

Activity Manual

Science 6

For use with SCIENCE 6
Fourth Edition

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SCIENCE 6 Activity Manual
For use with **SCIENCE 6 Fourth Edition**

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Looking Ahead

Name _____

A. Circle the word or phrase that best completes each sentence.

1. The crust of the earth is made up of large pieces known as (plates) / layers).
2. (Faults) / Seismic waves) are breaks in the earth's surface.
3. A (faultometer / seismograph) measures the earth's movements.
4. The Richter scale measures the (strength) / level of destruction) of an earthquake's waves.
5. An earthquake in the ocean may cause the formation of a large wave called a (tsunami) / stromboli).
6. The lithosphere contains (pockets of volcanic ash / magma chambers).
7. A composite cone volcano has (gradually / steeply) sloping sides.
8. A volcano that is expected to erupt again is called (active) / dormant).
9. The gases and debris released into the air during a volcanic eruption is called (vents / vog).
10. (Igneous) / Metamorphic) rock is produced from hardened lava.

B. Write a question for something you would like to learn about the following:

- earthquakes

- volcanoes

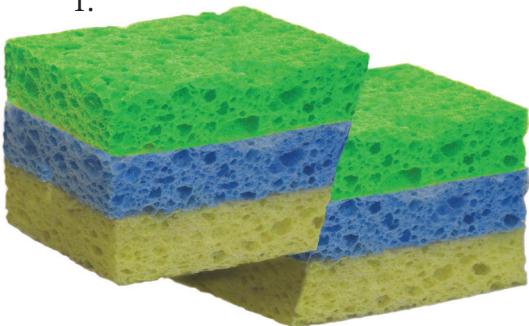
Modeling Faults

Name _____

Student Text pages 6–7

Roland is modeling the types of faults using sponges. Identify the type of fault being modeled in each picture. Write a description of how the earth is moving in each model.

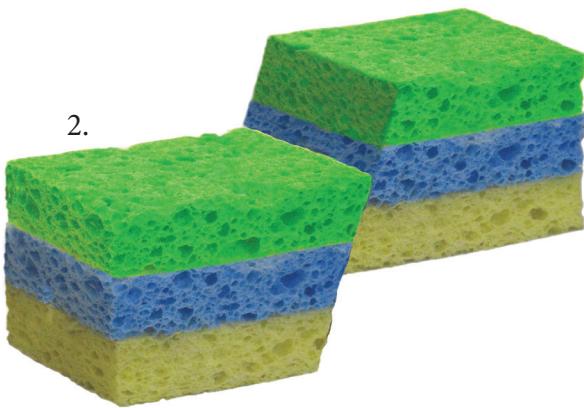
1.



Fault reverse

Answer should include that rocks push together and push a section upward.

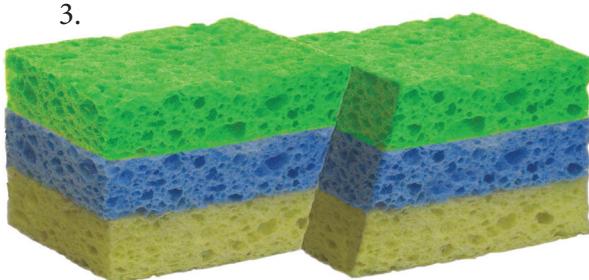
2.



Fault normal

Answer should include that rocks move apart and a section falls.

3.



Fault strike-slip

Answer should include that rocks move horizontally past each other.

Epicenter Map

Name _____



Locate the Epicenter

Name _____

Scientists gather many types of data each time an earthquake occurs. These types of data help them track the movement of plates and possibly predict future earthquakes and their intensities. One useful piece of data is the location of the epicenter.

