separate pile next to the other container.
2. Divide into two teams. One team will represent the use of manual labor, and the other team will represent the use of machinery and equipment.
3. One at a time, one member from each team will race to see who can pick up all the pieces of his or her construction paper the fastest. Keep track of the winner of each round.
4. The manual labor team can use only the tweezers to pick up the pieces of red construction paper and place them in the container one at a time.
5. The machinery and equipment team can use the plastic shovel to scoop up the pieces of green construction paper and place them in the container.

Conclusions

Which team won the most rounds? What does this tell you about the use of machinery and equipment to get a job done? If the pieces of construction paper were crops, how much more food would you be able to provide by using machinery and equipment?

Name _____

HUNT FOR MACHINERY AND EQUIPMENT

Directions

Machinery and equipment are used all around us. They help us get our work done more quickly and efficiently than if we had to do the work by hand. Without the machinery and equipment, we would not be able to accomplish nearly the amount of work that we do! Keep track of the machinery and equipment that you see being used around your house, neighborhood, and school for a day. This might include machinery and equipment used for construction, transportation, lawn care, business, and/or household use. Record all of your sitings in the table below. For each piece of machinery and equipment, also list what the alternative would be if the machinery and equipment were not available. Compare your list with the rest of the class and discuss what you found.

Machinery and Equipment	Where Used	Alternative

Name _____

MACHINERY AND EQUIPMENT IDENTIFICATION

Directions

Write the name of the piece of machinery or equipment on the line under its photo.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

WS KEY: G–4C

MACHINERY AND EQUIPMENT IDENTIFICATION KEY

1. Baler
2. Cultivator
3. Sprayer(s)
4. Combine
5. Drill
6. Duster
7. Planter
8. Plow
9. Tractor(s)
10. Mower

Lesson G–5

PRECISION FARMING

Indiana Agricultural Literacy Lesson Plan Library

Unit G. Agricultural Mechanics

Lesson 5. Precision Farming

Indiana's Academic Standard. **Science:** 4.1.8 — Recognize and explain that any invention may lead to other inventions.

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Define precision farming.
2. List and explain the components of precision farming.
3. Describe the benefits of precision farming.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Ag Mag, Issue 21, "Technology." Illinois Agricultural Association.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Morgan, Mark, and Dan Ess. *The Precision Farming Guide for Agriculturists.* Moline, Illinois: Deere and Company, 1997.

"Precision Farming: A New Approach to Crop Management." L-5177, Texas Agricultural Extension Service.

www.terraserver-usa.com

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Hand-held GPS unit

Terms. The following terms are presented in this lesson (shown in bold italics):

- Geographic Information System (GIS)
- Global Positioning System (GPS)
- Precision farming
- Variable Rate Technology (VRT)

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Use www.terraserver-usa.com to demonstrate topographic and satellite maps to students. Locate your school and another landmark recognizable to the students. Explain that the technology you are demonstrating is now being used by farmers to help them be more efficient and productive.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Define precision farming.

Anticipated Problem: What is precision farming?

I. ***Precision farming*** is a system that uses satellites and computer technology to help farmers to grow more and better crops. Precision farming can improve the economic and environmental sustainability of crop production.

A. In the past, producers tended to look at each field as a single unit. Although they realized that fertility, soil type, pest populations, and other things were very different throughout the field, they did not have the tools to deal with these differences individually. They had to manage the field based on the average conditions and hope that the average would be good enough for most of the field.

B. Today, precision farming allows farmers to manage their fields in small segments. This allows them to apply fertilizer, pesticide, and other materials in the precise locations that they are needed. Precision farming can be used in all aspects of the crop production cycle from pre-planting operations to harvest.

Use TM: G–5A to cover the content of the objective. Use WS: G–5A to demonstrate the basic concept of precision farming to students.

Objective 2: List and explain the components of precision farming.

Anticipated Problem: What are the components of precision farming?

II. Precision farming uses technology to gather, store, view, and analyze large amounts of data that can then be converted into usable knowledge to make better management decisions for crop production. Many tools and techniques make up the components of precision farming.

A. Satellites can be used in precision farming to capture images so that a farmer can look at moisture content and quickly assess the health of a crop before visible damage appears.

B. Field scouting involves observing different areas of fields to identify and record the location of problems or events that will affect production—soil differences, insect problems, fertility deficiencies, weed problems, etc. Once a farmer has this information, he or she can make accurate applications of water, chemicals, or fertilizers and perform any other important management functions.

C. A ***Global Positioning System (GPS)*** is a satellite-based approach to find exact positions in fields. Farmers can use a GPS to locate the exact areas of a field that need attention.

D. A ***Geographic Information System (GIS)*** uses a computer to combine yield and soil information with other data and presents the information in the form of layered maps. GIS provides the maps that show what is needed, and GPS guides the farmer to the right location.

E. ***Variable Rate Technology (VRT)*** is a system of varying crop practices based on specific field conditions. VRT can be used to put just the right amount of seed, fertilizer, and crop protectants on the sections of the field where they are needed.

F. Yield monitors can be used to eliminate having to wait until the entire harvest is complete before projecting yields and making important decisions on how much to store or sell. Yield monitors can forecast yield as bushels per acre, total pounds, acres per hour worked, or grain moisture content.

Use TM: G–5B to illustrate the components of precision farming to students. Use WS: G–5B to help students better understand and recognize the components of the precision farming system. Use a hand-held GPS unit to demonstrate to students how it can be used to locate positions.

Objective 3: Describe the benefits of precision farming.

Anticipated Problem: What are the benefits of precision farming?

III. The concept of only applying what is needed where it is needed is the foundation of precision farming. Producers who take the time to learn about and use precision farming practices will find many benefits.

A. Precision farming technology provides producers with data that helps them make informed management decisions. The data can also assist producers in evaluating crop inputs, new products, and new methods.

B. Information on soil types and weather can be used to plan and improve scheduling of operations. This results in better efficiency and lower costs.

C. Precision farming can be used to improve variety choices, crop rotation schedules, and other practices that reduce the risk of loss to the producer. Information on crop growth gathered throughout the growing season can also help producers make informed marketing decisions.

D. Precise application of chemicals and fertilizers only where they are needed will protect the environment from over-application and prevent unnecessary costs from under-application.

Use TM: G–5C to discuss the benefits associated with the use of precision farming practices. Invite a local producer who uses precision farming practices to visit the class and discuss the benefits he or she has seen from using the technology.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: G–5A and WS: G–5B.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. a
2. d
3. b
4. c

Fill-in-the-Blank

1. Satellites
2. Yield
3. GIS, GPS

Short Answer

1. Answers may vary. Use Objective 3 to score this question.

Test G–5

Name_____

PRECISION FARMING

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. Variable Rate Technology (VRT)
b. Geographic Information System (GIS)
c. Global Positioning System (GPS)
d. precision farming

_____1. A system of varying crop practices based on specific field conditions.

_____2. A system that uses satellites and computer technology to help farmers to grow more and better crops.

_____3. A system that uses a computer to combine yield and soil information with other data and presents the information in the form of layered maps.

_____4. A satellite-based approach to find exact positions in fields.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ can be used in precision farming to capture images so that a farmer can look at moisture content and quickly assess the health of a crop before visible damage appears.

2. _____ monitors can be used to eliminate having to wait until the entire harvest is complete before projecting yields and making important decisions on how much to store or sell.

3. _____ provides the maps that show what is needed, and _____ guides the farmer to the right location.

▶ Short Answer

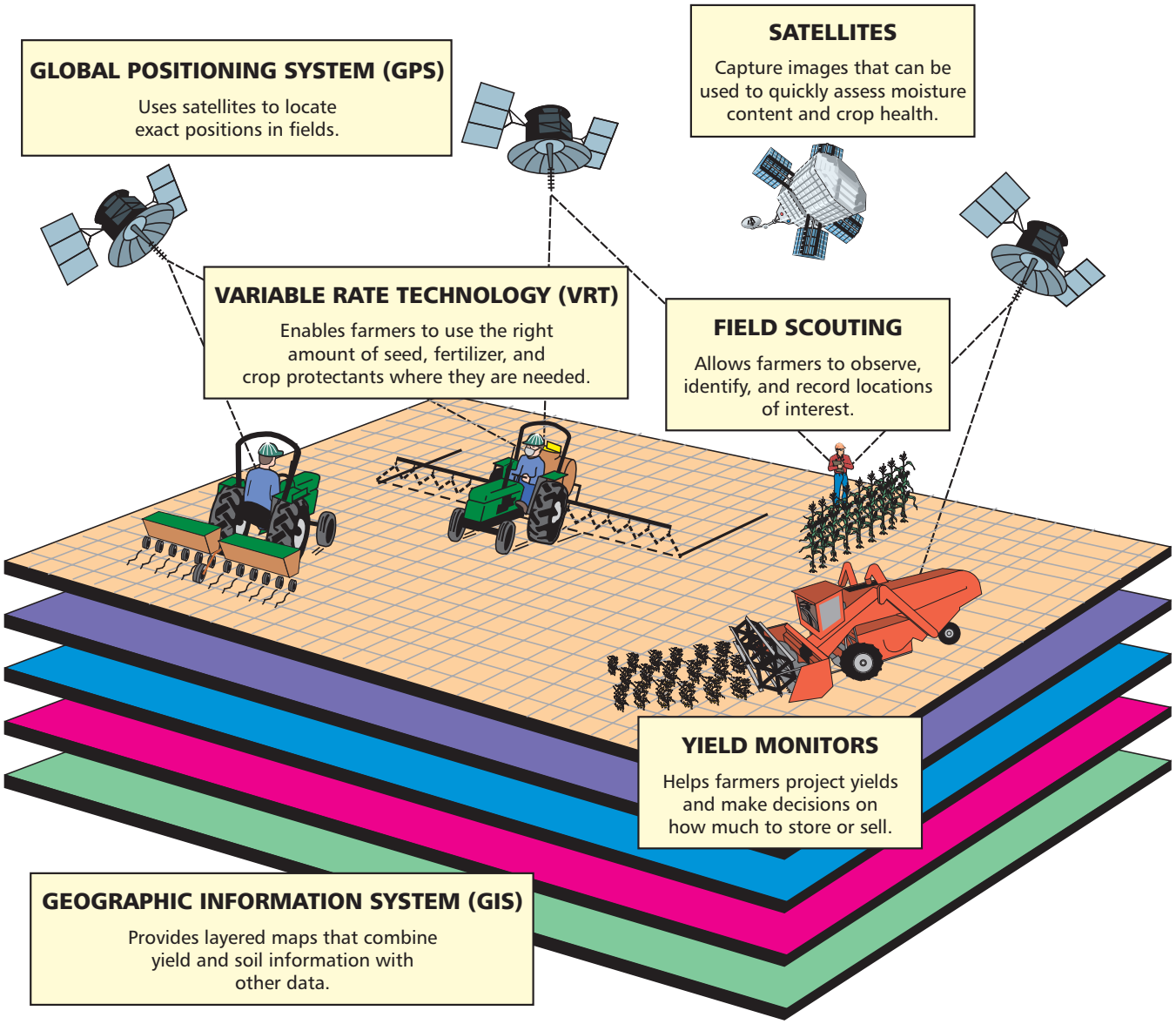
***Instructions*. Answer the following questions.**

What are the benefits of precision farming?

PRECISION FARMING

- Precision farming is a system that uses satellites and computer technology to help farmers to grow more and better crops.
- Precision farming can improve the economic and environmental sustainability of crop production.
- Precision farming allows farmers to manage their fields in small segments. This allows them to apply fertilizer, pesticide, and other materials in the precise locations that they are needed.
- Precision farming can be used in all aspects of the crop production cycle from pre-planting operations to harvest.

COMPONENTS OF PRECISION FARMING



BENEFITS OF PRECISION FARMING

- Informed management decisions
- Improved scheduling of operations
- Improved variety choices, crop rotation schedules, and other practices.
- Environmental protection and cost reduction

WS: G–5A

Name _____

TO BE…OR NOT TO BE…PRECISE

Materials

- ✓ One large clear container
- ✓ Four smaller clear containers
- ✓ Tablespoon
- ✓ Different colored water (red, green, blue, and orange)

Directions

1. Mark four equal sections on the bottom of the large container and label them 1 through 4. This container represents a field with four sections being farmed without the benefit of precision farming. When something is needed in one of the sections of the field, it must be added to the entire field.
2. Label the four small containers 1 through 4. These containers represent four sections of a field being farmed with precision farming practices. When something is needed in one of the sections of the field, it can be added only to that section.
3. Keep track of your information in the Data Tables provided.
4. Section 1 has a large population of weeds. The other sections have only a few weeds. For the precision farming sections, add 3 tablespoons of herbicide (red water) to Section 1. Add 1 tablespoon of herbicide to the rest of the sections. For the field not using precision farming, you will have to add 2 tablespoons of herbicide for each of the four sections and hope that this is enough to kill all of the weeds in Section 1 and not so much that it will damage the crops in the other sections.
5. The soil in Section 2 needs fertilizer. The other sections are okay. Add 6 tablespoons of fertilizer (green water) to Section 2. Do not add any fertilizer to the rest of the sections. To make the soil more fertile in Section 2 of the field not using precision farming, you decide you must add 3 tablespoons of fertilizer for each of the four sections.
6. Section 3 is dryer than the other sections. Add 4 tablespoons of water (blue water) to Section 3. Add 2 tablespoons of water to the other sections. Without precision farming, you will have to add 3 tablespoons of water for each of the four sections.
7. The insect population in Section 4 is much higher than in the other sections. Add 6 tablespoons of insecticide (orange water) to Section 4. Add 1 tablespoon of insecticide to the other sections. In order to get rid of the insects in Section 4 without using precision farming, you must add 4 tablespoons of insecticide for each of the four sections.
8. Complete the Data Tables and answer the questions.

DATA TABLE 1—PRECISION FARMING (SMALL CONTAINERS)				
		Number of Tablespoons Needed	Number of Tablespoons Applied	Difference (+ or –)
Herbicide (red)	Section 1	3		
	Section 2	1		
	Section 3	1		
	Section 4	1		
	TOTAL	6		
Fertilizer (green)	Section 1	0		
	Section 2	6		
	Section 3	0		
	Section 4	0		
	TOTAL	6		
Water (blue)	Section 1	2		
	Section 2	2		
	Section 3	4		
	Section 4	2		
	TOTAL	10		
Insecticide (orange)	Section 1	1		
	Section 2	1		
	Section 3	1		
	Section 4	6		
	TOTAL	9		

DATA TABLE 2—NO PRECISION FARMING (LARGE CONTAINER)				
		Number of Tablespoons Needed	Number of Tablespoons Applied	Difference (+ or –)
Herbicide (red)	Section 1	3		
	Section 2	1		
	Section 3	1		
	Section 4	1		
	TOTAL	6		
Fertilizer (green)	Section 1	0		
	Section 2	6		
	Section 3	0		
	Section 4	0		
	TOTAL	6		
Water (blue)	Section 1	2		
	Section 2	2		
	Section 3	4		
	Section 4	2		
	TOTAL	10		
Insecticide (orange)	Section 1	1		
	Section 2	1		
	Section 3	1		
	Section 4	6		
	TOTAL	9		

▶ Questions

1. Each tablespoon of herbicide costs $2.
   a. How much did it cost to apply the herbicide to the sections using precision farming?

   b. How much did it cost to apply the herbicide to the sections not using precision farming?

   c. How much money was wasted by not using precision farming?

2. Each tablespoon of fertilizer costs $4.
   a. How much did it cost to apply the fertilizer to the sections using precision farming?

   b. How much did it cost to apply the fertilizer to the sections not using precision farming?

   c. How much money was wasted by not using precision farming?

3. It costs $3 to produce each tablespoon of irrigation water.
   a. How much did it cost to irrigate the sections using precision farming?

   b. How much did it cost to irrigate the sections not using precision farming?

   c. How much money was wasted by not using precision farming?

4. Each tablespoon of insecticide costs $6.
   a. How much did it cost to apply the insecticide to the sections using precision farming?

   b. How much did it cost to apply the insecticide to the sections not using precision farming?

   c. How much money was wasted by not using precision farming?

5. a. What was the total cost of adding materials to the sections using precision farming?

   b. What was the total cost of adding materials to the sections not using precision farming?

   c. What was the total amount of money wasted by not using precision farming?

6. With the proper amount of irrigation, you will get 20 ears of corn from the plants in each of the four sections. Each extra tablespoon of water applied reduces the yield by 5 ears. Each tablespoon of water needed that was not applied reduces the yield by 10 ears.
   a. How many ears did the field using precision farming yield?

   b. How many ears did the field not using precision farming yield?

   c. If each ear of corn is worth $4, how much money did the sections using precision farming make?

d. If each ear of corn is worth $4, how much money did the sections not using precision farming make?

e. How much money was lost by not using precision farming?

7. To figure out your profit, you must subtract the cost of adding materials from the amount you sold your corn for.
   a. How much profit did you make on the sections using precision farming?

   b. How much profit did you make on the sections not using precision farming?

   c. How much more profit would you make by using precision farming?

8. Suppose you own 40 fields.
   a. How much profit would you make using precision farming?

   b. How much profit would you make not using precision farming?

   c. How much more profit would you make by using precision farming?

TO BE…OR NOT TO BE…PRECISE KEY

▶ Data Tables Key

DATA TABLE 1—PRECISION FARMING (SMALL CONTAINERS)				
		Number of Tablespoons Needed	Number of Tablespoons Applied	Difference (+ or –)
Herbicide (red)	Section 1	3	3	0
	Section 2	1	1	0
	Section 3	1	1	0
	Section 4	1	1	0
	TOTAL	6	6	0
Fertilizer (green)	Section 1	0	0	0
	Section 2	6	6	0
	Section 3	0	0	0
	Section 4	0	0	0
	TOTAL	6	6	0
Water (blue)	Section 1	2	2	0
	Section 2	2	2	0
	Section 3	4	4	0
	Section 4	2	2	0
	TOTAL	10	10	0
Insecticide (orange)	Section 1	1	1	0
	Section 2	1	1	0
	Section 3	1	1	0
	Section 4	6	6	0
	TOTAL	9	9	0

DATA TABLE 2—NO PRECISION FARMING (LARGE CONTAINER)				
		Number of Tablespoons Needed	Number of Tablespoons Applied	Difference (+ or –)
Herbicide (red)	Section 1	3	2	–1
	Section 2	1	2	+1
	Section 3	1	2	+1
	Section 4	1	2	+1
	TOTAL	6	8	2
Fertilizer (green)	Section 1	0	3	+3
	Section 2	6	3	–3
	Section 3	0	3	+3
	Section 4	0	3	+3
	TOTAL	6	12	6
Water (blue)	Section 1	2	3	+1
	Section 2	2	3	+1
	Section 3	4	3	–1
	Section 4	2	3	+1
	TOTAL	10	12	2
Insecticide (orange)	Section 1	1	4	+3
	Section 2	1	4	+3
	Section 3	1	4	+3
	Section 4	6	4	–2
	TOTAL	9	16	7

Questions Key

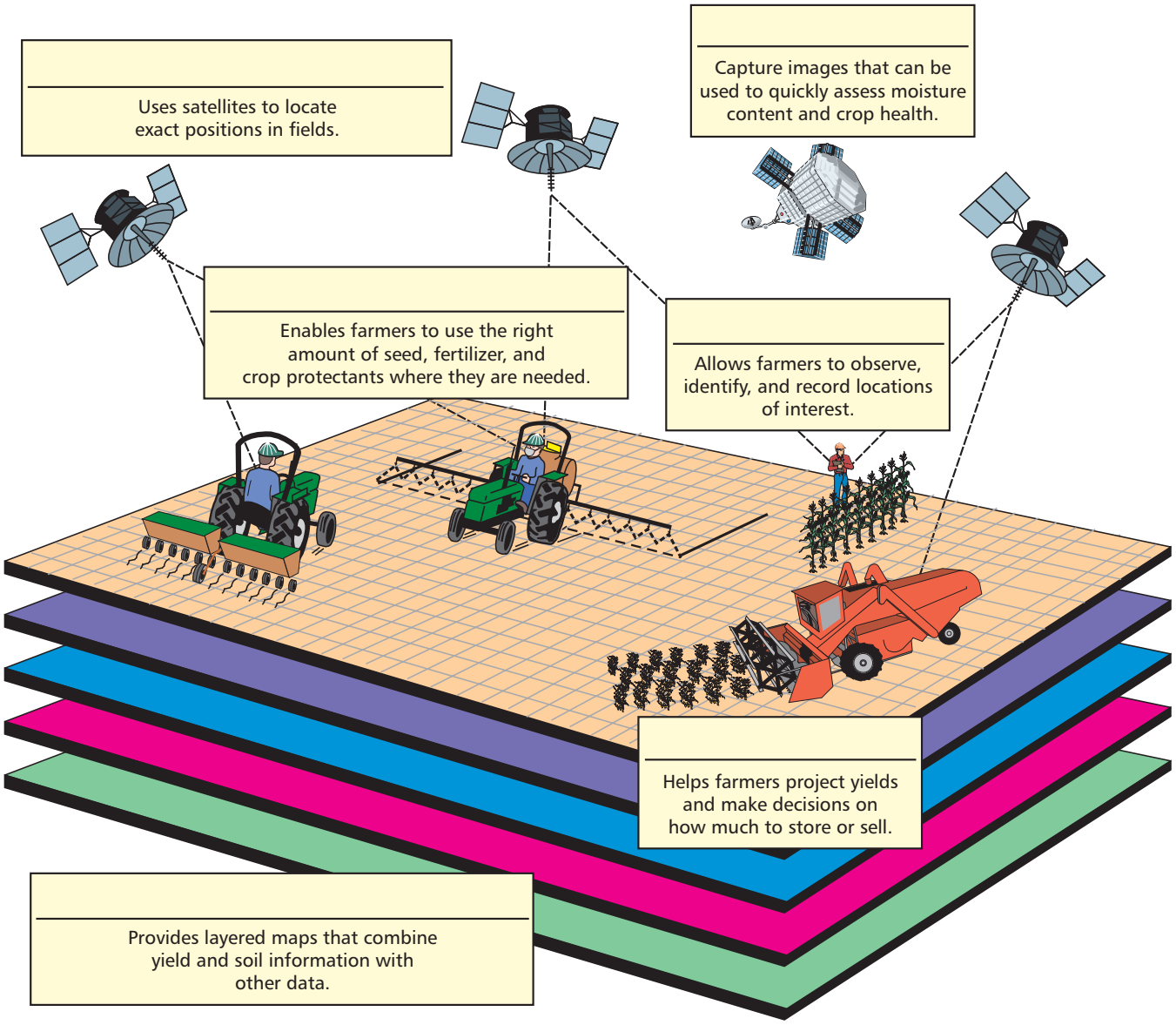
1. a. $12
   b. $16
   c. $4
2. a. $24
   b. $48
   c. $24
3. a. $30
   b. $36
   c. $6
4. a. $54
   b. $96
   c. $42
5. a. $120
   b. $196
   c. $76
6. a. 80 ears
   b. 55 ears
   c. $320
   d. $220
   e. $100
7. a. $200
   b. $24
   c. $176
8. a. $8,000
   b. $960
   c. $7,040

Name _____

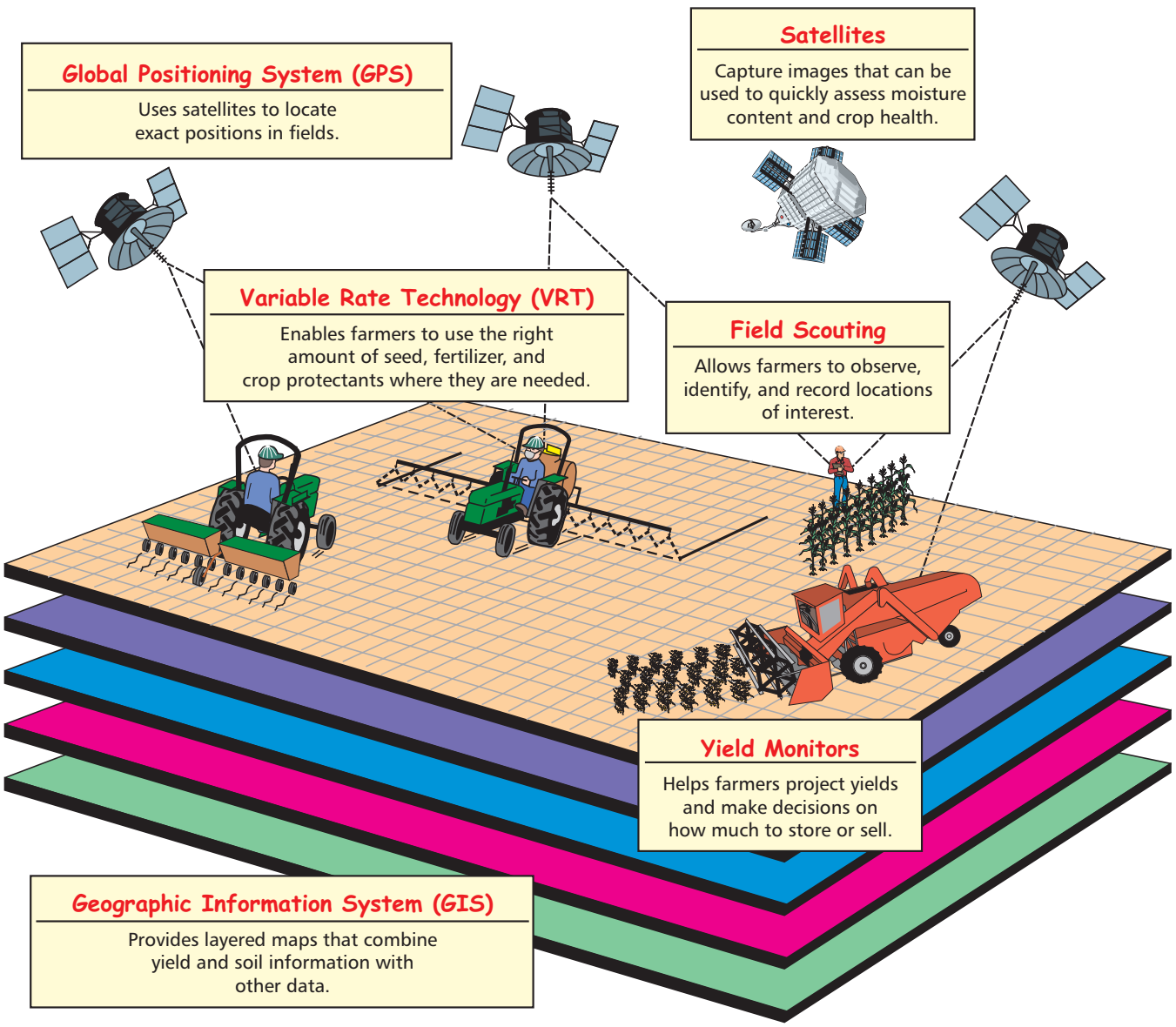
COMPONENTS OF PRECISION FARMING

Directions

Fill in the components of precision farming in the blanks provided.



COMPONENTS OF PRECISION FARMING KEY



Lesson H–1

SANITATION, SPOILAGE, AND STORAGE

Indiana Agricultural Literacy Lesson Plan Library

Unit H. Food Science

Lesson 1. Sanitation, Spoilage, and Storage

Indiana's Academic Standard. **Science:** 4.4.10 — Explain that if germs are able to get inside the body, they may keep it from working properly. Understand that for defense against germs, the human body has tears, saliva, skin, some blood cells, and stomach secretions. Also note that a healthy body can fight most germs that invade it. Recognize, however, that there are some germs that interfere with the body's defenses.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Discuss food safety.
2. Outline safe food handling.
3. Name methods of food preservation.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Food, Land, and People. San Francisco, California, 2000.

Kids, Crops, and Critters (4–6). Bloomington, Illinois: Illinois Farm Bureau, 2000.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Morgan, Elizabeth M., Jasper S. Lee, and Elizabeth Wilson. *AgriScience Explorations*, Third Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2004.

Science and Our Food Supply. Washington, DC: Center for Food Safety and Applied Nutrition, 2001.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Magnifying glasses (one for each student)

Terms. The following terms are presented in this lesson (shown in bold italics):

- Aseptic packaging
- Blanching
- Canning
- Contamination
- Curing
- Dehydration
- Fermentation
- Food-borne illness
- Food preservation
- Food spoilage
- Freezing
- Irradiation
- Paraffin
- Pasteurization
- Pathogen
- Perishable food
- Pickling
- Refrigeration
- Sterilization

- Vacuum wrapping
- Wholesome food

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask the students when was the last time they washed their hands. Tell them to look at their hands and notice the natural lines, cracks, and wrinkles. These are the perfect places for dirt and germs to hang out. Give each student a magnifying glass. Have the students use the magnifying glasses to examine their hands more closely. Ask them what they see. They should be able to better see the natural cracks, lines, and wrinkles of their hands, and they may also be able to see some dirt on their hands. Tell them that no matter how hard they look, they will not see any germs. Germs are microorganisms that can only be seen with a microscope. Just because they can't see them, however, does not mean that they aren't there. Inform the students that germs live everywhere and billions of them grow and live on their bodies every day. Most of these germs are not harmful, but the germs we pick up from everything around us can be harmful. Many of them can make us sick. If these harmful germs get onto our food, they can spread and cause food poisoning. We must wash our hands frequently and do whatever else we can to prevent spreading harmful germs that can make us sick.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Discuss food safety.

Anticipated Problem: How do we guarantee safe food?

I. Food is an essential component in our lives. Food provides the nutrients required for us to live. Steps must be taken to keep our food safe for us to eat.

A. Food safety is very important to insure that the foods we eat are wholesome. ***Wholesome food*** is food that is nutritious and safe to eat. Wholesome food does not contain foreign substances that could make us sick. Spoiled food or food with foreign substances in it is unwholesome. Unwholesome food may cause sickness.

B. A ***food-borne illness*** is an illness that results from eating unwholesome food.

1. Symptoms of food-borne illness include fever, vomiting, diarrhea, abdominal cramps, and headache.

2. About 76 million people become ill each year from the food they eat. Of those, 325,000 need to be hospitalized.
3. About 5,000 people die each year from food-borne illness.
4. It is estimated that proper hand washing could eliminate over half of the cases of food-borne illness.
5. At least 85% of food-borne illnesses can be avoided by handling food properly.
6. Bacteria such as *Salmonella*, *E. coli*, and *Clostridium botulism* are common causes of food-borne illness.

C. ***Food spoilage*** is a condition in which food becomes unsafe to eat. The food may be decaying. Most food spoilage is caused by bacteria and fungi. Food that is spoiled is not safe to eat.

D. Food must be handled safely to avoid contamination. ***Contamination*** is the addition of something unwholesome or undesirable. Contaminated food is not safe to eat.

E. To keep food safe, it must be properly handled throughout the food chain, from the farm to the consumer.

F. Some foods must be packaged and stored differently to prevent spoilage because they do not keep as well as others. ***Perishable food*** is food that is highly susceptible to spoilage and must be consumed in a short period of time. All types of food will eventually spoil if they are not preserved, but some foods are more perishable than others. Bread, meat, and dairy products, for example, are more perishable than grains and nuts.

G. Temperature is very important in preventing illness from pathogens. A ***pathogen*** is a contaminant that causes sickness. Bacteria, molds, and fungi are common pathogens. Most pathogens can only live in temperatures between 40°F and 140°F. Pathogens cannot be seen or smelled. When a product looks or smells bad, then it is already too late.

H. Government regulations help insure that our food is safe. The United States Department of Agriculture (USDA) is responsible for inspecting food. The Federal Food and Drug Administration (FDA) monitors the food supply to make sure that all laws are being followed.

Use TM: H–1A to cover the content of the objective. Use WS: H–1A to demonstrate to students the importance of properly washing their hands with soap and warm water to help prevent food-borne illness. ***NOTE:*** *Check for allergies to cinnamon before doing the activity. Cocoa could be substituted.*

Objective 2: Outline safe food handling.

Anticipated Problem: How do you handle food properly?

II. Handling food properly keeps our food safe and helps reduce the risk of food-borne illness. The Four Cs of Food Safety can be used as guidelines for handling food safely—clean, cook, combat cross-contamination, and chill.

A. **Clean—**

1. Wash your hands, all utensils, and surfaces in warm soapy water before and after preparing food, especially after handling raw meat, poultry, eggs, or seafood.
2. Rinse raw produce under running water. Cut off any bruised or damaged areas.
3. Use paper towels for cleaning up kitchen surfaces, and throw them away when done. If cloth towels are used, wash them often in the hot cycle of your washing machine.

B. **Cook—**

1. Cook food to the proper temperature. You cannot tell if food is properly cooked just by looking at the color.
2. Use a clean meat thermometer to check the temperature of meat. All meat should be cooked to the proper temperature. Seafood should be cooked until opaque. Cook eggs until they are firm and no liquid remains.
3. All leftovers should be reheated to 165°F.

C. **Combat Cross-Contamination—**

1. Raw meat, poultry, and seafood should be sealed and kept separate from other foods in your refrigerator to avoid contamination.
2. Either clean cutting boards thoroughly between uses or use different cutting boards for meats and fresh produce.
3. Wash your hands, cutting boards, dishes, and utensils after use.
4. Do not place cooked food on the same dish where raw food was held.
5. Do not use sauces that were used for marinating raw meat unless you boil them first.

D. **Chill—**

1. Refrigerate food at 40°F or lower.
2. Refrigerate leftover food as soon as possible but always within two hours.
3. Put leftovers in shallow containers for quick cooling.
4. Marinate and thaw foods in the refrigerator, **not** on the counter or in the sink at room temperature.
5. Do not pack the refrigerator too full because it does not allow cold air to circulate.
6. Pack coolers full and with plenty of ice to keep foods cool at picnics or barbeques.

Use TM: H–1B, TM: H–1C, TM: H–1D, and TM: H–1E to discuss the four Cs and to emphasize the importance of food safety. Use WS: H–1B and H–1C to further the students' understanding of food safety.

Objective 3: Name methods of food preservation.

Anticipated Problem: What are some methods of food preservation?

III. ***Food preservation*** is the treatment of food to keep it from spoiling. Food preservation can be accomplished by several methods.

A. ***Canning*** is a method of food preservation in which food is placed in a container and heated at high temperatures under pressure to kill all microorganisms. The food containers are held at the right temperature for a period of time and then cooled. An airtight seal must be created on the container to keep microorganisms from getting back into the container after it cools. Vegetables, fruits, and meats can be canned.

B. ***Freezing*** is a preservation method in which foods are stored at a low temperature so the water in the product becomes ice. Most microbial activity stops when frozen. Fruits, vegetables, and meat can all be frozen. Foods should be prepared carefully for freezing.

1. Only food free of decay should be frozen.
2. Most fruits and vegetables are blanched before freezing. ***Blanching*** is a heat treatment designed to raise the temperature of food between 180°F to 190°F followed by rapid cooling. Blanching does not destroy microorganisms. It inactivates enzymes that can alter the taste and color of a food product.

C. ***Fermentation*** is a method of food preservation that uses the carefully controlled activity of certain bacteria, molds, and yeasts. Fermentation is used in making wines, breads, vinegars, and cheeses.

D. ***Dehydration***, or drying, is a method of preservation that involves the removal of all the moisture from a food product. Microbes require moisture to function, so removing the water ends their activity. Fruits and meats are often dehydrated. Raisins and beef jerky are examples of dried foods.

E. ***Curing*** is a food preservation method in which substances that prevent microorganism growth are added to foods to prevent spoilage. Concentrations of salt, sugar, sodium nitrate, and other materials are used for curing. Meats are often cured.

F. ***Refrigeration*** is a method of food preservation that involves storing foods between freezing and room temperature. Refrigeration does not kill any microorganisms, but it slows down their growth. Many foods are refrigerated temporarily.

G. ***Pasteurization*** is a heat treatment that kills all pathogenic microorganisms (ones that cause illness) but does not kill all spoilage microorganisms. All milk in stores has been pasteurized.

H. ***Irradiation*** is a food preservation method in which foods are treated with electrically charged particles, such as X-rays, electron beams, or gamma rays. Low amounts of radiation will kill spoilage organisms. Meats and fruits are often irradiated.

I. Special packaging can be used to preserve food.

1. ***Aseptic packaging*** is a method of preservation in which the food and the container are sterilized. ***Sterilization*** is a heating method that completely destroys all microorgan-

isms. Food in aseptic packaging can be stored for weeks or months at room temperature without spoiling.

2. ***Vacuum wrapping*** is a method of food preservation in which all oxygen is removed from the food's packaging. Microorganisms cannot grow without oxygen. Vacuum-wrapped foods can be stored for quite some time at the proper temperature without spoiling.

J. ***Pickling*** is a food preservation method that prevents the growth of spoilage organisms by placing foods in acid solutions. Vinegar is commonly used for pickling. Cucumbers, cauliflower, okra, peppers, other vegetables, and some meat products are pickled.

K. A thin layer of ***paraffin***, a type of wax, can be applied to some foods to preserve them. The paraffin holds moisture in and keeps organisms out. Apples and rutabagas are commonly coated with a thin layer of paraffin.

Use TM: H–1F to discuss the different methods of food preservation with the students. Use WS: H–1D as a fun activity to help students become more familiar with the different food preservation methods. Use WS: H–1E to have students observe the drying process. Bring in samples of food products preserved with some of the different methods and allow students to examine them.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: H–1A, WS: H–1B, WS: H–1C, WS: H–1D, and WS: H–1E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. b
2. a
3. c
4. d
5. h
6. f

7. e
8. g

Fill-in-the-Blank

1. Wholesome
2. Contamination
3. fermentation
4. Food-borne

Short Answer

1. clean, cook, combat cross-contamination, and chill

Test H–1

Name_____

SANITATION, SPOILAGE, AND STORAGE

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. dehydration	d. freezing	g. canning
b. refrigeration	e. pathogen	h. sterilization
c. irradiation	f. perishable food	

_____1. A method of food preservation that involves storing foods between freezing and room temperature.

_____2. A method of preservation that involves the removal of all the moisture from a food product.

_____3. A food preservation method in which foods are treated with electrically charged particles.

_____4. A preservation method in which foods are stored at a low temperature so the water in the product becomes ice.

_____5. A heating method that completely destroys all microorganisms.

_____6. Food that is highly susceptible to spoilage and must be consumed in a short period of time.

_____7. A contaminant that causes sickness.

_____8. A method of food preservation in which food is placed in a container and heated at high temperatures under pressure to kill all microorganisms.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. _____ food is food that is nutritious and safe to eat.
2. _____ is the addition of something unwholesome or undesirable.
3. Cheese and wine are preserved by _____.
4. _____-_____ illness is an illness caused by eating unwholesome food.

▶ Short Answer

***Instructions*. Answer the following question.**

What are the Four Cs of Food Safety?

FOOD SAFETY

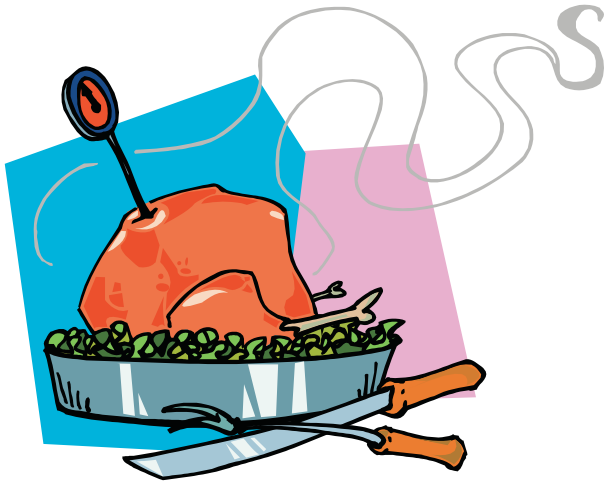
- Wholesome food—food that is nutritious and safe to eat.
- Food-borne illness—an illness that results from eating unwholesome food.
- Food spoilage—a condition in which food becomes unsafe to eat.
- Contamination—the addition of something unwholesome or undesirable.
- Perishable food—food that is highly susceptible to spoilage and must be consumed in a short period of time.
- Pathogen—a contaminant that causes sickness.

FOUR Cs OF FOOD SAFETY—CLEAN

- Wash your hands, all utensils, and surfaces in warm soapy water before and after preparing food, especially after handling raw meat, poultry, eggs, or seafood.

- Rinse raw produce under running water. Cut off any bruised or damaged areas.
- Use paper towels for cleaning up kitchen surfaces, and throw them away when done. If cloth towels are used, wash them often in the hot cycle of your washing machine.