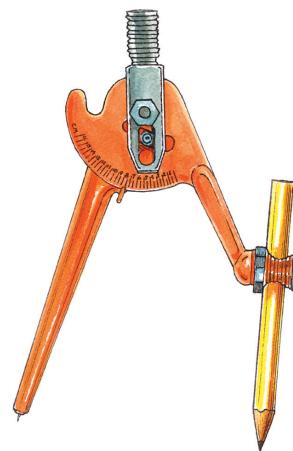
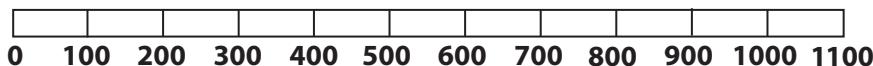
P and S waves originate from the focus of an earthquake. P waves travel through the earth faster than S waves. Scientists use the difference in the arrival times of seismic waves at recording stations to determine the distance to an earthquake. Finding the epicenter of one earthquake requires information from at least three different recording stations.

Use a compass and follow the steps to determine the location of each earthquake.

- Use the scale 1 cm = 100 km.
- Figure the number of centimeters between the earthquake and each city below.
- Set your compass for each city using the scale below.
- Place the point of the compass on the first city and draw a circle (or part of a circle) around the city.
- Follow the same procedure for the other two cities.
- The epicenter is the city at the intersection of the three circles. Write the city and state.

Scale

1 cm = 100 km



Distance to earthquake

1. Earthquake 1

Pendleton, Oregon	600 km	6 cm
Fort Collins, Colorado	900 km	9 cm
Lethbridge, Canada	300 km	3 cm
epicenter: Great Falls, Montana		

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Distance to earthquake

2. Earthquake 2

Las Vegas, Nevada	400 km	4 cm
Caborca, Mexico	700 km	7 cm
Twin Falls, Idaho	1000 km	10 cm
epicenter: Los Angeles, California		

Study Guide

Student Text pages 4–11

Name _____



A. Write the letter of the correct answer.

- C 1. crust and upper area of the mantle
B 2. beginning point of an earthquake
F 3. scientist who studies the movement of the earth
E 4. vibrations of energy flowing from the focus
A 5. point on Earth's surface directly above the focus
D 6. strength of an earthquake's seismic waves
H 7. giant ocean wave
G 8. idea that the earth's crust is made up of moving plates

- A. epicenter
B. focus
C. lithosphere
D. magnitude
E. seismic wave
F. seismologist
G. theory of plate tectonics
H. tsunami

B. Identify three causes of earthquakes.

9. *the buildup and release of energy when two surface plates move or shift against each other*

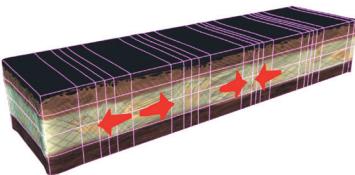
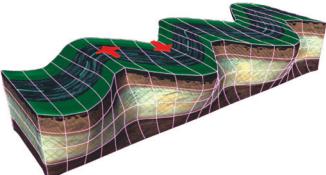
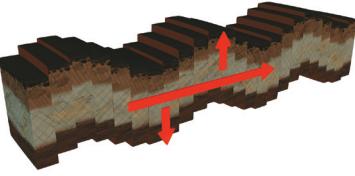
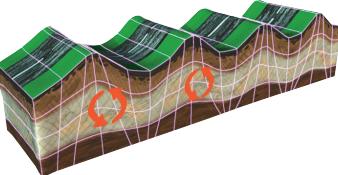
10. *when large amounts of earth are removed or added*

11. *when molten rock moves under a volcano*

C. Write the type of fault next to its description.

- strike-slip* 12. plate boundaries move horizontally past each other
reverse 13. plate boundaries push together forcing rock upward
normal 14. plate boundaries move apart forming a gap

D. Write the name for the category of waves at the top of each column. Write the name of each kind of wave in the correct section of the table.

15. <u>Body waves</u> fast-moving waves that occur beneath the surface of the earth	16. <u>Surface waves</u> slower destructive waves that occur on the surface of the earth
17. <u>P wave</u>  moves in a straight path with a push-and-pull motion	18. <u>Love wave</u>  moves back and forth in a zigzag pattern
19. <u>S wave</u>  moves in an up-and-down pattern	20. <u>Rayleigh wave</u>  moves in a rolling motion

E. Write T if the sentence is true. If the statement is false, write a correction for the underlined words.

T

21. Scientists believe that Earth is made up of plates that float on the partly melted rock of Earth's mantle.

Faults

22. Waves are breaks in the earth's surface along which rock can move.

T

23. A seismograph is used to detect, time, and measure the movements of the earth.

Richter scale

24. The Mercalli scale measures the magnitude of an earthquake's seismic waves and assigns it a number.

A Science Experiment

Name _____



Scientists follow a procedure when conducting experiments. The procedure we will practice includes identifying the problem, listing materials, forming a hypothesis, establishing and following a procedure, and drawing conclusions.