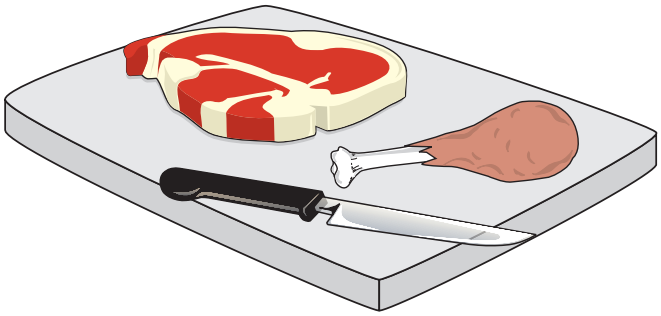
FOUR Cs OF FOOD SAFETY—COOK

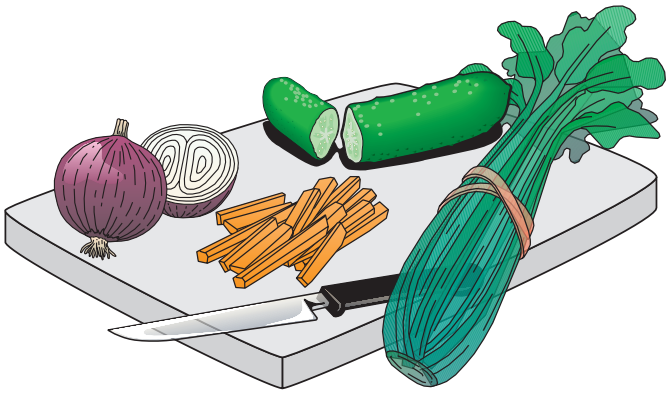


- Cook food to the proper temperature. You cannot tell if food is properly cooked just by looking at the color.
- Use a clean meat thermometer to check the temperature of meat. All meat should be cooked to the proper temperature. Seafood should be cooked until opaque. Cook eggs until they are firm and no liquid remains.
- All leftovers should be reheated to 165°F.

FOUR Cs OF FOOD SAFETY—COMBAT CROSS-CONTAMINATION

- Raw meat, poultry, and seafood should be sealed and kept separate from other foods in your refrigerator to avoid contamination.
- Either clean cutting boards thoroughly between uses or use different cutting boards for meats and fresh produce.
- Wash your hands, cutting boards, dishes, and utensils after use.
- Do not place cooked food on the same dish where raw food was held.
- Do not use sauces that were used for marinating raw meat unless you boil them first.





FOUR Cs OF FOOD SAFETY—CHILL

- Refrigerate food at 40°F or lower.
- Refrigerate leftover food as soon as possible but always within two hours.
- Put leftovers in shallow containers for quick cooling.
- Marinate and thaw foods in the refrigerator, not on the counter or in the sink at room temperature.

- Do not pack the refrigerator too full because it does not allow cold air to circulate.
- Pack coolers full and with plenty of ice to keep foods cool at picnics or barbeques.

FOOD PRESERVATION

- Canning
- Freezing
- Fermentation
- Dehydration
- Curing
- Refrigeration
- Pasteurization
- Irradiation
- Special packaging (aseptic packaging and vacuum wrapping)
- Pickling
- Paraffin

Name _____

WASH YOUR HANDS!

Introduction

Washing your hands properly and frequently is one of the best ways to reduce your chances of getting a food-borne illness. Your hands contain natural oils that allow dirt and germs to stick to them. To get rid of dirt and germs, you must use warm water and soap. If you don't wash properly, then you aren't really washing!

Materials

- ✓ Cooking spray
- ✓ Cinnamon
- ✓ Soap
- ✓ Paper towels
- ✓ Access to faucet with warm and cold running water

Directions

1. Working in groups of two, you will try to wash some "germs" from your hands.
2. Have your partner spray your hands with cooking spray.
3. Next, have your partner sprinkle cinnamon on the palms, backs, and in-between the fingers of your hands. The cinnamon represents germs that get on your hands.
4. Use cold water to try to wash off the cinnamon. Have your partner record the results in the Data Table.
5. Next, try using soap and cold water to wash off the cinnamon. Have your partner record the results in the Data Table.
6. Now use soap and warm water to try to wash off the cinnamon. Have your partner record the results in the Data Table.

DATA TABLE	
	Results
Cold water	
Cold water and soap	
Warm water and soap	

Conclusions

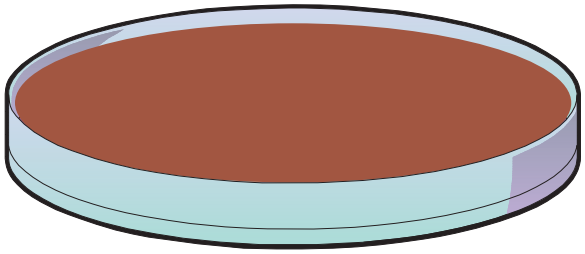
What happened when you tried to wash the cinnamon off of your hands using cold water? What happened when you used soap and warm water? How is this similar to washing germs off of your hands? Is it important to use soap and warm water to wash your hands?

(Adapted from Kids, Crops, and Critters—Serving Up Food Safety)

Name _____

WHERE DO GERMS COME FROM?

Materials



- ✓ Three petri dishes with sterilized agar and lids
- ✓ Permanent marker
- ✓ Soap
- ✓ Paper towels
- ✓ Access to faucet with warm and cold running water

Directions

1. Label the three petri dishes 1 through 3.
2. In petri dish 1, place one strand of your hair. Place the lid on the dish.
3. Touch three fingers from your hand to the medium in petri dish 2. Place the lid on the dish.
4. Go wash your hands thoroughly with soap and warm water. Dry your hands with a paper towel.
5. Touch three fingers from your clean hand to the medium in petri dish 3. Place the lid on the dish.
6. Place the three petri dishes in a safe area.
7. Observe the petri dishes over the next couple of weeks and record your observations.

Conclusion

What happened in the petri dishes? What does this tell you about what happens when your hair or unclean hands come into contact with food? Why is it a good idea to wash your hands properly when handling food?

Name _____

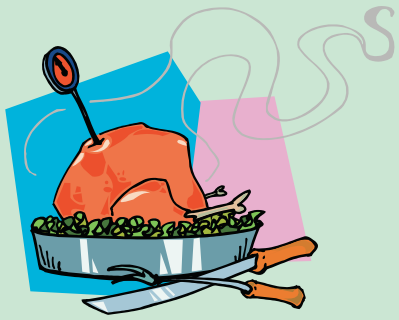
THE FOUR Cs OF FOOD SAFETY

Directions

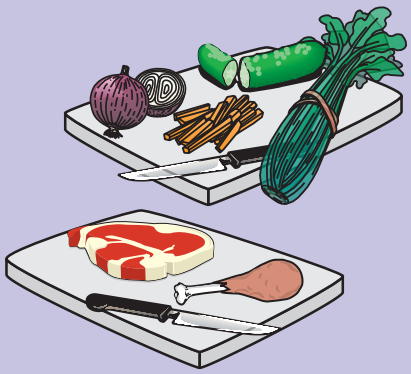
Create a poster or bulletin board display that will help inform others about the Four Cs of Food Safety. Be sure to include information about what people can do to reduce their chances of getting a food-borne illness. You might also want to make flyers that you can pass out to your friends and family to help them make their food safe.

FOUR Cs OF FOOD SAFETY

CLEAN



COOK



COMBAT CROSS-CONTAMINATION

CHILL

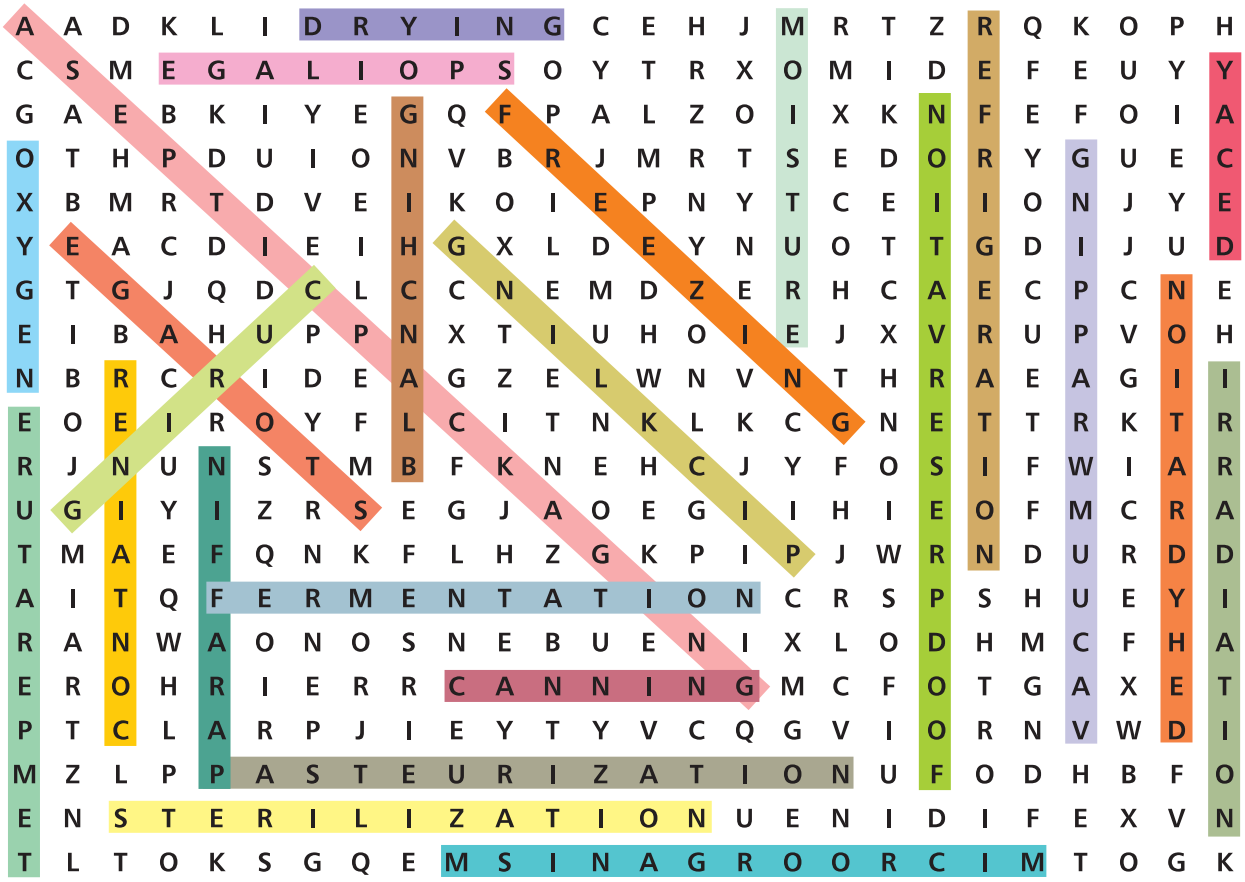
Name _____

FOOD PRESERVATION WORD SEARCH

A A D K L I D R Y I N G C E H J M R T Z R Q K O P H
C S M E G A L I O P S O Y T R X O M I D E F E U Y Y
G A E B K I Y E G Q F P A L Z O I X K N F E F O I A
O T H P D U I O N V B R J M R T S E D O R Y G U E C
X B M R T D V E I K O I E P N Y T C E I I O N J Y E
Y E A C D I E I H G X L D E Y N U O T T G D I J U D
G T G J Q D C L C C N E M D Z E R H C A E C P C N E
E I B A H U P P N X T I U H O I E J X V R U P V O H
N B R C R I D E A G Z E L W N V N T H R A E A G I I
E O E I R O Y F L C I T N K L K C G N E T T R K T R
R J N U N S T M B F K N E H C J Y F O S I F W I A R
U G I Y I Z R S E G J A O E G I I H I E O F M C R A
T M A E F Q N K F L H Z G K P I P J W R N D U R D D
A I T Q F E R M E N T A T I O N C R S P S H U E Y I
R A N W A O N O S N E B U E N I X L O D H M C F H A
E R O H R I E R R C A N N I N G M C F O T G A X E T
P T C L A R P J I E Y T Y V C Q G V I O R N V W D I
M Z L P P A S T E U R I Z A T I O N U F O D H B F O
E N S T E R I L I Z A T I O N U E N I D I F E X V N
T L T O K S G Q E M S I N A G R O O R C I M T O G K

ASEPTIC PACKAGING
BLANCHING
CANNING
CONTAINER
CURING
DECAY
DEHYDRATION
DRYING
FERMENTATION
FOOD PRESERVATION
FREEZING
IRRADIATION
MICROORGANISM
MOISTURE
OXYGEN
PARAFFIN
PASTEURIZATION
PICKLING
REFRIGERATION
SPOILAGE
STERILIZATION
STORAGE
TEMPERATURE
VACUUM WRAPPING

FOOD PRESERVATION WORD SEARCH KEY



Name _____

DRYING

Materials

- ✓ Parchment paper
- ✓ Pieces of fruit (grapes, apples, apricots, oranges, etc.)
- ✓ Pencil
- ✓ Needle and string

Directions

1. Place a piece of parchment paper in a safe, sunny location.
2. Arrange pieces of fruit on the parchment paper.
3. Use a pencil to carefully trace around the pieces of fruit so you can keep track of how much they shrink.
4. Leave the fruit undisturbed for a couple of weeks and record your observations every few days.
5. When your fruit is completely dried, hang it on some string to make a decoration.

Conclusions

What happened to the fruit? Did the size change? How about the color and texture? Why do you think the changes happened?

Lesson H–2

NUTRITIONAL BALANCE

Indiana Agricultural Literacy Lesson Plan Library

Unit H. Food Science

Lesson 2. Nutritional Balance

Indiana's Academic Standard. **Science:** 4.4.9 — Explain that food provides energy and materials for growth and repair of body parts. Recognize that vitamins and minerals, present in small amounts in foods, are essential to keep everything working well. Further understand that as people grow up, the amounts and kinds of food and exercise needed by the body may change.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. List the main nutritional requirements.
2. Understand the sections of the Food Guide Pyramid.
3. Explain how to use the Food Guide Pyramid.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Innovations in Agriculture. Bloomington, Illinois: Illinois Farm Bureau, 2002.

Kids, Crops, and Critters. Bloomington, Illinois: Illinois Farm Bureau, 2000.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Pyramid Explorations. Rosemont, Illinois: National Dairy Council, 1998.

www.agclassroom.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Carbohydrate
- Complex carbohydrate
- Fat
- Food Guide Pyramid
- Mineral
- Nutrient
- Protein
- Simple carbohydrate
- Vitamin

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask students to name their favorite salad ingredients (lettuce, tomatoes, bacon bits, ham, turkey, cheese, hard-boiled eggs, dressing, etc.). List their choices on the writing surface. Next, ask students if they know what food group each ingredient is from. Help them name the food groups and list them next to each of the ingredients on the writing surface. Explain that a good salad can be not only delicious, but it can also be a very nutritious way to have something from all of the food groups. A good variety of foods is also an excellent way to make sure that we get all the nutrients our bodies need to grow and stay healthy.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: List the main nutritional requirements.

Anticipated Problem: What nutrients do our bodies require?

I. Food provides nutrition for our bodies. A ***nutrient*** is a substance that our bodies need to carry out life processes. Nutrients help us grow and stay healthy. The main nutrients that our bodies require are carbohydrates, proteins, fats, vitamins, minerals, and water.

A. A ***carbohydrate*** is a nutrient that provides energy and is found in one of two basic forms: simple or complex.

1. A ***simple carbohydrate*** is a carbohydrate with three or fewer simple sugar molecules linked together. Simple carbohydrates are sugars and are found in foods like candy bars, soda pop, and other foods with high sugar content.
2. A ***complex carbohydrate*** is a carbohydrate with long chains of simple sugar molecules. Starch is the most common example of a complex carbohydrate. Bread, pasta, potatoes, and rice are sources of complex carbohydrates.

B. A ***protein*** is a nutrient made up of amino acids that is used for maintenance, growth, reproduction, and other functions in the body. Foods like red meat, fish, poultry, eggs, and dairy products (milk, yogurt, cheese) are high in amino acids, containing all that your body needs. Beans, peanuts, peas, and cereal grains only contain some of the needed amino acids.

C. A ***fat***, also called a lipid, is a nutrient that provides energy for the body. There are two types of fat: saturated and unsaturated.

1. Saturated fats, such as animal fats, are solid at room temperate. Diets high in saturated fats can lead to heart disease.
2. Unsaturated fats, such as corn oil and other vegetable oils, are liquid at room temperature.

D. A ***vitamin*** is a complex chemical substance that is needed to regulate the body. Even though they are found in small amounts, vitamins are essential for proper growth and function. Many vitamins have been identified and each has a specific role, but vitamins A, B, C, and D are the most important for health and growth. Vegetables are excellent sources of vitamins.

E. A ***mineral*** is an inorganic element that is essential for growth and health. Calcium, phosphorous, iron, zinc, magnesium, manganese, and sodium are examples of minerals. Milk, eggs, meat, and vegetables are sources of some minerals.

F. Water is needed to help digest food, transport waste, regulate body temperature, and keep cells functioning properly. Every cell in the body is composed of water, so it is essential that enough is consumed daily.

Use TM: H–2A to explain what the necessary nutritional requirements are for the human body. Use WS: H–2A as a fun activity to help students further understand the different nutrients that the body needs.

Objective 2: Understand the sections of the Food Guide Pyramid.

Anticipated Problem: What are the different sections of the Food Guide Pyramid?

II. The ***Food Guide Pyramid*** is a chart developed by the U.S. Department of Agriculture that shows the recommended amounts of different food groups that should be eaten each day. By eating the recommended amounts, you will get all of the needed nutrients necessary for a healthy body. The Food Guide Pyramid is divided into six groups.

A. **Bread, Cereal, Rice, and Pasta Group**
   1. The Food Guide Pyramid recommends eating 6 to 11 servings from this group.
   2. Foods in this group are good sources of carbohydrates that provide energy for the body.

B. **Vegetable Group**
   1. The Food Guide Pyramid recommends eating 3 to 5 servings from this group.
   2. Vegetables are excellent sources of protein, vitamins, and minerals.

C. **Fruit Group**
   1. The Food Guide Pyramid recommends eating 2 to 4 servings from this group.
   2. Fruits are good sources of vitamins and minerals.

D. **Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group**
   1. The Food Guide Pyramid recommends eating 2 to 3 servings from this group.
   2. Foods in this group are sources of protein.

E. **Milk, Yogurt, and Cheese Group**
   1. The Food Guide Pyramid recommends eating 2 to 3 servings from this group.
   2. Foods in this group provide minerals and vitamins.

F. **Fats, Oils, and Sweets**
   1. The Food Guide Pyramid recommends eating foods from this group sparingly.
   2. Fats, oils, and sweets do not provide many nutrients, and eating too many can lead to poor health.

Use TM: H–2B to show students the Food Guide Pyramid. Use TM: H–2C to discuss the USDA Dietary Guidelines for Americans with students. Use WS: H–2B to have students fill in their own copy of the Food Guide Pyramid. Use WS: H–2C to have students build a food pyramid out of construction paper squares. The squares can be any size, but they should be large enough for students to paste photographs of food on them. If space is available, you might want to have the entire class participate as a group to create one large pyramid that you can post in the classroom.

Objective 3: Explain how to use the Food Guide Pyramid.

Anticipated Problem: How do you use the Food Guide Pyramid?

III. The Food Guide Pyramid recommends eating a range of servings from each of the food groups each day.

A. The actual number of servings you should eat depends largely on age and activity level.

1. Infants and younger children need nutrients that support the growth of strong bones and muscles.
2. Older children and teens need added servings of grains, vegetables, and fruits to add calories for energy, as well as nutrients.
3. Adults can base their servings mostly on their activity level. Staying active requires energy and burns calories.
4. Senior citizens need fewer calories but still need nutrients to stay healthy.

B. Women who are pregnant or nursing a baby or people with a specific illness or health problem may have special dietary needs that will determine the number of servings they should eat.

C. To properly use the Food Guide Pyramid, you must also know what amount equals one serving. Just because you are only eating one portion, doesn't necessarily mean that it is only one serving. Many restaurants offer large portions that may be equal to two or three times the recommended serving size.

1. One serving from the Bread, Cereal, Rice, and Pasta Group =
   - 1 slice of bread
   - About 1 cup of ready-to-eat cereal
   - ½ cup of cooked cereal, rice, or pasta
2. One serving from the Vegetable Group =
   - 1 cup of raw leafy vegetables
   - ½ cup of other vegetables—cooked or raw
   - ¾ cup of vegetable juice
3. One serving from the Fruit Group =
   - 1 medium apple, banana, orange, or pear
   - ½ cup of chopped, cooked, or canned fruit
   - ¾ cup of fruit juice
4. One serving from the Milk, Yogurt, and Cheese Group = (preferably fat free or low fat)
   - 1 cup of milk or yogurt
   - 1½ ounces of natural cheese (such as cheddar)
   - 2 ounces of processed cheese (such as American)

5. One serving from the Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group = (preferably lean or low fat)
   - 2–3 ounces of cooked lean meat, poultry, or fish

   These count as 1 ounce of meat:
   - ½ cup of cooked dry beans or tofu
   - 2½ ounce soyburger
   - 1 egg
   - 2 tablespoons of peanut butter
   - $^1/_3$ cup of nuts

Use TM: H–2D to show students how to use the Food Guide Pyramid and help them decide how many servings from each group they should be eating. Use WS: H–2D to have students keep track of their meals for a day and evaluate their food choices. Invite a dietician to come to the class and discuss with students the importance of eating the right foods, getting enough exercise, and preventing future health problems.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: H–2A, WS: H–2B, WS: H–2C, and WS: H–2D.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. f
2. e
3. d
4. b
5. c
6. a

Short Answer

Students should draw a Food Guide Pyramid similar to the one shown on TM: H–2B.

Test H–2

Name_____

NUTRITIONAL BALANCE

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. carbohydrate
b. fat
c. mineral
d. protein
e. vitamin
f. water

_____1. Needed to help digest food, transport waste, regulate body temperature, and keep cells functioning properly.

_____2. A complex chemical substance that is needed in small amounts to regulate the body.

_____3. A nutrient made up of amino acids that is used for maintenance, growth, reproduction, and other functions in the body.

_____4. A nutrient that provides energy for the body, also called a lipid.

_____5. An inorganic element that is essential for growth and health.

_____6. A nutrient that provides energy and is found in one of two basic forms: simple or complex.

▶ Short Answer

***Instructions*. Complete the following.**

On a separate sheet of paper, draw the Food Guide Pyramid, label the six sections, and list the servings suggested for each section.

NUTRITIONAL NEEDS

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Water

FOOD GUIDE PYRAMID

Food Guide Pyramid
A Guide to Daily Food Choices

Fats, Oils, & Sweets
USE SPARINGLY

Key
- Fat (naturally occurring and added)
- Sugars (added)

These symbols show fat and added sugars in foods.

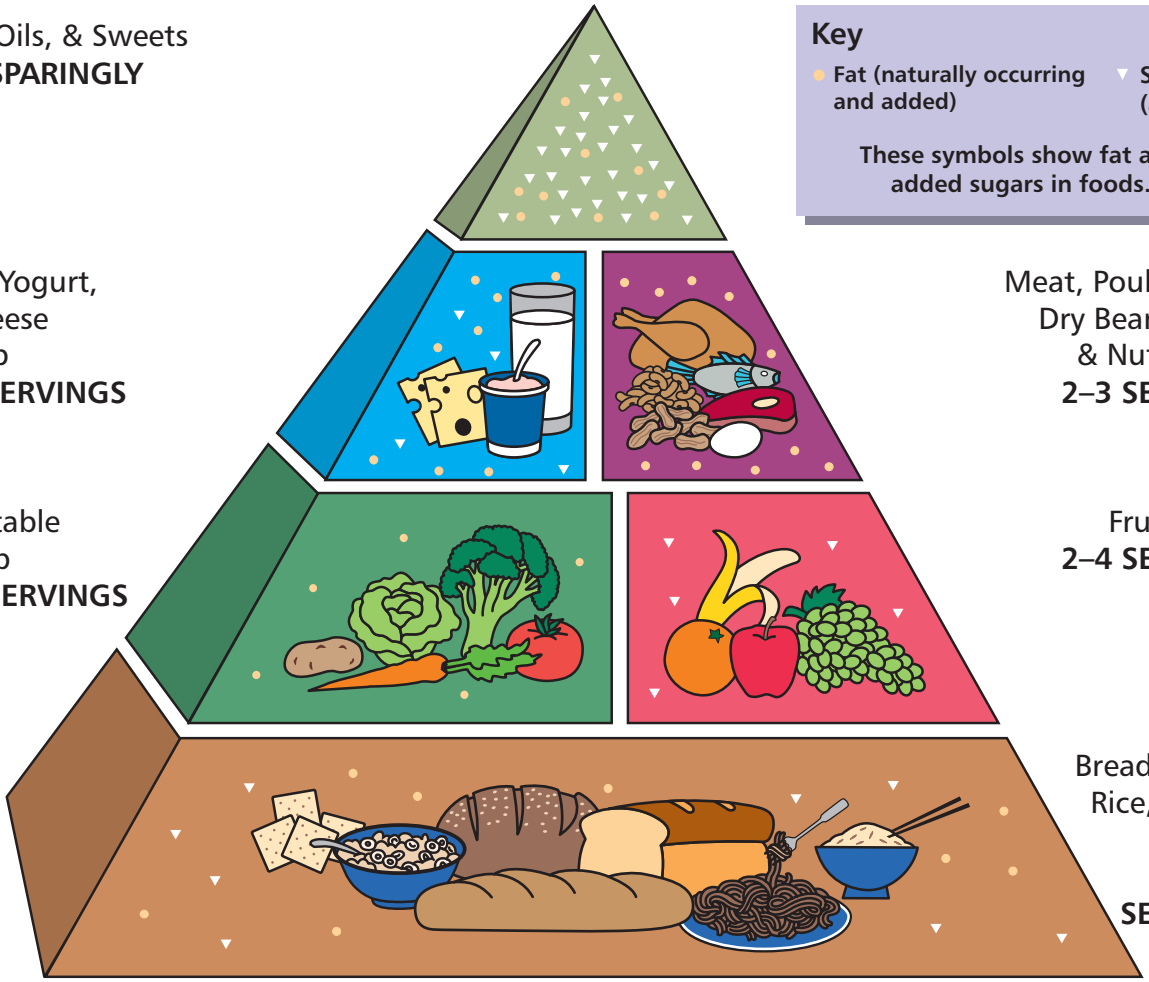
Milk, Yogurt, & Cheese Group
2–3 SERVINGS

Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts Group
2–3 SERVINGS

Vegetable Group
3–5 SERVINGS

Fruit Group
2–4 SERVINGS

Bread, Cereal, Rice, & Pasta Group
6–11 SERVINGS



Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

DIETARY GUIDELINES FOR AMERICANS

AIM FOR FITNESS…

- Aim for a healthy weight.
- Be physically active each day.

BUILD A HEALTHY BASE…

- Let the Pyramid guide your food choices.
- Choose a variety of grains daily, especially whole grains.
- Choose a variety of fruits and vegetables daily.
- Keep food safe to eat.

CHOOSE SENSIBLY…

- Choose a diet that is low in saturated fat and cholesterol and moderate in total fat.
- Choose beverages and foods to moderate your intake of sugars.
- Choose and prepare foods with less salt.

HOW TO USE THE FOOD GUIDE PYRAMID

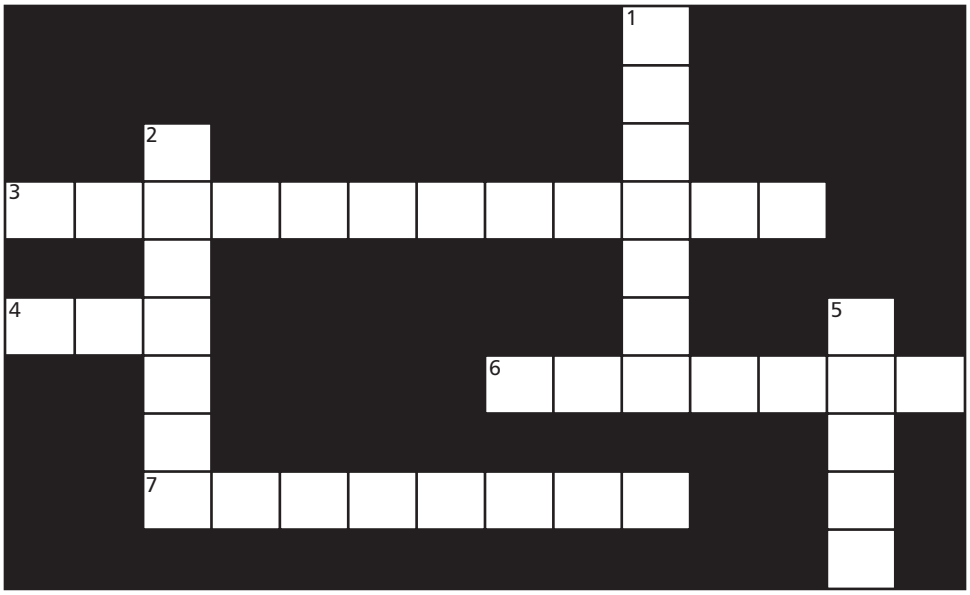
What counts as a serving?	How many servings do you need each day? Children ages 2 to 6, women, some older adults (1,600 calories)	Older children, teen girls, active women, most men (2,200 calories)	Teen boys and active men (2,800 calories)
Grains Group (Bread, Cereal, Rice, and Pasta)—especially whole grain • 1 slice of bread • About 1 cup of ready-to-eat cereal • ½ cup of cooked cereal, rice, or pasta	6	9	11
Vegetable Group • 1 cup of raw leafy vegetables • ½ cup of other vegetables—cooked or raw • ¾ cup of vegetable juice	3	4	5
Fruit Group • 1 medium apple, banana, orange, pear • ½ cup of chopped, cooked, or canned fruit • ¾ cup of fruit juice	2	3	4
Milk, Yogurt, and Cheese Group—preferably fat free or low fat • 1 cup of milk** or yogurt • 1½ ounces of natural cheese (such as Cheddar) • 2 ounces of processed cheese (such as American)	2 or 3*	2 or 3*	2 or 3*
Meat and Beans Group (Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts)—preferably lean or low fat • 2–3 ounces of cooked lean meat, poultry, or fish These count as 1 ounce of meat: • ½ cup of cooked dry beans or tofu • 2½ ounce soyburger • 1 egg • 2 tablespoons of peanut butter • ⅓ cup of nuts	2, for a total of 5 ounces	2, for a total of 6 ounces	3, for a total of 7 ounces

* Older children and teens ages 9 to 18 years and adults over age 50 need 3 servings daily; others need 2 servings daily.

** This includes lactose-free and lactose-reduced milk products. Soy-based beverages with added calcium are an option for those who prefer a non-dairy source of calcium.

Name _____

NUTRIENTS CROSSWORD



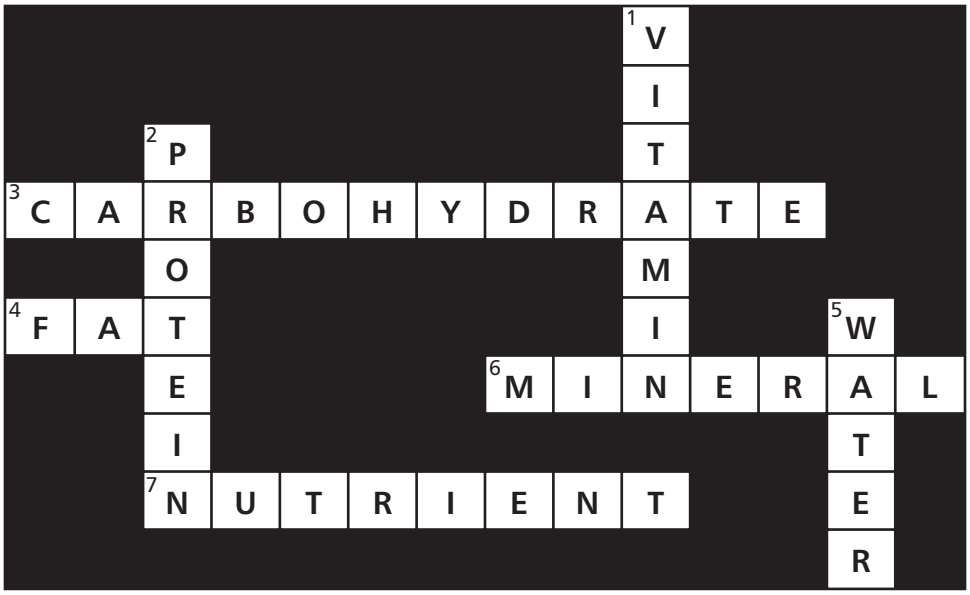
▶ Across

3. A nutrient that provides energy and is found in one of two basic forms: simple or complex.
4. A nutrient that provides energy for the body (also called a lipid).
6. An inorganic element that is essential for growth and health.
7. A substance that our bodies need to carry out life processes.

▶ Down

1. A complex chemical substance that is needed to regulate the body.
2. A nutrient made up of amino acids that is used for maintenance, growth, reproduction, and other functions in the body.
5. Needed to help digest food, transport waste, regulate body temperature, and keep cells functioning properly.

NUTRIENTS CROSSWORD KEY



Name _____

FOOD GUIDE PYRAMID

Directions

Fill in the recommended serving amounts on the Food Guide Pyramid below.

Food Guide Pyramid
A Guide to Daily Food Choices

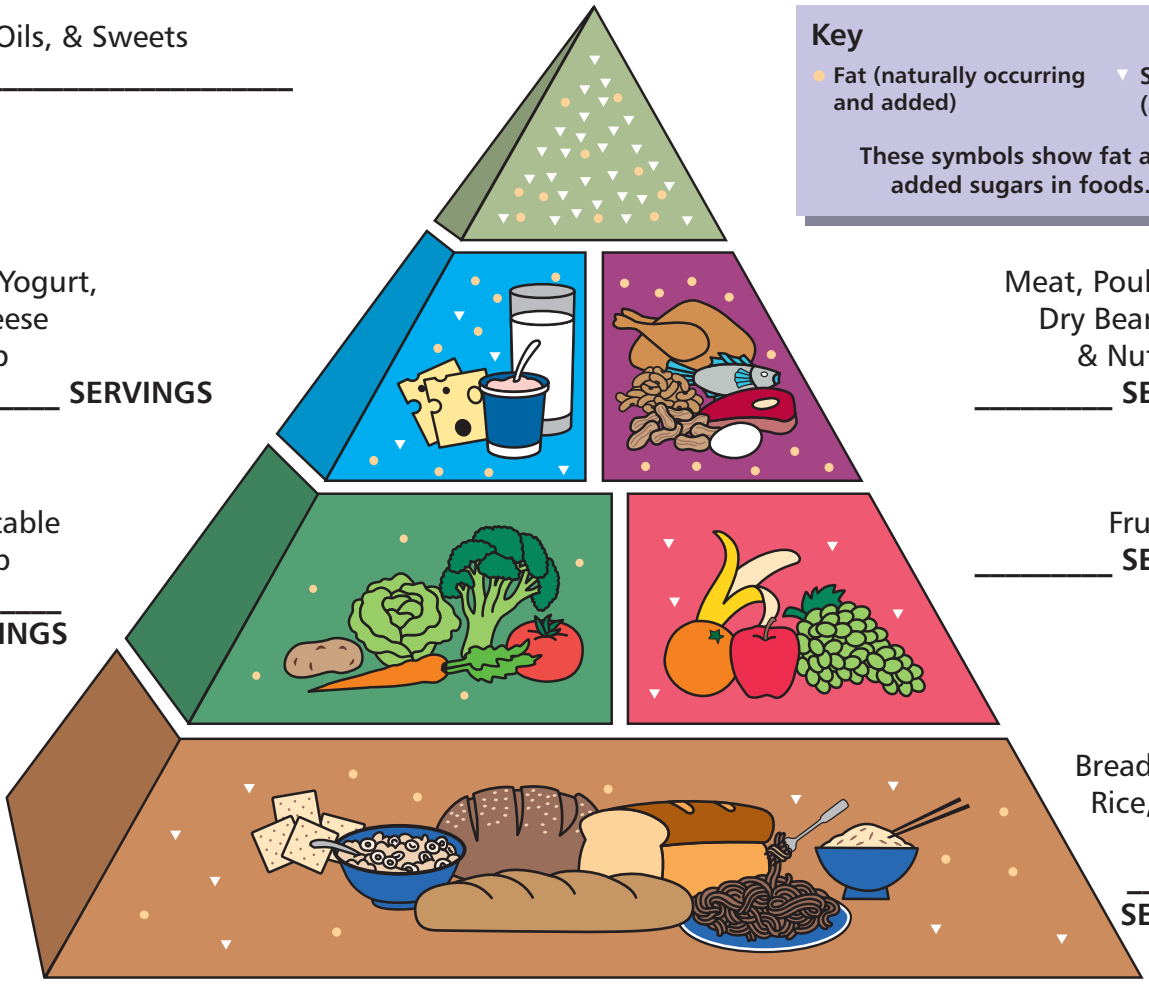
Fats, Oils, & Sweets
USE _____

Key
- Fat (naturally occurring and added)
- Sugars (added)

These symbols show fat and added sugars in foods.

Milk, Yogurt, & Cheese Group
_____ **SERVINGS**

Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts Group
_____ **SERVINGS**



Vegetable Group
_____
SERVINGS

Fruit Group
_____ **SERVINGS**

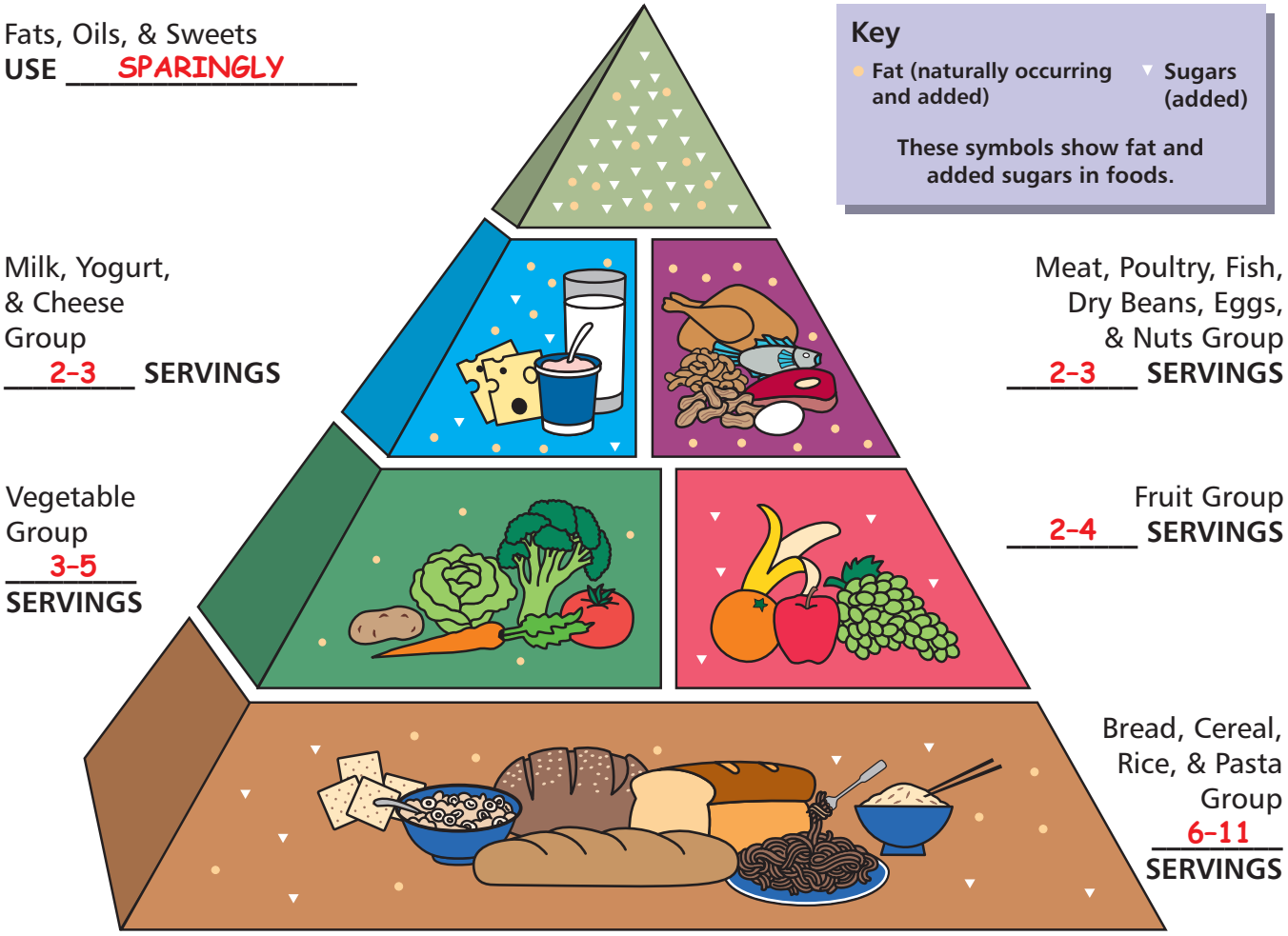
Bread, Cereal, Rice, & Pasta Group
_____
SERVINGS

Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

WS KEY: H–2B

FOOD GUIDE PYRAMID KEY

Food Guide Pyramid
A Guide to Daily Food Choices



Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

Name _____

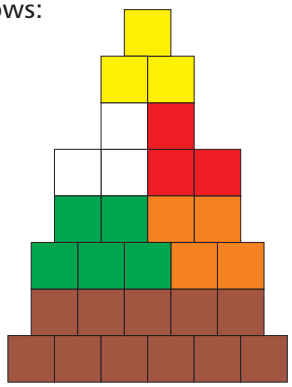
BUILD A FOOD GUIDE PYRAMID

▶ Materials

- ✓ Squares of construction paper: 11 brown, 5 green, 4 orange, 3 white, 3 red, and 3 yellow
- ✓ Food photographs (from magazines, grocery ads, or other materials)
- ✓ Glue
- ✓ Tape

▶ Directions

1. Arrange the construction paper squares in rows, starting at the bottom, as follows:
   a. Row 1: 6 brown squares
   b. Row 2: 5 brown squares
   c. Row 3: Starting from the left, 3 green boxes and 2 orange boxes
   d. Row 4: Starting from the left, 2 green boxes and 2 orange boxes
   e. Row 5: Starting from the left, 2 white boxes and 2 red boxes
   f. Row 6: Starting from the left, 1 white box and 1 red box
   g. Row 7: 2 yellow boxes
   h. Row 8: 1 yellow box



2. Tape the squares together. You now have your own Food Guide Pyramid!
3. Paste photographs of foods from each group to decorate the correct sections on the pyramid:
   a. Brown: Bread, Cereal, Rice, and Pasta Group
   b. Green: Vegetable Group
   c. Orange: Fruit Group
   d. White: Milk, Yogurt, and Cheese Group
   e. Red: Meat, Dry Beans, Eggs, and Nuts Group
   f. Yellow: Fats, Oil, and Sweets

▶ Conclusion

Which group is the largest? Which group do most of the foods that you eat come from? Do you eat the correct balance from each of the groups?