Problem

Each experiment begins with a **problem**, or question that needs answering. This experiment's problem asks about the strength of uncooked fettuccine.

A. Write the problem.

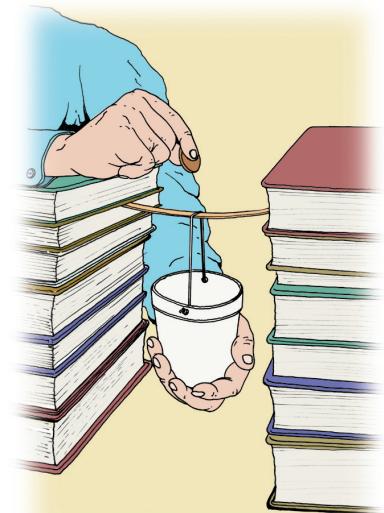
How many pennies can one strand of fettuccine hold before breaking?

Materials

In the list of **materials**, include all the materials and equipment you will use to conduct the experiment. In some experiments all of the materials will be listed for you. In others, you will choose some or all of the materials.

B. List the materials you will use.

1 fettuccine noodle (uncooked) 1 paper or foam cup
30 cm piece of string 1 roll of pennies
2 stacks of books 30 cm high



Hypothesis

A **hypothesis** is a scientist's idea of the answer to a problem. As you conduct an experiment, the hypothesis is a *statement* of your idea or a diagram of how the problem will be answered through that experiment. A hypothesis often includes *specific criteria* about the conditions of the experiment.

C. Four choices for a hypothesis are given. Read each and decide if it is a good hypothesis. If you answer No, explain what is wrong with that hypothesis.

1. Will ten pennies break one suspended piece of fettuccine? Yes No

A hypothesis is written as a statement, not as a question.

2. Twelve pennies will break the suspended fettuccine. Yes No

This hypothesis does not tell how many pieces of fettuccine are being used. (specific criteria)

3. I think six pennies will break one suspended piece of fettuccine. Yes No

4. One piece of fettuccine will hold no more than ten pennies without breaking. Yes No

This hypothesis does not tell that the fettuccine is suspended. (the condition of the fettuccine)

D. Write a hypothesis in your own words.

Answers will vary.

Procedure

The **procedure** is the steps of an experiment. The steps must be followed exactly to ensure the accuracy of the results. Scientists **record** their observations and results throughout an experiment.

E. Follow the procedure.

1. Prepare the cup by making a string handle for it.
2. Hang the empty cup on the piece of fettuccine.
3. Suspend the fettuccine between the stacks of books. Place a book on each end of the fettuccine to hold it in place.
4. Support the cup with your hand and place one penny inside it. Gently lower the cup until it hangs from the fettuccine.
5. Repeat step 4 until the number of pennies reaches the number in your hypothesis or until the fettuccine breaks.
6. Record your observations and results.

Number of pennies	Did the fettuccine break?

Conclusions

The **conclusions** evaluate the accuracy of a hypothesis. They relate and apply the information to other areas.

F. Answer the questions.

1. Do your results support your hypothesis? If not, was your prediction too low or too high? *Answers will vary.*
2. Would each piece of fettuccine hold the same number of pennies? Explain. *Answers will vary.*

Follow-up

The **follow-up** usually considers variations to an experiment. Sometimes specific details or suggestions to change the variables are given.

Example: Try dropping the cup instead of lowering it gently after adding pennies.

Construction Site

Student Text pages 12–13

Name _____



Problem

How would you design a building that can withstand an “earthquake”?