WS: H–2D

Name _____

ARE YOU EATING RIGHT?

Directions

1. Write down all of the foods you eat in one day. Don't forget to include snacks that you eat throughout the day.
2. For each food, also list the number of servings from each food group that you got from eating the food. Remember that some foods will be from more than one food group. For example, a cheeseburger would provide meat (burger), dairy (cheese), and bread (bun). If it had lettuce and onions, those would be from the vegetable group.
3. Check your results. Did you eat something from each of the groups? Did you eat too many things in the "Fats, Oils, and Sweets" section? Share your chart with your parents and try to improve your diet!

Foods	Bread Group	Vegetable Group	Fruit Group	Milk Group	Meat Group	Fats, Oils, and Sweets

Lesson H–3

FOOD INGREDIENTS

Indiana Agricultural Literacy Lesson Plan Library

Unit H. Food Science

Lesson 3. Food Ingredients

Indiana's Academic Standard. **Science:** 4.4.9 — Explain that food provides energy and materials for growth and repair of body parts. Recognize that vitamins and minerals, present in small amounts in foods, are essential to keep everything working well. Further understand that as people grow up, the amounts and kinds of food and exercise needed by the body may change.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe the information included on a food package.
2. Recognize plant sources of food ingredients.
3. Recognize animal sources of food ingredients.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Exploring Planet Pizza. Indiana Farm Bureau.

Herron, Ray V., *The Science of Agriculture: A Biological Approach*. Albany, New York: Delmar, 2002.

Kids, Crops, & Critters (4–6). Bloomington, Illinois: Illinois Farm Bureau, 2000.

Lee, Jasper S., et al. *AgriScience Discovery*. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Pondering Pizza: A Slice of Agriculture. Bloomington, Illinois: Illinois Farm Bureau.

Talented and Gifted Agriculture. Waco, Texas: Texas Farm Bureau, 1995.

Yellow Pages. Washington, DC: American Meat Institute, 1994.

www.agclassroom.org

www.agintheclassroom.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets

Terms. The following terms are presented in this lesson (shown in bold italics):

- Aquaculture
- Beef
- Broiler
- Crop
- Federal Trade Commission (FTC)
- Food and Drug Administration (FDA)
- Ingredient
- Lamb
- Livestock
- Mutton
- Pork
- Poultry
- Universal Product Code (UPC)
- Veal

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask students to name their favorite pizza topping (cheese, sauce, onions, green peppers, pepperoni, sausage, etc.). List the toppings on the writing surface as students name them. Next, ask students if they know where all these ingredients come from. Some come from plants (onions, green peppers, sauce), and some come from animals (cheese, pepperoni, sausage). Most of them are produced on farms and ranches throughout the United States. Tell students that without agricultural products, their pizza wouldn't be possible!*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe the information included on a food package.

Anticipated Problem: What information is provided on a food package?

I. Food packages contain a variety of information about the product.

A. Packaging is used to advertise the product. It attempts to persuade consumers to buy the product by using wording and colors that are attractive.

B. Some information is provided on a food package is required by law.

1. The common name of the product must appear on the package.
2. The name and address of the manufacturer or distributor must also be somewhere on the package.
3. The content amount must be listed on the package (weight, count, etc.)
4. Foods with two or more ingredients must include an ingredients list on the package. An ***ingredient*** is a part of something. The ingredients must be listed in descending order, by weight, with the most given first.
5. A "Nutrition Facts" panel must also appear on the package. Foods that contain a minimal amount of nutrients (coffee, tea, spices, flavorings, etc.) and raw, single-ingredient products are exempt from this requirement. The Nutrition Facts panel includes the serving size and number of servings in the container and provides the nutritional value of the food.

C. Some food labels contain nutrient content claims, such as "rich in calcium," "low calorie," and "high fiber." Content claims must use a standard format set by law.

D. Food labels may also contain health claims that describe actual benefits that a food or nutrient may provide. Health claims are not allowed unless they have been proven. To help avoid false claims being made, only certain claims are allowed, such as a connection between calcium and osteoporosis; fat and cancer; cholesterol/saturated fat and heart disease; fiber and cancer; fiber and heart disease; and fruits/vegetables and cancer.

E. The brand name of the product may also appear on the package.

F. The ***Universal Product Code (UPC)*** is a symbol found on food packages that can be scanned by a computer to show the price and help stores keep track of inventory.

G. The ***Federal Trade Commission (FTC)*** is a government agency that checks for truth in advertising to insure that the claims made on food packages are legitimate.

H. The ***Food and Drug Administration (FDA)*** is a government agency that establishes safety and nutrition guidelines. They help assure the quality of food products.

Use TM: H–3A to show students the information that is required by law to be on a food package. Use TM: H–3B to show students some of the other information that may also appear on food packages. Use WS: H–3A to have students list the information they can find on a food package. Provide a variety of packages for students to use.

Objective 2: Recognize plant sources of food ingredients.

Anticipated Problem: What are plant sources of food ingredients?

II. Many of the ingredients in our favorite foods come from plants. Most of these plants are grown in the United States, but some are imported from other countries. Crops are grown in certain areas or countries because they grow better in that climate or soil. A ***crop*** is a plant that is grown and harvested for profit. Agriculture provides us with a wide variety of crops that we can eat or use as ingredients in other foods.

A. Grain crops include wheat, corn, rice, oats, barley, rye, and grain sorghum.

1. Grain crops can be used in making bread, cereal, cooking oil, pasta, corn chips, tortillas, oatmeal, bagels, cakes, cookies, crackers, muffins, granola, noodles, and many other things.
2. Grain crops are grown throughout the United States. Kansas, North Dakota, Illinois, and Montana are major grain producing states.

B. Sugar and oil crops include sugar beets, sugar cane, sweet sorghum, soybeans, sunflowers, canola, and peanuts.

1. Sugar and oil crops can be used in making sugar, candy, syrup, soy milk, mayonnaise, tofu, soy sauce, peanut butter, and cooking oils.
2. Sugar beets are more widely grown than sugar cane and sweet sorghum in the United States. Sugar cane requires a warm tropical climate that is only found in certain areas of the United States. A limited amount of sweet sorghum is produced in some southeastern states.

3. The most important oil crop in the United States is the soybean. Soybeans are grown throughout the Midwest.

C. Vegetable crops include potatoes, cabbage, onions, eggplants, cucumbers, beets, spinach, broccoli, lettuce, green peppers, watermelons, radishes, asparagus, sweet corn, cauliflower, tomatoes, artichokes, muskmelons, celery, carrots, and many others.

1. Vegetables may be eaten raw, cooked, or used as ingredients in making other foods (in soups or sauces, as pizza toppings, on sandwiches, etc.).
2. Vegetables are grown throughout the United States. Temperature is the most important factor that determines where to grow vegetables. California produces roughly half of all the vegetables grown commercially in the United States. Other states that produce large quantities of vegetables are Florida, Arizona, Texas, and Oregon.

D. Fruit crops include apples, oranges, lemons, grapefruits, cherries, pears, apricots, peaches, plums, strawberries, blueberries, raspberries, grapes, and many others.

1. Fruits can be eaten raw, used as toppings for ice cream, baked in many desserts, used for making juices, jams, jellies, glazes, and many other things.
2. Different fruits are grown throughout the United States. Where fruits are grown depends largely on the climate and how sensitive the plants are to it. Some fruit trees, like oranges, lemons, and grapefruits, can only be grown in the warm southern states.

E. Nut crops include walnuts, pecans, chestnuts, pistachios, almonds, filberts, hazelnuts, macadamias, and coconuts.

1. Nuts can be eaten raw or used as toppings or ingredients in many baked goods and other foods.
2. Nuts are grown across the United States.

Use TM: H–3D through TM: H–3K to cover the content of this objective. Remind students that the food ingredients in all of our favorite foods come from agriculture. Even though we import many of the foods we eat from other countries, most of them are also produced in some amount here in the United States. Continue to the next objective to discuss the food ingredients we get from animals.

Objective 3: Recognize animal sources of food ingredients.

Anticipated Problem: What are animal sources of food ingredients?

III. Many of the ingredients in our favorite foods come from animals. ***Livestock*** are animals produced on farms and ranches for food and other purposes. Livestock are raised all over the world to provide us with the variety of products we want and need.

A. We use the meat from different animals as ingredients in many foods.

1. ***Beef*** is the meat that comes from cattle. ***Veal*** is the meat that comes from calves.
   a. Steaks, roasts, hamburger, hot dogs, bologna, and lunch meat all come from or can be made with beef. Beef is an ingredient in many foods.

b. There are 101 million head of beef cattle on farms and ranches in the United States.
c. Americans eat about 66.6 pounds of beef per person every year.

2. ***Pork*** is the meat that comes from swine (hogs).
   a. Roasts, ham, sausage, hot dogs, bologna, lunch meat, and bacon come from or can be made with pork. Pork is also an ingredient in many other foods.
   b. Nearly 70 million head of hogs are raised on farms and ranches in the United States. Iowa, Illinois, Minnesota, Nebraska, Indiana, North Carolina, and Missouri are the leading states in swine production.
3. Most chicken meat is from broilers. A ***broiler*** is a young chicken six to seven weeks of age that weighs about 4 pounds. Broilers are tender and easy to cook.
   a. Chicken is eaten separately or used as an ingredient in many foods.
   b. About 7 billion broilers are raised each year in the United States. The leading states in broiler production are Arkansas, Georgia, Alabama, North Carolina, Mississippi, and Texas.
4. ***Mutton*** is the meat that comes from sheep. ***Lamb*** is the meat that comes from young sheep.
   a. Mutton and lamb can be eaten alone or as an ingredient in many foods.
   b. Sheep are raised throughout the United States, but over half are found in 10 western range states and Texas. Australia and New Zealand are the leading producers of sheep.
5. ***Aquaculture*** is the production of aquatic plants, animals, and other species. We use the meat of many aquaculture species, such as shrimp, scallops, different kinds of fish, oysters, and clams, as food ingredients.
6. Although most of the meat we eat in the United States comes from cattle, swine, chickens, or sheep, we also use smaller amounts of the meat from other animals, such as goats, turkeys, deer, ostriches, and many others.

B. Eggs from chickens and other poultry can be used as ingredients in many foods. ***Poultry*** are domesticated birds raised primarily for meat, eggs, and feathers.

C. Milk from cows is used to make all the dairy products we eat. Cheese, yogurt, sour cream, milk chocolate, cottage cheese, and ice cream are all made from milk.

Use TM: H–3L to discuss with students the food ingredients we get from animals. Remind students that no matter how much processing a food product goes through, its ingredients were probably all produced on farms and ranches. Use WS: H–3B through WS: H–3E to help students discover some of the origins of different food ingredients. The "Bountiful" poster available from the American Farm Bureau (www.fb.org) is an excellent visual to show students a map of where different food products are produced.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: H–3A, WS: H–3B, WS: H–3C, WS: H–3D, and WS: H–3E.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. d
2. c
3. f
4. a
5. b
6. e

Fill-in-the-Blank

1. ingredient
2. Universal Product Code
3. Federal Trade Commission
4. Food and Drug Administration

Short Answer

Answers will vary. Use Objectives 2 and 3 to score this question.

Test H–3

Name_____

FOOD INGREDIENTS

▶ Matching

Instructions. **Match the word with the correct definition.**

a. pork	d. mutton
b. broiler	e. livestock
c. beef	f. crop

_____1. The meat that comes from sheep.

_____2. The meat that comes from cattle.

_____3. A plant that is grown and harvested for profit.

_____4. The meat that comes from swine (hogs).

_____5. A young chicken six to seven weeks of age that weighs about 4 pounds.

_____6. Animals produced on farms and ranches for food and other purposes.

▶ Fill-in-the-Blank

Instructions. **Complete the following statements.**

1. A(n) _____ is a part of something.
2. UPS stands for _____ _____ _____.
3. FTC stands for _____ _____ _____.
4. FDA stands for _____ _____ _____ _____.

▶ Short Answer

Instructions. **Answer the following questions.**

List five food ingredients we get from plants and five food ingredients we get from animals.

INFORMATION REQUIRED ON FOOD PACKAGES

- Common name of the product
- Name and address of the manufacturer or distributor
- Content amount
- Ingredients list
- "Nutrition Facts" panel

OTHER INFORMATION ON FOOD PACKAGES

- Nutrient content claims
- Health claims
- Brand name
- Universal Product Code (UPC)

NUTRITION FACTS PANEL

Nutrition Facts

Serving Size 1 oz (30g) about 1 inch cube
Servings Per Container 48

Amount Per Serving

Calories 100 Calories from Fat 70

	% Daily Value
Total Fat 8g	**12%**
Saturated Fat 5g	**25%**
Cholesterol 25mg	**8%**
Sodium 285mg	**12%**
Total Carbohydrate 0g	**0%**
Dietary Fiber 0g	**0%**
Sugars 0g	
Protein 8g	

Vitamin A 6% • **Vitamin C** 0%
Calcium 23% • **Iron** 0%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your caloric needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300mg	375g
Dietary Fiber		25mg	30g

Calories per gram:
Fat 0 • Carbohydrates 4 • Protein 4

CROPS

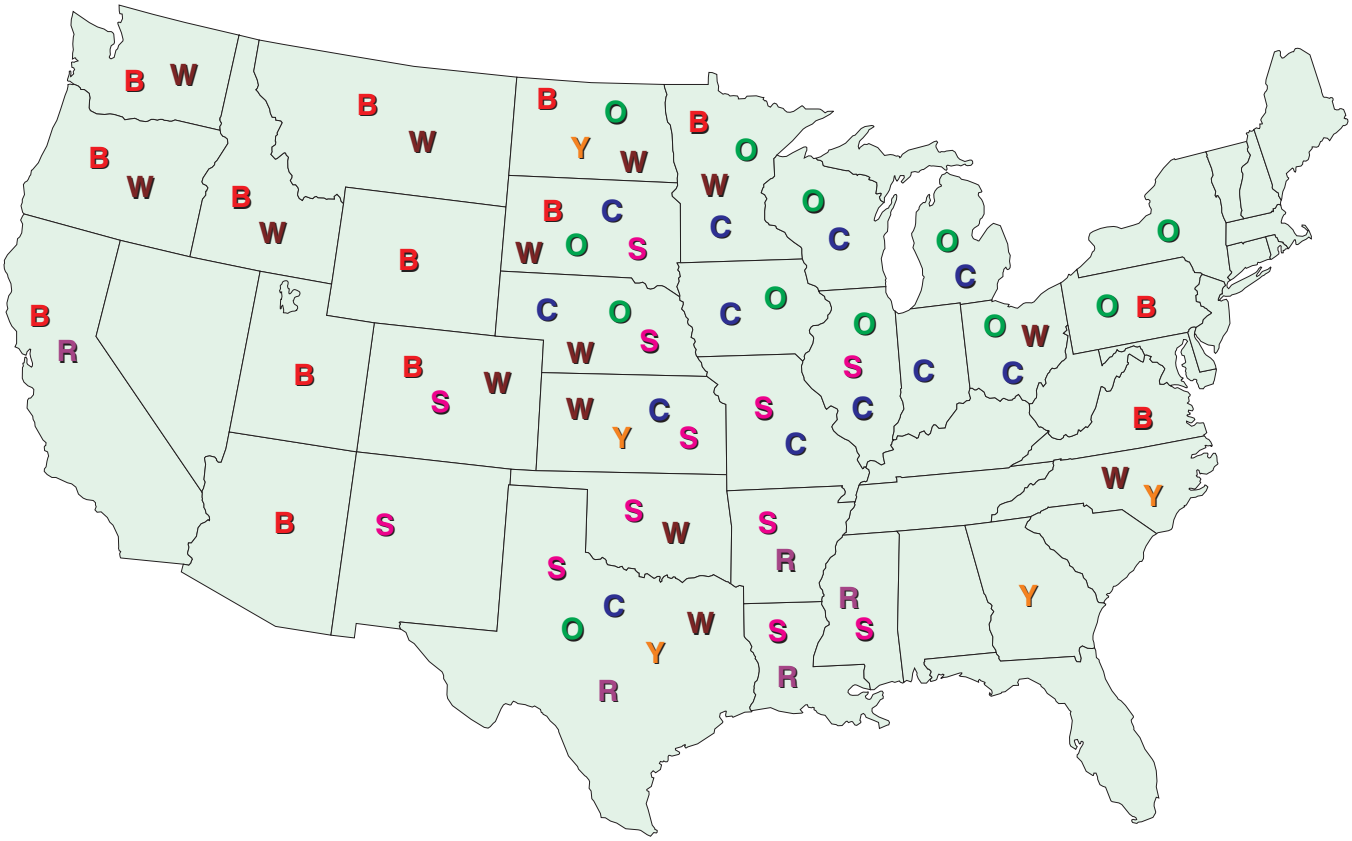
- Grain crops
- Sugar and oil crops
- Vegetable crops
- Fruit crops
- Nut crops

GRAIN CROPS

- Wheat
- Corn
- Rice
- Oats
- Barley
- Rye
- Grain sorghum

Grain crops can be used in making bread, cereal, cooking oil, pasta, corn chips, tortillas, oatmeal, bagels, cakes, cookies, crackers, muffins, granola, noodles, and many other things.

WHERE GRAIN CROPS ARE GROWN

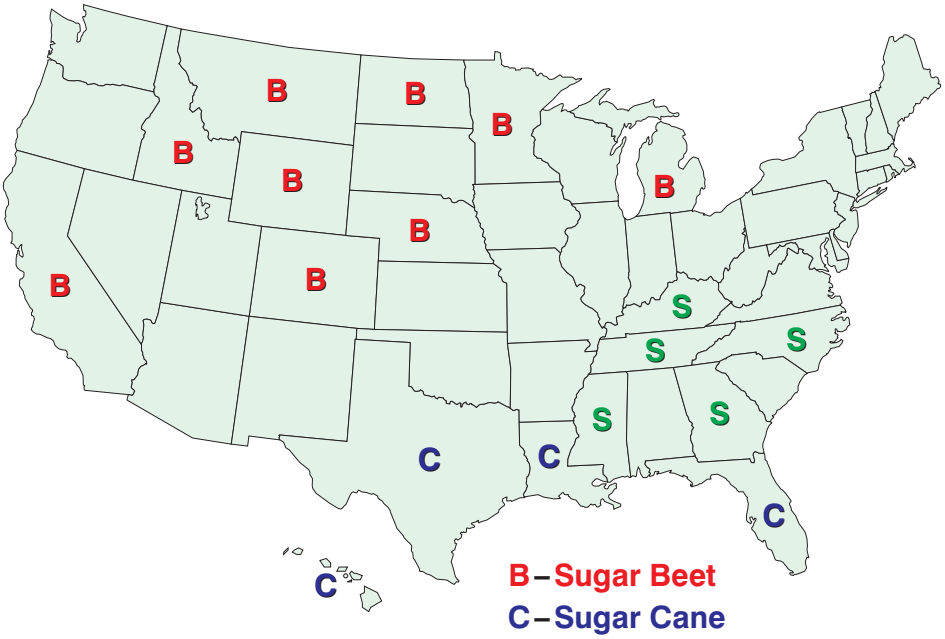


SUGAR AND OIL CROPS

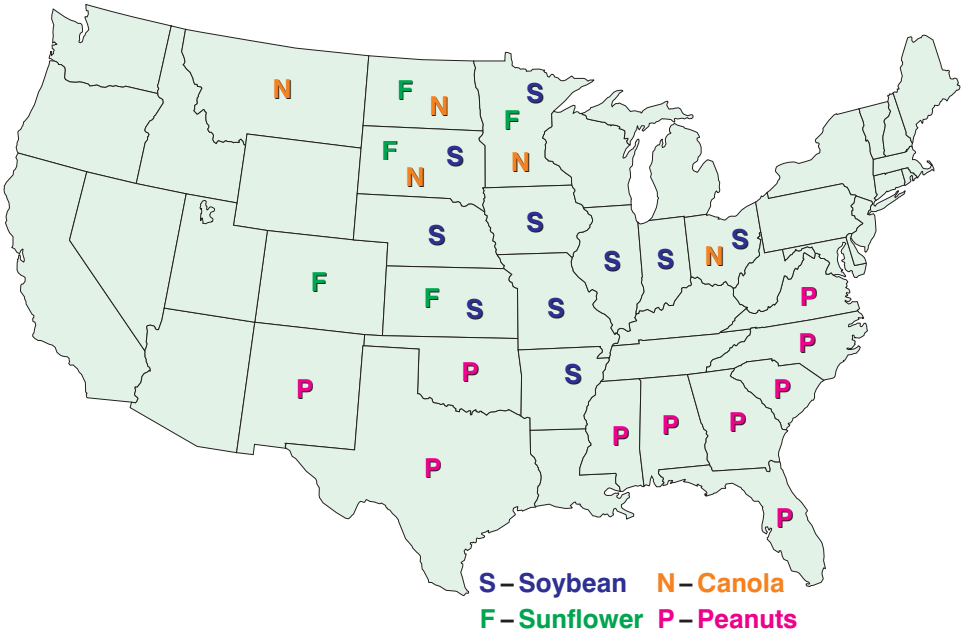
- Sugar beets
- Sugar cane
- Sweet sorghum
- Soybeans
- Sunflowers
- Canola
- Peanuts

Sugar and oil crops can be used in making sugar, candy, syrup, soy milk, mayonnaise, tofu, soy sauce, peanut butter, and cooking oils.

WHERE SUGAR CROPS ARE GROWN



WHERE OIL CROPS ARE GROWN



VEGETABLE CROPS

- Vegetable crops include potatoes, cabbage, onions, eggplants, cucumbers, beets, spinach, broccoli, lettuce, green peppers, watermelons, radishes, asparagus, sweet corn, cauliflower, tomatoes, artichokes, muskmelons, celery, carrots, and many others.
- Vegetables may be eaten raw, cooked, or used as ingredients in making other foods (in soups or sauces, as pizza toppings, on sandwiches, etc.).
- Vegetables are grown throughout the United States. Temperature is the most important factor that determines where to grow vegetables. California produces roughly half of all the vegetables grown commercially in the United States. Other states that produce large quantities of vegetables are Florida, Arizona, Texas, and Oregon.

FRUIT CROPS

- Fruit crops include apples, oranges, lemons, grapefruits, cherries, pears, apricots, peaches, plums, strawberries, blueberries, raspberries, grapes, and many others.
- Fruits can be eaten raw, used as toppings for ice cream, baked in many desserts, used for making juices, jams, jellies, glazes, and many other things.
- Different fruits are grown throughout the United States. Where fruits are grown depends largely on the climate and how sensitive the plants are to it. Some fruit trees, like oranges, lemons, and grapefruits, can only be grown in the warm southern states.

NUT CROPS

- Nut crops include walnuts, pecans, chestnuts, pistachios, almonds, filberts, hazelnuts, macadamias, and coconuts.
- Nuts can be eaten raw or used as toppings or ingredients in many baked goods and other foods.
- Nuts are grown across the United States.

LIVESTOCK PRODUCTS

- Meat:
  - Beef (cattle)
  - Veal (calves)
  - Pork (swine)
  - Chicken
  - Mutton (sheep)
  - Lamb (young sheep)
  - Aquaculture species—shrimp, scallops, different kinds of fish, oysters, and clams
  - Others—goats, turkeys, deer, ostriches, and many others
- Eggs
- Milk

WS: H–3A

Name: _____

WHAT'S ON THE PACKAGE?

Directions

Look at a food package and fill in the information below.

1. Common name of the product _____
2. Name and address of the manufacturer or distributor _____

   _____
3. Content amount _____
4. First three ingredients _____
5. Serving size _____
6. Number of servings _____
7. Number of calories per serving _____
8. Nutrient content claims (if any) _____
9. Health claims (if any) _____

   _____
10. Brand name (if listed) _____
11. Universal Product Code (UPC) number (if available) _____

WS: H–3B

Name: _____

AGRICULTURE IN YOUR FOOD

Directions

Write the words below in alphabetical order in the column of the table where they belong.

Milk	Pumpkins	Cheese	Chicken
Oranges	Rice	Pork chops	Apples
Tofu	Cream cheese	Peanuts	Tomatoes
Mutton	Butter	Wheat	Broccoli
Onions	Hamburger	French fries	Ice cream
Turkey	Sweet corn	Strawberries	Eggs

Crops	Livestock

WS KEY: H–3B

AGRICULTURE IN YOUR FOOD KEY

Crops	Livestock
Oranges	Milk
Tofu	Mutton
Onions	Turkey
Pumpkins	Cream cheese
Rice	Butter
Sweet corn	Hamburger
Peanuts	Cheese
Wheat	Pork chops
French fries	Chicken
Strawberries	Ice cream
Apples	Eggs
Tomatoes	
Broccoli	

Name: _____

FOOD IN THE UNITED STATES

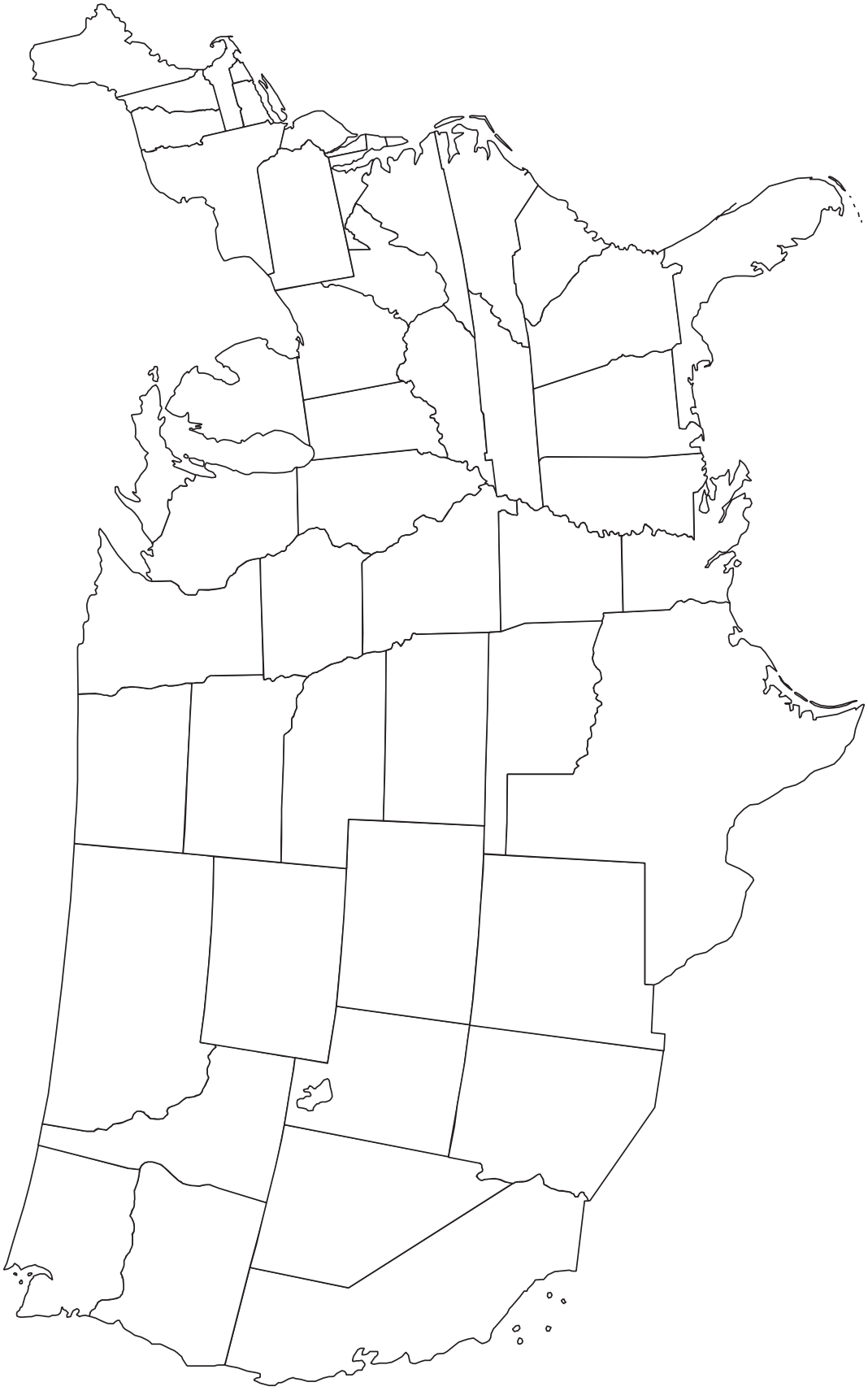
Directions

Different food ingredients are produced in different areas of the country. Climate is a big factor in determining what can be grown or raised in a particular area. Use the list of products below as a legend to create a map that shows the location of different agriculture products produced throughout the United States. Color each of the squares in the legend a different color. Draw the different colored squares in the states where they belong on the map. Some states will have squares of more than one color.

Legend

- ☐ BEEF: Texas, Nebraska, Kansas, Colorado, Iowa, Oklahoma, and California
- ☐ CHICKENS: Arkansas, Georgia, Alabama, North Carolina, Mississippi, and Texas
- ☐ CORN: Illinois, Iowa, Nebraska, Indiana, Minnesota, and Ohio
- ☐ DAIRY PRODUCTS: Wisconsin, California, New York, Pennsylvania, and Minnesota
- ☐ EGGS: California, Georgia, Arkansas, Indiana, Pennsylvania, and Texas
- ☐ FRUITS AND VEGETABLES: California, Florida, Arizona, Washington, New York, Georgia
- ☐ PORK: Iowa, Illinois, Minnesota, Nebraska, Indiana, North Carolina, and Missouri
- ☐ SOYBEANS: Illinois, Iowa, Nebraska, Indiana, Minnesota, and Ohio
- ☐ POTATOES: Idaho, Washington, California, North Dakota, Maine, and Wisconsin
- ☐ TOMATOES: Florida, California, Virginia, Ohio, Georgia, and Michigan
- ☐ WHEAT: North Carolina, Kansas, Montana, Oklahoma, Washington, and Minnesota

(Adapted from USDA—Ag in the Classroom—Agriculture in Your Life)



WS KEY: H–3C

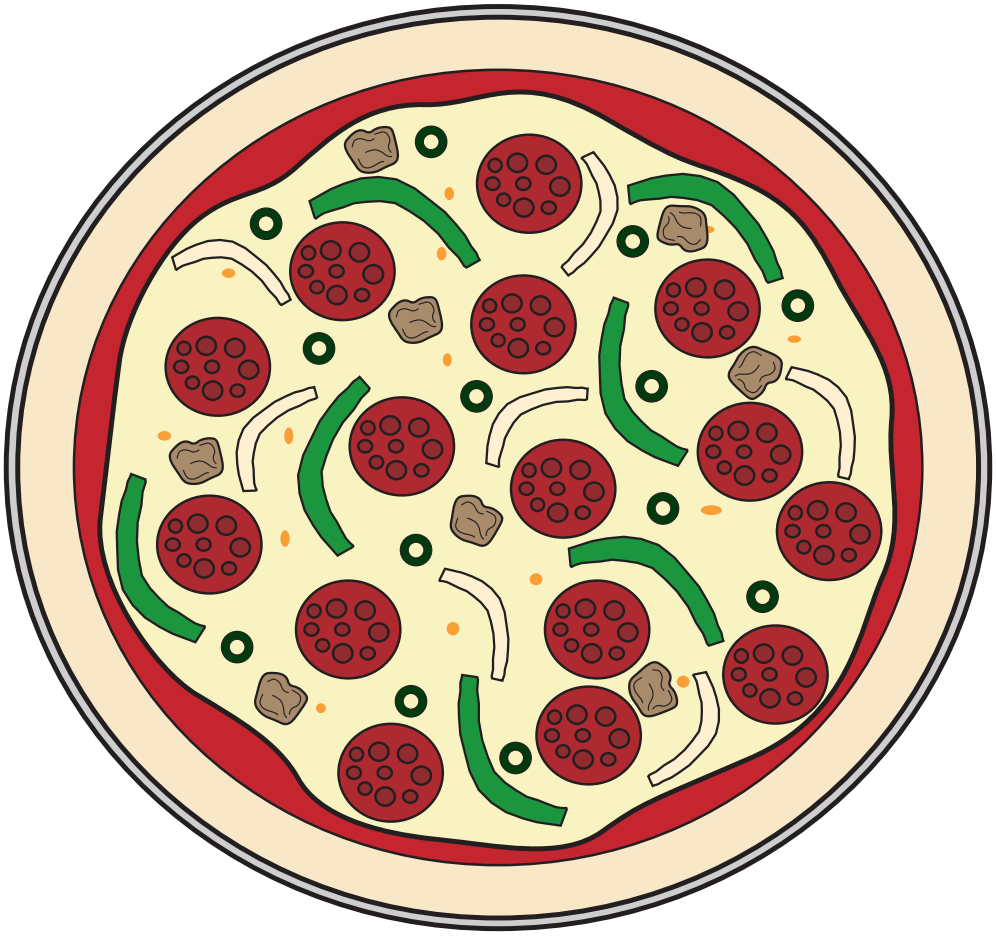
FOOD IN THE UNITED STATES KEY

Name: _____

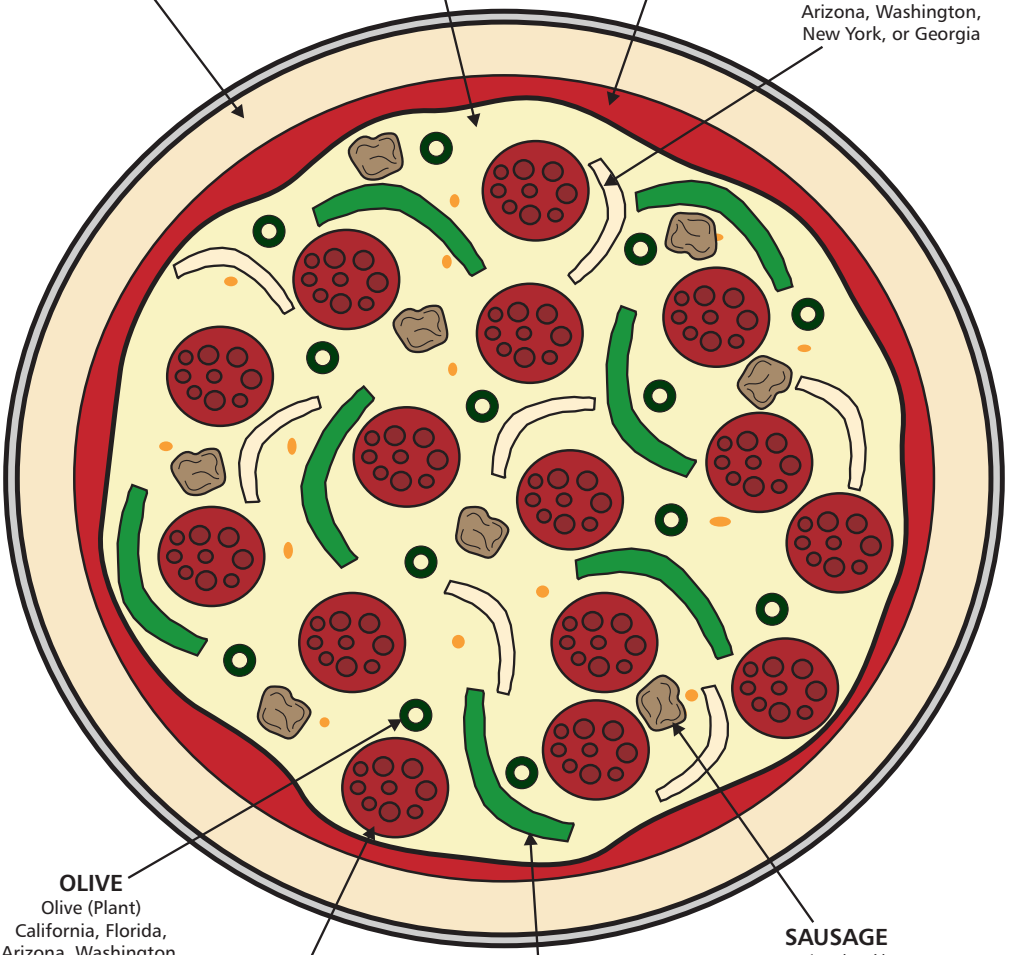
WHERE DID THE PIZZA COME FROM?

Directions

Draw a line and label the following parts of the pizza: crust, sauce, cheese, onions, olives, sausage, pepperoni, and green peppers. Under each label, also list where each product comes from (name of plant or livestock animal) and one state where each product might have originated from (use the map you created in an earlier activity to help you).