Planning

- How many shakes will the earthquake last? _____
- How far will each shake be (magnitude)? _____
- In what directions will it shake? (up-and-down, side-to-side, corner-to-corner) _____

- What kind of seismic waves will the shaking demonstrate? _____

Materials

foam base, approximately 20 cm × 25 cm (8 in. × 10 in.)

package of large marshmallows

box of fettuccine noodles

Hypothesis

Procedure

A. Sketch your design. Construct your building to match your sketch.

B. Test your building according to the details chosen. Record your results.

1. How many shakes did your building withstand?
Answers will vary.
2. What damage was done to your building during the earthquake?
Answers will vary.

3. How can you improve your building to lessen the amount of damage during another earthquake?

Answers will vary.

C. Rebuild and add your improvements.

4. Write a hypothesis about how your improved building will withstand another earthquake. Then test your building.

Answers will vary.

5. How many shakes did your building withstand?

Answers will vary.

6. What damage was done to your building during the second earthquake?

Answers will vary.

Conclusions

1. What are some features that make a structure unstable?

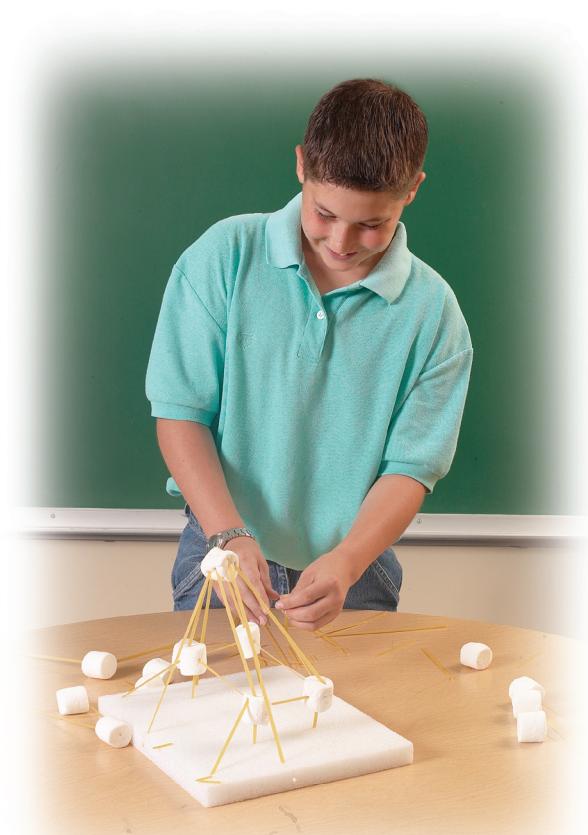
Possible answers: no reinforcement between marshmallows; poor foundation

2. What are some features that make a structure more stable?

Possible answers: structure solidly secured in the base; additional support of cross beams; multiple pieces of fettuccine between marshmallows

3. How could you rebuild your structure to improve its stability?

Answers will vary.



Locations of Volcanoes

Name _____

Volcanologists understand much about how the earth works. Many use their knowledge to prevent or reduce the damage from volcanic eruptions. Learning about volcanoes can help us appreciate the people who dedicate their lives to studying the earth to help protect others.

Label the seven continents, the Pacific Ocean, and the Atlantic Ocean. Use a red colored pencil to draw the outline of the Ring of Fire.



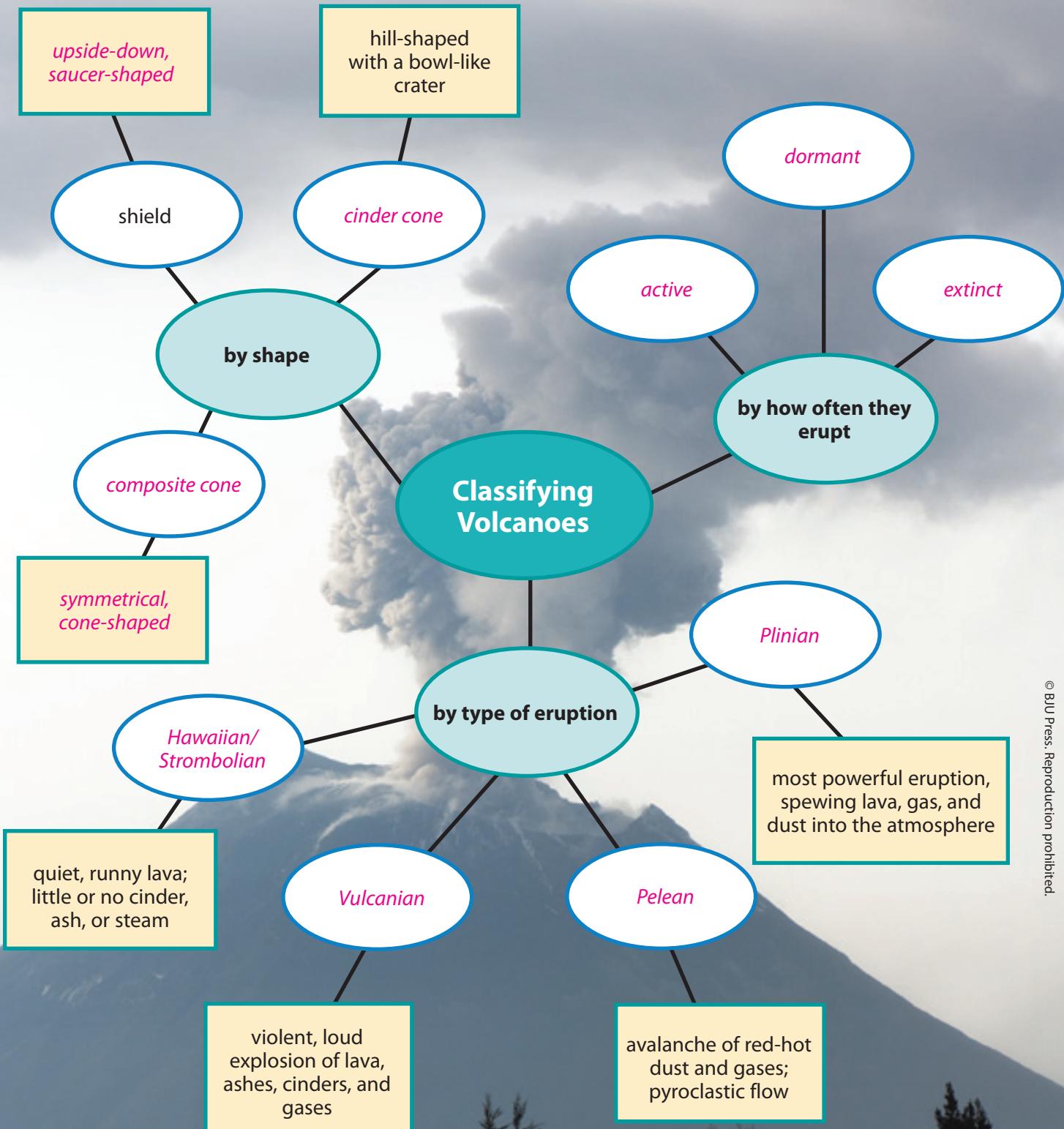
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Classifying Volcanoes

Student Text pages 14–17

Name _____

Complete the web.



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Create an Eruption

Student Text pages 18–19

Name _____



Purpose

Make a model of a volcano.

Materials

Volcano

Eruption

Procedure

A. Draw your design.

My volcano shape is a _____.

B. Record the information from your trial solutions.

Ingredients	Amount in Solution 1	Amount in Solution 2	Amount in Solution 3
Baking soda			
Vinegar			
Red food coloring			

C. Erupt your volcano.

Conclusions *(All answers will vary.)*

1. Which one of your trial solutions did you use for your eruption?

2. What type of eruption did you imitate? Why?

3. Did your volcano erupt as you expected? If not, what was the eruption like?

4. How was the eruption similar to a real volcanic eruption?

5. How was the eruption different from a real volcanic eruption?

Possible answers: Real eruptions are more violent; real eruptions are not a result of baking soda and vinegar.