WHERE DID THE PIZZA COME FROM? KEY



CRUST
Wheat
North Carolina, Kansas, Montana, Oklahoma, Washington, or Minnesota

CHEESE
Dairy Cow
Wisconsin, California, New York, Pennsylvania, or Minnesota

SAUCE
Tomato (Plant)
Florida, California, Virginia, Ohio, Georgia, or Michigan

ONION
Onion (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

OLIVE
Olive (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

PEPPERONI
Beef Cattle
Texas, Nebraska, Kansas Colorado, Iowa, Oklahoma, or California

GREEN PEPPER
Green Pepper (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

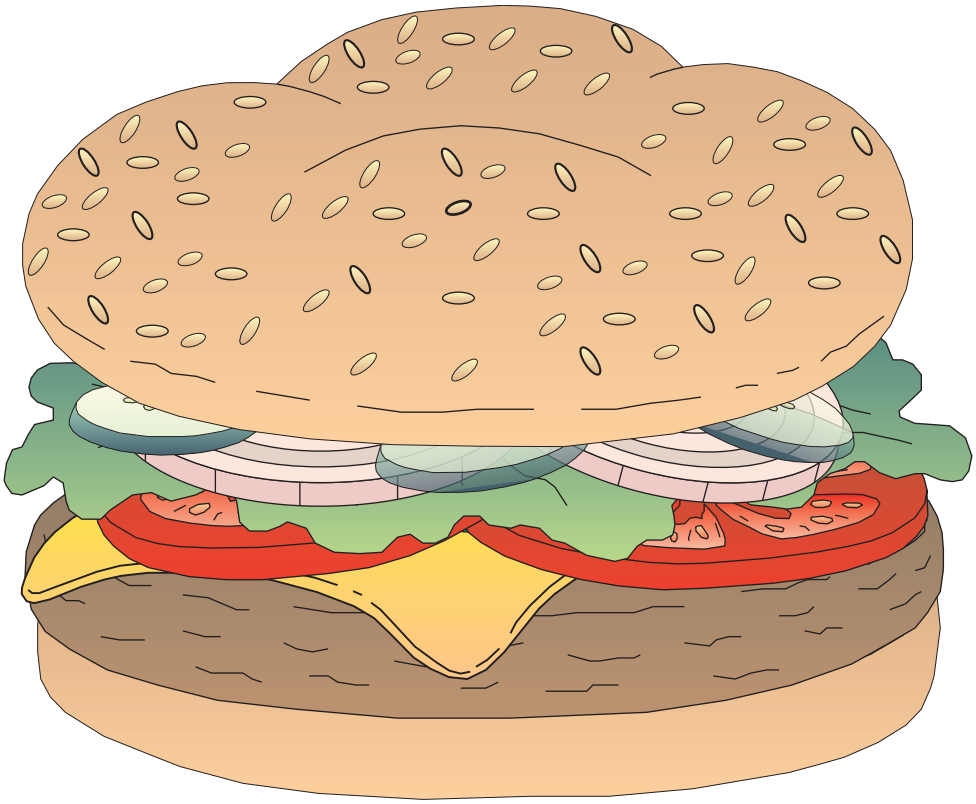
SAUSAGE
Swine (Pork)
Iowa, Illinois, Minnesota, Nebraska, Indiana, North Carolina, or Missouri

Name: _____

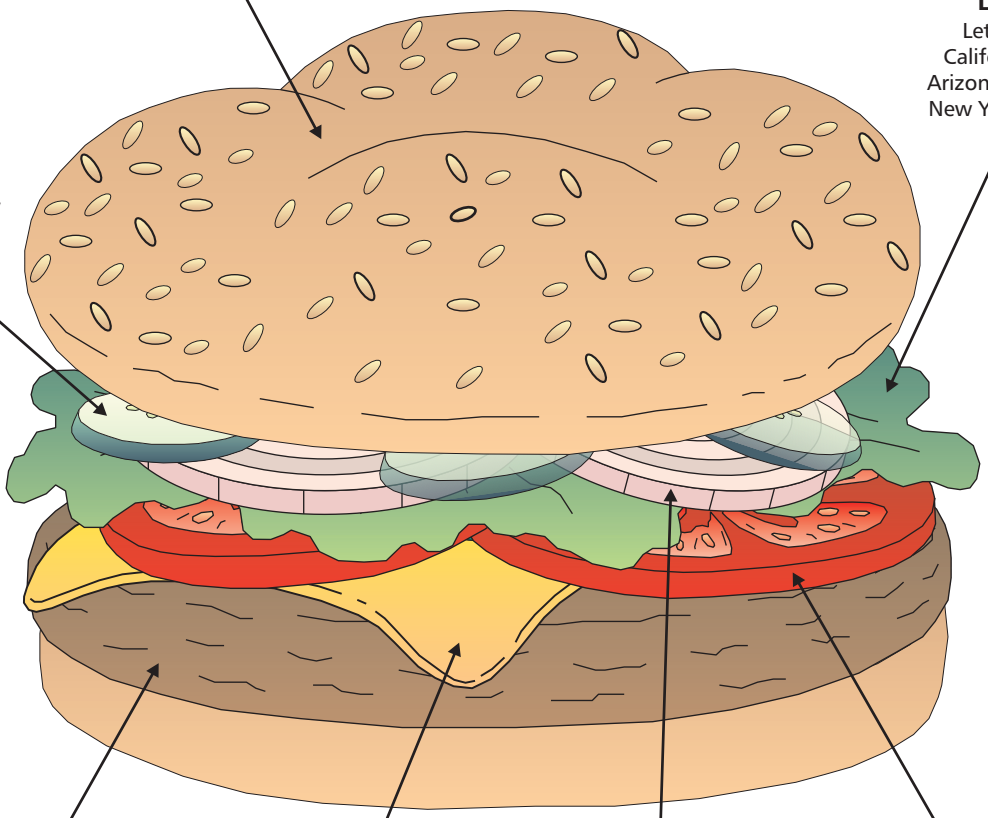
WHERE DID THE CHEESEBURGER COME FROM?

Directions

Draw a line and label the following parts of the cheeseburger: bun, burger, cheese, lettuce, tomato, onion, and pickle. Under each label, also list where each product comes from (name of plant or livestock animal) and one state where each product might have originated from (use the map you created in an earlier activity to help you).



WHERE DID THE CHEESEBURGER COME FROM? KEY



BUN
Wheat
North Carolina, Kansas, Montana, Oklahoma, Washington, or Minnesota

LETTUCE
Lettuce (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

PICKLE
Cucumber (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

BURGER
Beef Cattle
Texas, Nebraska, Kansas Colorado, Iowa, Oklahoma, or California

CHEESE
Dairy Cow
Wisconsin, California, New York, Pennsylvania, or Minnesota

ONION
Onion (Plant)
California, Florida, Arizona, Washington, New York, or Georgia

TOMATO
Tomato (Plant)
Florida, California, Virginia, Ohio, Georgia, or Michigan

Lesson H–4

FOOD PREPARATION

Indiana Agricultural Literacy Lesson Plan Library

Unit H. Food Science

Lesson 4. Food Preparation

Indiana's Academic Standard. **Math:** 4.5.8 — Use volume and capacity as different ways of measuring the space inside a shape.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe the information found in a recipe.
2. Describe how measurements are used in recipes.
3. Define some common cooking terms.
4. Explain basic guidelines of food preparation.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Kids, Crops, and Critters (4–6). Bloomington, Illinois: Illinois Farm Bureau, 2000.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

www.agclassroom.org

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Various ingredients for a recipe
- ✓ Measuring cups and spoons

Terms. The following terms are presented in this lesson (shown in bold italics):

- Bake
- Beat
- Boil
- Chop
- Dice
- Dissolve
- Knead
- Mince
- Mix
- Peel
- Preheat
- Recipe
- Saute
- Simmer
- Steam
- Stir
- Stir fry

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Assemble all the ingredients of a recipe and display them to the students. Have them try to guess what can be made from the ingredients. Ask them if they have ever used a recipe to make anything. Allow students to share their experiences and results. Show students several different measuring instruments and ask them which ones they used while following their recipe.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe the information found in a recipe.

Anticipated Problem: What information is included in a recipe?

I. A ***recipe*** is a list of ingredients and directions used to make a food item. A recipe must be read and followed carefully. A recipe includes the title, ingredients needed, directions, quantity made, and sometimes nutritional information.

A. A recipe title is normally the name of the food item (pizza, chocolate chip cookies, etc.) The title may also include the name of the person who created the recipe (Granny's Chocolate Cake, Tracy's Potato Salad). Sometimes catchy names are used.

B. The ingredients are generally listed in the order that they are used in the recipe. The amount and form of the ingredients are also stated. For example, 1 cup sifted flour, ½ cup melted butter.

C. The directions or instructions tell how to actually prepare the food.

1. How and when to mix the ingredients
2. What utensils, dishes, and pans to use
3. How long and at what temperature to refrigerate, cook, or bake the food

D. The quantity made, or yield, is usually included in the recipe. For example, one 9" pie, serves four, 24 cupcakes, 3 dozen cookies.

E. Many recipes also include nutritional information. This is important for people on restricted or special diets who need to know the nutritional value of the food they eat.

> *Use TM: H–4A to show the students what should be included on a recipe. Use TM: H–4B to illustrate to students a sample recipe card showing the location of the*

different parts. Use WS: H–4A as an activity to have students label the different parts of a recipe.

Objective 2: Describe how measurements are used in recipes.

Anticipated Problem: How are measurements used in recipes?

II. Accurate measurements are essential when following recipes. The food you are making might not taste right if the measurements are not accurate. Using the wrong amounts of ingredients might also cause your food to not rise or bake properly.

A. Many different measurements are used in recipes.
   1. Cup: 1 cup (C.) = 8 ounces (oz.)
   2. Tablespoon: 1 tablespoon (T or TB) = $^{1}/_{16}$ cup
   3. Teaspoon: 3 teaspoons (t or ts) = 1 tablespoon
   4. Ounce: 16 ounces = 1 pound (lb.); 8 ounces = 1 cup
   5. Pint: 1 pint (pt.) = 2 cups; 2 pints = 1 quart (qt.); 8 pints = 1 gallon (gal.). A liquid pint is 16 ounces.
   6. Quart: 1 quart = 2 pints; 1 quart = 4 cups; 4 quarts = 1 gallon. A liquid quart is 32 ounces.
   7. Gallon: 1 gallon = 4 quarts; 1 gallon = 8 pints; 1 gallon = 16 cups. A liquid gallon is 128 ounces.
   8. Pound: 1 pound = 16 ounces (liquid)

B. Liquid ingredients are measured in clear or glass plastic measuring cups and measuring spoons.
   1. When using a measuring cup, place the cup on a level surface so that it remains steady, and bend down so you can look at the measurement markings at eye level. Fill the cup to the marking.
   2. When using a measuring spoon, pour the liquid just to the top of the spoon without letting it spill over. Don't hold the spoon over your mixing bowl because the liquid could overflow into the bowl.

C. Dry ingredients are measured in dry measuring cups and measuring spoons.
   1. It is generally best to spoon most dry ingredients into the measuring cup. Measuring spoons can be scooped directly into the ingredient.
   2. Some dry ingredients, like brown sugar, should be tightly pressed into the dry measuring cup so that it holds the shape of the cup when turned out.
   3. Use the straight edge of a knife to level off the top of the measuring cup or spoon.

Use TM: H–4C to discuss how measurements are used in recipes. Use WS: H–4B to have students practice measuring ingredients and answer questions about different measurements.

Objective 3: Define some common cooking terms.

Anticipated Problem: What are some common cooking terms?

III. It is important to know the different terms used in recipes so that you prepare the food correctly.

A. ***Beat*** means to make a mixture smooth by briskly stirring it.

B. ***Dissolve*** means to stir a dry substance in a liquid until no solids remain. Making Jello® or Kool-Aid® involves dissolving the dry powder in water.

C. ***Knead*** means to work dough with the heel of your hand in a pressing and folding motion.

D. ***Mix*** means to stir until the ingredients are thoroughly combined.

E. ***Stir*** means to mix ingredients with a spoon in a circular motion until they are combined.

F. ***Peel*** means to remove the outer layer of skin from a fruit or vegetable. Oranges, grapefruits, potatoes, and carrots are usually peeled.

G. ***Dice*** means to cut the ingredient into narrow strips and then cut the strips crosswise to form small pieces.

H. ***Chop*** means to cut the ingredient into irregularly sized pieces about pea size.

I. ***Mince*** means to cut the ingredient into tiny, irregularly shaped pieces.

J. ***Preheat*** means to heat the oven to the temperature recommended in the recipe before cooking in it.

K. ***Simmer*** means to heat a liquid over low heat until bubbles form slowly and burst below the surface.

L. ***Steam*** means to cook food in the steam given off by boiling water.

M. ***Bake*** means to cook food in the indirect, dry heat of an oven.

N. ***Boil*** means to heat a liquid until bubbles steadily form, rise, and break on the surface.

O. ***Saute*** means to cook or brown food in a small amount of hot butter or fat.

P. ***Stir fry*** means to cook food quickly while lifting and turning the food constantly over high heat in a lightly oiled wok or skillet.

Use TM: H–4D to discuss some of the common cooking terms with students. Use WS: G–4C as a fun activity to help students become more familiar with some of the terms they might find in recipes. Plan a class visit to the cafeteria and allow students to see demonstrations of some of the different terms discussed.

Objective 4: Explain basic guidelines of food preparation.

Anticipated Problem: How do you prepare a food?

IV. Preparing food requires following basic guidelines.

A. Always wash your hands with soap and warm water before preparing food.
B. Clean the surface where you will be preparing the food.
C. Gather all of your utensils, pans, etc., ahead of time and make sure they are clean and ready to use.
D. Check the recipe and gather all of the ingredients you will need before you begin.
E. Read through the recipe so that you have a good idea of what you will need to do.
F. Measure all ingredients accurately and in the correct measuring cups or spoons.
G. Follow the recipe carefully to make sure your food turns out as it should. Make sure you follow all of the steps in the order they should be done.

Use TM: H–4E to discuss the basic guidelines that should be followed when preparing food. Use WS: H–4D and WS: H–4E to have students follow simple recipes to prepare gumdrops and Tootsie Rolls. Have students fill out the form provided on WS: H–4F as they prepare each recipe. After each activity, discuss the recipes, the procedures, and the results. Did the food turn out as expected? How could they have made the product better? What would they change? Make sure that the students have copies of the recipes. Encourage them to attempt them again at home and report to the class on their results.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: H–4A, WS: H–4B, WS: H–4C, WS: H–4D, WS: H–4E, and WS: H–4F.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. e
2. a
3. f
4. b
5. d
6. c

Fill-in-the-Blank

1. nutritional information
2. level
3. 3
4. Preheat

Short Answer

Answers will vary. Use Objective 4 to score this question.

Test H–4

Name_____

FOOD PREPARATION

▶ Matching

Instructions. **Match the word with the correct definition.**

a. dissolve
b. bake
c. peel
d. boil
e. recipe
f. knead

_____1. A list of ingredients and directions used to make a food item.
_____2. To stir a dry substance in a liquid until no solids remain.
_____3. To work dough with the heel of your hand in a pressing and folding motion.
_____4. To cook food in the indirect, dry heat of an oven.
_____5. To heat a liquid until bubbles steadily form, rise, and break on the surface.
_____6. To remove the outer layer of skin from a fruit or vegetable.

▶ Fill-in-the-Blank

Instructions. **Complete the following statements.**

1. Many recipes include _____ _____. This is important for people on restricted or special diets who need to know the nutritional value of the food they eat.
2. When using a measuring cup, place the cup on a _____ surface so that it remains steady.
3. There are _____ teaspoons in 1 tablespoon.
4. _____ means to heat the oven to the temperature recommended in the recipe before cooking in it.

▶ Short Answer

Instructions. **Answer the following question.**

List three basic guidelines of food preparation.

A RECIPE INCLUDES:

- Recipe title
- Ingredients
- Directions
- Quantity made
- Nutritional information

SAMPLE RECIPE CARD

RECIPE TITLE →

SUNFLOWER BROCCOLI

INGREDIENTS →

- 2 garlic cloves, minced
- 3 tablespoons canola oil
- 2½ pounds fresh broccoli, cut into florets
- ¼ cup chicken broth
- ½ teaspoon dried oregano
- ½ teaspoon salt
- ¼ teaspoon pepper
- 2 tablespoons sunflower kernels

DIRECTIONS →

In a large skillet, saute garlic in oil for 1 minute. Add broccoli; cook and stir for 3 minutes. Add the broth, oregano, salt and pepper; cover and cook until broccoli is crisp-tender, about 4 minutes. Sprinkle with sunflower kernels.

QUANTITY MADE →

Yield: 10 servings.

NUTRITIONAL INFORMATION →

Nutritional Analysis: One serving (¾ cup) equals 80 calories, 6 g fat (trace saturated fat), 0 cholesterol, 174 mg sodium, 7 g carbohydrate, 3 g fiber, 4 g protein. **Diabetic Exchanges:** 1 vegetable, 1 fat.

MEASURING FOOD

- Many different measurements are used in recipes.
  - Cup: 1 cup (C.) = 8 ounces (oz.)
  - Tablespoon: 1 tablespoon (T or TB) = $^{1}/_{16}$ cup
  - Teaspoon: 3 teaspoons (t or ts) = 1 tablespoon
  - Ounce: 16 ounces = 1 pound (lb.); 8 ounces = 1 cup
  - Pint: 1 pint (pt.) = 2 cups; 2 pints = 1 quart (qt.); 8 pints = 1 gallon (gal.). A liquid pint is 16 ounces.
  - Quart: 1 quart = 2 pints; 1 quart = 4 cups; 4 quarts = 1 gallon. A liquid quart is 32 ounces.
  - Gallon: 1 gallon = 4 quarts; 1 gallon = 8 pints; 1 gallon = 16 cups. A liquid gallon is 128 ounces.
  - Pound: 1 pound = 16 ounces (liquid)
- Liquid ingredients are measured in clear or glass plastic measuring cups and measuring spoons.
- Dry ingredients are measured in dry measuring cups and measuring spoons.

COMMON COOKING TERMS

- Beat—make a mixture smooth by briskly stirring it.
- Dissolve—stir a dry substance in a liquid until no solids remain.
- Knead—work dough with the heel of your hand in a pressing and folding motion.
- Mix—stir till the ingredients are thoroughly combined.
- Stir—mix ingredients with a spoon in a circular motion until they are combined.
- Peel—remove the outer layer of skin from a fruit or vegetable.
- Dice—cut the ingredient into narrow strips and then cut the strips crosswise to form small pieces.
- Chop—cut the ingredient into irregularly sized pieces about pea size.
- Mince—cut the ingredient into tiny, irregularly shaped pieces.
- Preheat—heat the oven to the temperature recommended in the recipe before cooking in it.
- Simmer—heat a liquid over low heat until bubbles form slowly and burst below the surface.
- Steam—cook food in the steam given off by boiling water.
- Bake—cook food in the indirect, dry heat of an oven.
- Boil—heat a liquid until bubbles steadily form, rise, and break on the surface.
- Saute—cook or brown food in a small amount of hot butter or fat.
- Stir fry—cook food quickly while lifting and turning the food constantly over high heat in a lightly oiled wok or skillet.

FOOD PREPARATION GUIDELINES

- Always wash your hands with soap and warm water before preparing food.
- Clean the surface where you will be preparing the food.
- Gather all of your utensils, pans, etc., ahead of time and make sure they are clean and ready to use.
- Check the recipe and gather all of the ingredients you will need before you begin.
- Read through the recipe so that you have a good idea of what you will need to do.
- Measure all ingredients accurately and in the correct measuring cups or spoons.
- Follow the recipe carefully to make sure your food turns out as it should.

Name _____

PARTS OF A RECIPE

Directions

Label the parts of a recipe shown on the card below.

1. _____
2. _____
3. _____
4. _____
5. _____

1 →

SUNFLOWER BROCCOLI

2 →

2 garlic cloves, minced
3 tablespoons canola oil
2½ pounds fresh broccoli, cut into florets
¼ cup chicken broth
½ teaspoon dried oregano
½ teaspoon salt
¼ teaspoon pepper
2 tablespoons sunflower kernels

3 →

In a large skillet, saute garlic in oil for 1 minute. Add broccoli; cook and stir for 3 minutes. Add the broth, oregano, salt and pepper; cover and cook until broccoli is crisp-tender, about 4 minutes. Sprinkle with sunflower kernels.

4 →

Yield: 10 servings.

5 →

Nutritional Analysis: One serving (¾ cup) equals 80 calories, 6 g fat (trace saturated fat), 0 cholesterol, 174 mg sodium, 7 g carbohydrate, 3 g fiber, 4 g protein. **Diabetic Exchanges:** 1 vegetable, 1 fat.

WS KEY: H–4A

PARTS OF A RECIPE KEY

1. Recipe title
2. Ingredients
3. Directions
4. Quantity made
5. Nutritional information

Name _____

MEASURING

Materials

- ✓ Measuring cups (for dry and liquid ingredients)
- ✓ Measuring spoons
- ✓ Small scale (1 ounce to 1 pound)
- ✓ Water
- ✓ Rice

Directions

Using the correct measuring cups and spoons, answer the following questions.