6. If you could make your volcano again, what would you do differently?



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Study Guide

Name _____

Student Text pages 14–17 and 20–22



A. Match the term with its correct description.

- H 1. scientists who study volcanoes
- D 2. avalanche-like emission of red-hot dust and gases
- C 3. magma that breaks the earth's surface
- E 4. area around the Pacific Ocean where volcanoes occur most
- F 5. mixture of cinders, ash, and rock discharged by a volcano
- B 6. water heated by hot magma
- G 7. volcanic fog
- A 8. mud and rock fragments that surge down a mountain when part of it collapses

- A. debris flow
B. hot spring
C. lava
D. pyroclastic flow
E. Ring of Fire
F. tephra
G. vog
H. volcanologists

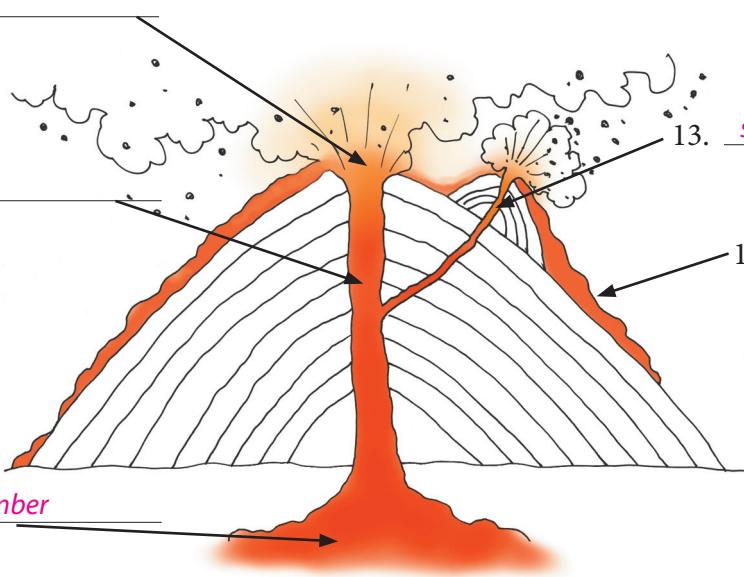
B. Write the word that describes each volcano.

- extinct 9. a volcano that has not erupted in the past and is not expected to erupt in the future
- active 10. a volcano that is expected to erupt
- dormant 11. a volcano that has erupted in the past, is currently inactive, and is not expected to erupt again

C. Label the parts of the volcano: *crater*, *lava*, *magma chamber*, *side vent*, *vent*.

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12. crater



13. side vent

14. vent

15. lava

16. magma chamber

D. Answer the questions.

17. Explain how a volcano forms. *Hot magma rises through dense rocks until it breaks through a crack in the earth's surface.*

18. Why can volcanoes sometimes have more than one kind of eruption? *One eruption can change the conditions inside of a volcano, thus causing the volcano to erupt differently the next time.*

E. Match the correct type of volcano to the description.

- D** 19. This large, gradually sloping volcano has mild eruptions and a continuous flow of lava. Scientists will study the composition of the gathered lava.
- A** 20. This large volcano seems to be layered, signifying that different types of lava flows have occurred in the past, but the volcano is presently inactive.

- A. dormant composite cone volcano
B. active cinder cone volcano
C. extinct shield volcano
D. active shield volcano

F. Choose all of the correct answers.

21. ___ could cause a volcanic eruption.
- Heated magma rising to the surface Weather changes
 Acid rain A hot spot
22. Volcanic activity may occur ___.
- under the ocean at hot spots
 at a fault along the Ring of Fire