Using Dry Ingredients (Rice):

1. Which is bigger, a teaspoon or a tablespoon?

2. How many teaspoons equal 1 tablespoon?

3. How many tablespoons equal 1 cup?

4. How many ½ cups equal 1 cup?

5. How many ¼ cups equal 1 cup?

6. How many tablespoons equal ½ cup?

Using Liquid Ingredients (Water):

1. Which is bigger, a cup or a pint?

2. How many cups are in a pint?

3. How many cups are in a quart?

4. How many pints are in a quart?

5. How many quarts are in a gallon?

6. How many cups are in a gallon?

Using a Scale:

1. How many ounces are in a ½ pound?

2. How many ounces are in a pound?

MEASURING KEY

Using Dry Ingredients (Rice):

1. tablespoon
2. 3
3. 16
4. 2
5. 4
6. 8

Using Liquid Ingredients (Water):

1. pint
2. 2
3. 4
4. 2
5. 4
6. 16

Using a Scale:

1. 8
2. 16

WS: H–4C

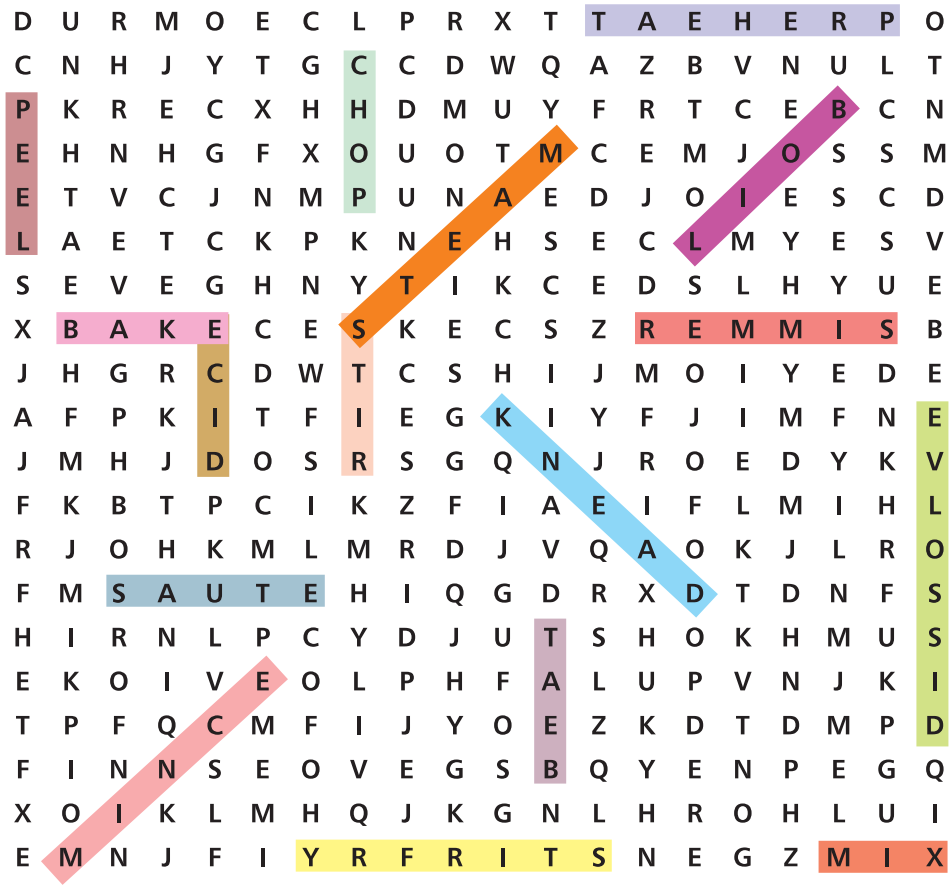
Name _____

COOKING TERMS WORD SEARCH

D U R M O E C L P R X T T A E H E R P O
C N H J Y T G C C D W Q A Z B V N U L T
P K R E C X H H D M U Y F R T C E B C N
E H N H G F X O U O T M C E M J O S S M
E T V C J N M P U N A E D J O I E S C D
L A E T C K P K N E H S E C L M Y E S V
S E V E G H N Y T I K C E D S L H Y U E
X B A K E C E S K E C S Z R E M M I S B
J H G R C D W T C S H I J M O I Y E D E
A F P K I T F I E G K I Y F J I M F N E
J M H J D O S R S G Q N J R O E D Y K V
F K B T P C I K Z F I A E I F L M I H L
R J O H K M L M R D J V Q A O K J L R O
F M S A U T E H I Q G D R X D T D N F S
H I R N L P C Y D J U T S H O K H M U S
E K O I V E O L P H F A L U P V N J K I
T P F Q C M F I J Y O E Z K D T D M P D
F I N N S E O V E G S B Q Y E N P E G Q
X O I K L M H Q J K G N L H R O H L U I
E M N J F I Y R F R I T S N E G Z M I X

BAKE
BEAT
BOIL
CHOP
DICE
DISSOLVE
KNEAD
MINCE
MIX
PEEL
PREHEAT
SAUTE
SIMMER
STEAM
STIR
STIR FRY

COOKING TERMS WORD SEARCH KEY



Name _____

GUMDROPS RECIPE

Ingredients

- ✓ 1 teaspoon Jello® powder (any flavor)
- ✓ 7 drops water
- ✓ 1 teaspoon sugar

Directions

Pour the Jello® powder into a small bowl. Using an eyedropper, add the water 1 drop at a time to the powder while mixing it with your finger. Roll the mixture into a ball. Roll the gumdrop in sugar to coat it.

Yield: 1 gumdrop

Name _____

TOOTSIE ROLLS RECIPE

Ingredients

- ✓ 2 tablespoons chocolate syrup
- ✓ 1 tablespoon margarine
- ✓ ¼ cup dark corn syrup
- ✓ ½ teaspoon vanilla
- ✓ 1¼ cup powdered sugar
- ✓ 6 tablespoons dry milk powder

Directions

Place the chocolate syrup, margarine, corn syrup, and vanilla in a quart-size resealable plastic bag. Close the bag and seal it tightly. Mix the ingredients with your hands until combined. Add the sugar and dry milk to the bag and knead the mixture for 3 minutes. Shape the mixture into 1" balls. Roll the balls into log shapes. Wrap the rolls in 2½" × 4" pieces of wax paper.

Yield: about 7 rolls

WS: H–4F

Name _____

FOOD PREPARATION FORM

Directions

Answer the following questions as you complete your recipe.

Questions

1. Did you wash your hands?
2. Did you wash the surface where you will be working?
3. What is the title of the food item?
4. How many ingredients are needed for this recipe?
5. Do you have all the ingredients needed?
6. Do you have all the necessary utensils and materials?
7. Did you read through the recipe? Do you understand all of the steps?
8. How much will this recipe make? Will there be enough to share with the class?
9. Does this recipe include nutritional information?
10. Did you measure all of the ingredients accurately?
11. What was the result? Did it turn out well?
12. Will you try this recipe again? Will you do anything differently?

Lesson H–5

BUYING FOOD

Indiana Agricultural Literacy Lesson Plan Library

Unit H. Food Science

Lesson 5. Buying Food

Indiana's Academic Standard. **Math:** 4.2.4 — Demonstrate mastery of the multiplication tables for numbers between 1 and 10 and of the corresponding division facts.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Understand the economics of America's food supply.
2. Name places where food can be bought.
3. Compare food for price, quality, and preferences.

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Farm Facts. Park Ridge, Illinois: American Farm Bureau Federation, 2002.

Heron, Ray V. *The Science of Agriculture: A Biological Approach.* Albany, New York: Delmar Publishers, 2002.

Lee, Jasper S., et al. *AgriScience Discovery.* Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003.

Medved, Eva. *The World of Food.* Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1988.

List of Equipment, Tools, Supplies, and Facilities

- ✓ Writing surface
- ✓ Overhead projector
- ✓ Transparencies from attached masters
- ✓ Copies of student worksheets
- ✓ Play money
- ✓ Bottle of cola
- ✓ Bag of chocolate chip cookies
- ✓ Box of soda crackers
- ✓ Jar of peanut butter
- ✓ Box of cereal

Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ Bulk
- ➤ Convenience store
- ➤ Discount market
- ➤ Farmer's market
- ➤ Food Check-Out Day
- ➤ Food cooperative
- ➤ Generic brand
- ➤ Name brand
- ➤ Speciality shop
- ➤ Store brand
- ➤ Supermarket
- ➤ Unit price

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Give each student a $5 bill (play money). Have a can or bottle of cola, a bag of chocolate chips cookies, a box of soda crackers, a jar of peanut butter, and a box of cereal on a table at the front of the classroom. Be sure that the prices are on the packages (if there is no price tag on them, write it on with a marker), but do not allow the students to see the prices. Ask the students what products and how many of each could they buy with the $5. Some students will have no idea how much anything costs and others will do well, especially if they have shopped for food with their parents. Hand out a piece of paper to each student and have them write what they think the price of each item is and what items they would buy with their money. When everyone is finished, allow each student to share their answers. Discuss as a class if they could have actually purchased the items with $5. The students could calculate the totals on the board. This activity will start them thinking about the cost of food.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Understand the economics of America's food supply.

Anticipated Problem: How do we spend our money for food in the United States?

I. American farmers produce the safest and most economical food in the world! Our food is produced in an efficient manner. Because farmers produce an abundance of food, it is very affordable.

   A. In the United States we spend only 7.1% of our annual income on food. This is lower than in any other country. For example, the United Kingdom spends 10.2%, France spends 17.7%, Mexico spends 24%, and India spends 48.4%.

   B. ***Food Check-Out Day*** is the day when most Americans have earned enough money to pay for their food for the year. The date generally decreases throughout the years. Right now, it takes about 37 days (February 6). In comparison, Tax Freedom Day is the day that most Americans have earned enough money to pay all their taxes for the year. At this time, it is about day 100.

   C. When you buy food, your money goes to many different people.

      1. The farmer or rancher who originally produced the food, only receive about 19¢ for every dollar that is spent.

2. The remaining 81¢ goes to off-farm costs (marketing, advertising, packaging, transportation, processing, etc.).

Use TM: H–5A to show the students how the United States compares with other countries in money spent on food. Some countries spend a lot more of their income just to feed their families than we do. Use TM: H–5B to show students how the Food Check-Out Day has changed throughout the years. Use TM: H–5C to illustrate to students where our food dollar is spent. Use WS: H–5A to have students calculate some problems about how much we spend on food annually. Remind students that many families may spend more than the 7.1%, but this is an average.

Objective 2: Name places where food can be bought.

Anticipated Problem: Where do people buy food?

II. People buy food in a variety of places. In the United States, there is always an ample supply of food, many brands to choose from, and a variety of different types of stores to shop in. In other countries, people might have to go to three or four places to get the food they need for the day. For example, they might have to go to the butcher to buy meat, the bakery to buy bread, the produce market to buy fruits and vegetables, and the dairy to buy milk and cheese. Buying food may take them all day, and if the supply is short, they might not be able to get all that they need.

A. Most people in the United States purchase their food in supermarkets. A ***supermarket***, sometimes called a grocery store, is a large self-service retail store that sells food and other items commonly used in a home. Supermarkets stock a large amount of all types of food products. The typical supermarket has around 40,000 food items. Meats, dairy products, produce, breads, canned foods, dry goods, frozen foods, and many other types of food can be bought at a supermarket. Many supermarkets also have delicatessens (delis), bakeries, or even restaurants where you can buy ready-to-eat or take-out foods.

B. A ***convenience store*** is a store that is smaller than the average supermarket that sells a limited number of food items. Many convenience stores also offer gasoline and other goods and services. These stores are usually located in convenient areas and might be much closer than the nearest supermarket. Because of their convenience, the prices of food items are usually higher.

C. A ***discount market*** is a store that offers its products at lower cost because of the warehouse-style shopping. Discount markets generally have less variety in brands and sizes of products and provide few services. They usually expect you to bag and carry out your own groceries.

D. A ***food cooperative*** is a discount market that requires membership to shop there. Food coops buy wholesale in large quantities, or ***bulk***, and pass the savings on to the members.

E. A ***speciality shop*** is a small food store or market that sells specific items. Specialty shops include butcher shops, candy stores, bakeries, and health food stores. They specialize in only certain products, such as candy, cheese, and health foods.

F. A ***farmer's market*** is a market that sells fresh fruits, vegetables, and other items directly from the producers. Farmer's markets are usually seasonal.

Use TM: H–5D to discuss with students the various places that food can be purchased. Use WS: H–5B to have students develop a plan for their own store. Give students paper bags and let them draw their store's logo on them. Plan a field trip to a local supermarket and allow students to see the variety of products available and the services provided at the store.

Objective 3: Compare food for price, quality, and preferences.

Anticipated Problem: What should we compare when shopping for food?

III. There are many factors to consider when shopping for food, including nutritional value, prices, brands, form of food (fresh, canned, frozen), and preparation time.

A. An increasing number of people are looking closely at the nutritional value of the food they buy. For example, some people may need to keep track of the amount of calories or sodium that they consume due to health concerns, and people with diabetes need to limit their intake of sugar and carbohydrates. People with special diets can check the nutritional information on different products and buy the foods that meet their needs.

B. Some people compare prices of foods to determine which ones to buy. Stores often offer specials, coupons, or refunds to encourage buying of certain foods. When comparing prices, always use the unit price. The ***unit price*** is the price of the food per standard unit, such as ounce, pound, quart, etc.

C. Brand is sometimes important when buying food. Some people are loyal to a certain brand or think that one brand tastes better than another. They will only buy the brand they like. For example, some people prefer Pepsi over Coke or vice versa.

1. A ***name brand*** is a product that is more recognizable because a large amount of advertising is usually done for it. Name brands are generally more expensive than other brands.
2. A ***store brand*** is a product that typically costs less because of less advertising and distribution. Store brands may actually be processed at the same plant as name brands, but they have different packaging.
3. A ***generic brand*** is a product that has very little advertising and cheaper packaging and labels. Generic brand foods may be slightly lower in quality than other brands.

D. Sometimes, the form of the food determines what you buy. If you were going to prepare the food soon, you might choose to buy fresh food. If you were not planning on cooking the food for some time, you would probably buy canned or frozen food because it would keep longer.

E. The length of time it takes to prepare food can also determine what you buy. More and more people buy easy-to-prepare food because they are busy and want to be able to fix a meal quickly. However, the faster a food is to prepare, the more expensive it may be.

Use TM: H–5E to discuss with students some of the factors to consider when shopping for food. Use WS: H–5C to help the students with comparing foods. Provide each student with a different packaged food product. Make sure the unit price is listed on the package, or write it on with a marker. You might want to give students the total price and have them figure out the unit price on their own. Have students complete the worksheet by finding important comparison information from the food by checking the package.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Use observations as the basis for reteaching areas where student mastery may need improvement.

Application. Students can apply the knowledge gained from the lesson as they complete WS: H–5A, WS: H–5B, and WS: H–5C.

Evaluation. Focus the evaluation of student achievement on mastery of the objectives as stated in the lesson. A written test can also be used to assess student achievement of the objectives. A sample written test is attached.

Answers to Sample Test:

Matching

1. e
2. c
3. a
4. d
5. b

Fill-in-the-Blank

1. generic brand
2. speciality shop
3. supermarkets

Short Answer

Nutritional value, prices, brands, form of food (fresh, canned, frozen), and preparation time

Test H–5

Name_____

BUYING FOOD

▶ Matching

***Instructions*. Match the word with the correct definition.**

a. farmer's market
b. name brand
c. bulk
d. unit price
e. Food Check-Out Day

_____1. The day when most Americans have earned enough money to pay for their food for the year.

_____2. A large quantity.

_____3. A market that sells fresh fruits, vegetables, and other items directly from the producers.

_____4. The price of the food per standard unit, such as ounce, pound, quart, etc.

_____5. a product that is recognizable because a large amount of advertising is usually done for it.

▶ Fill-in-the-Blank

***Instructions*. Complete the following statements.**

1. A(n) _____ _____ is a product that has very little advertising and cheaper packaging and labels.
2. A(n) _____ _____ is a small food store or market that sells specific items.
3. Most people in the United States purchase their food in _____.

▶ Short Answer

***Instructions*. Answer the following questions.**

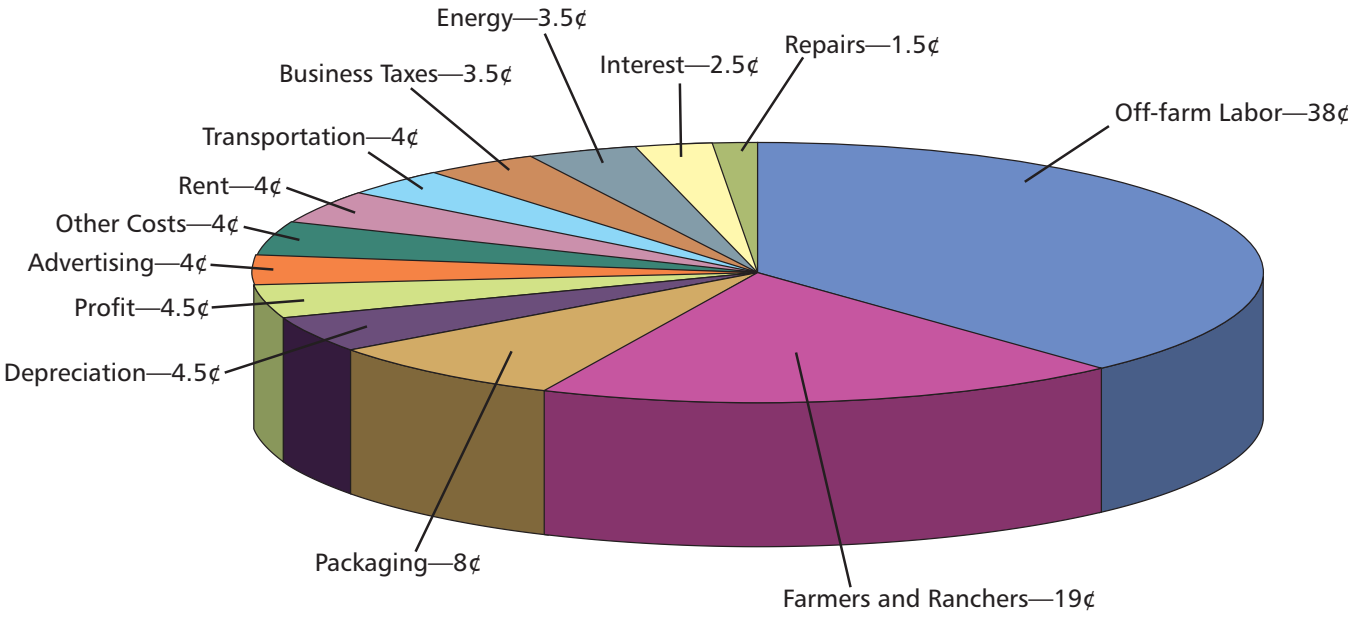
List the five factors you should consider when shopping for food.

PERCENT OF INCOME SPENT ON FOOD CONSUMED AT HOME

FOOD CHECK-OUT DAY

- 1930—Day 90
- 1940—Day 78
- 1950—Day 76
- 1960—Day 65
- 1970—Day 51
- 1980—Day 49
- 1990—Day 42
- 1995—Day 39
- 1996—Day 38
- 1997—Day 38
- 1998—Day 37
- 1999—Day 38
- 2000—Day 37
- 2001—Day 37

WHERE OUR FOOD DOLLAR GOES



PLACES TO BUY FOOD

- Supermarket
- Convenience store
- Discount market
- Food cooperative
- Speciality shop
- Farmer's market

SHOPPING CONSIDERATIONS

- Nutritional value
- Price
- Brands
- Form of food (fresh, canned, frozen)
- Preparation time

WS: H–5A

Name _____

FOOD FOR A YEAR

Directions

Solve the following problems using the average of 7.1% spent on food each year by the average family.

1. The Quick family has a household income of $30,000. How much would they spend on food each year?

2. The Hines family makes $25,000 a year. How much would they spend on food each year?

3. The Hunter family spent $4,200 on food last year, and they have an annual household income of $40,000. How much more or less did they spend than the average 7.1%?

4. The Clark family makes $35,000 a year. Last year, they spent $2,000 on food. How much more or less did they spend than the average 7.1%?

FOOD FOR A YEAR KEY

1. $30,000 × 7.1% = $2,130
2. $25,000 × 7.1% = $1,775
3. $40,000 × 7.1% = $2,840; $4,200 – $2,840 = $1,360 more than the average
4. $35,000 × 7.1% = $2,485; $2,485 – $2,000 = $485 less than the average

Name _____

PLAN YOUR OWN STORE

Directions

Come up with an idea for your own food store! Fill in the information below about your store.

1. Name of store _____
2. Type of store (supermarket, specialty shop, convenience store, etc.)_____
3. Location of store_____
4. Type of products you will sell _____

   _____
5. In the space below, design a logo for your store that you can display on your building and have printed on your shopping bags. After you have designed your logo, you might also want to copy it on a paper bag so you can see how it will look.

Name _____

COMPARISON SHOPPING

Directions

When shopping for food, you should look at the nutritional value, price, brand, form of the food, and preparation time. Use the food product your teacher gave you to fill in the information below.

Name of the product: _____

Nutritional Value:

1. Does the package list any special nutritional information (low fat, sugar-free, low sodium, etc.)?

2. How many calories are in the product?

3. Would this product be good for someone who is on a diet?

Price

1. What is the total price of the product?

2. What is the unit price of the product?

3. Are there any coupons or specials listed on the package?

Brand

1. What brand is the product (name brand, store brand, or generic brand)?

2. If the product is name brand, what is the name?

3. Is this the brand of the product that you like?

4. Would you be willing to try this brand even if you have never had it before?

Form

1. What form is the product in (frozen, canned, in a bag, fresh)?

2. What is the expiration date for the product?

3. If you wanted to eat this product for lunch today, would you be able to?

Preparation

1. How long does it take to prepare this product?

2. Is it easy to prepare this product, or does it require some skill?

3. Can the product be microwaved, or does it have to be prepared on the stove or in the oven?

4. Will preparing the product create a lot of dirty utensils, bowls, pots, or pans that will have to be cleaned up?