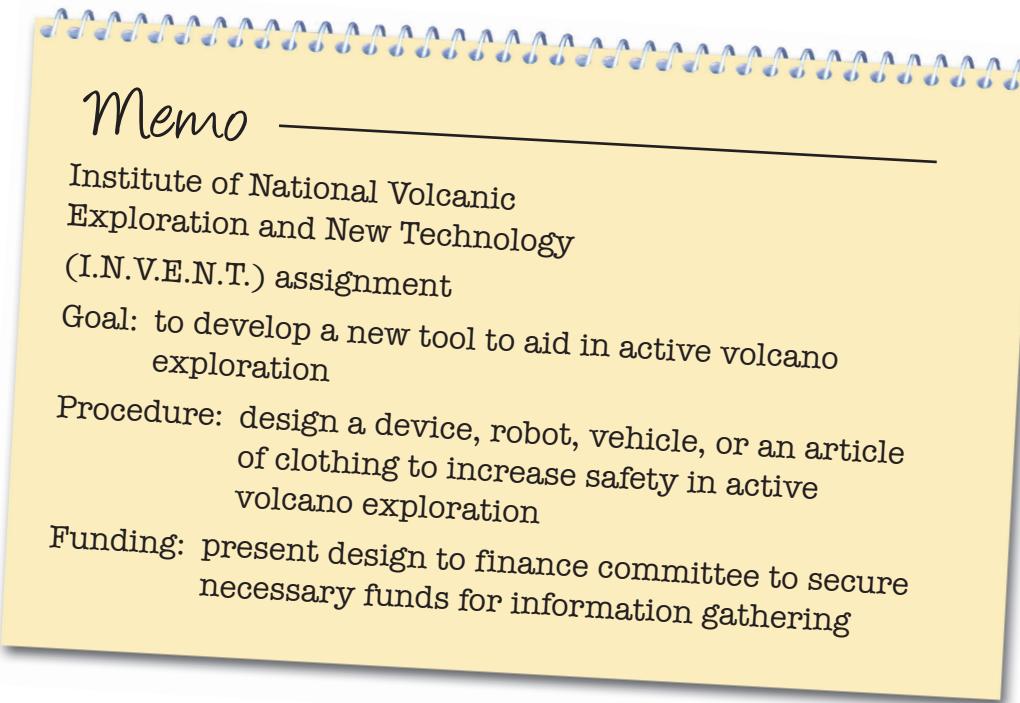
G. Write a sentence telling what the two terms have in common.

23. geyser and mud pot *Both are hot springs.*

24. soil rich in nutrients and igneous rock *Both are products of volcanoes.*



Follow the procedure to plan your device and prepare a short presentation.

**Procedure** (*All answers will vary.*)

1. Identify the type of device you will develop. _____

2. Describe the purpose of your device. _____

3. Explain how your invention will accomplish its purpose. _____

4. List the materials you need to make your invention. _____

5. Identify the ways your invention will benefit the study of volcanoes. _____

6. Make sketches of your invention. Show several different views. For example, show the outside, the inside, and a close-up of a small section. Label your sketches. Develop the sketches into a visual.

7. Describe the function of your invention. _____

8. Prepare and give a presentation. Use your planning notes and visual.



Thinking It Through

Student Text pages 4–24

Name _____



Read each scenario. Plan and write a paragraph answering each question.

1. Coal has been mined for hundreds of years in an area far from any fault lines. During that time millions of tons of coal have been removed. Inspectors have found cracks in some of the sandstone over the mining tunnels and empty rooms. Recently an earthquake shook the area. It measured 4.0 on the Richter scale. People are worried and want the mining to stop. Why could the mining have possibly caused this earthquake?

Possible answer: Earthquakes can occur where large amounts of earth have been removed. Since so much coal had been removed from these mines, the rock around the mines was under stress.

The cracks in the sandstone possibly created the seismic waves that caused the earthquake.

2. In 2011 a volcano in Iceland erupted. Days later, areas across Europe and Asia were covered with volcanic dust and ash, causing potential health problems, especially for people with asthma or other respiratory issues. How did the volcano in Iceland cause the dust and ash problem in places over 1,000 miles away?

Possible answer: Volcanic dust and ash can travel great distances. The force of the volcano's eruption blasted the dust and ash high into the atmosphere. Wind would have carried the dust for miles until eventually the particles fell down to Earth.

3. In 1933 a moderate earthquake happened during early evening in Southern California. It caused over 120 deaths and millions of dollars worth of property damage in an area with soft, sandy, or marshy soil. Brick buildings and walls fell, chimneys toppled, and porches collapsed. Water pipes broke and gas lines ruptured. At least 70 school buildings were destroyed by the earthquake, and many others suffered great damage. This damage led authorities to later develop improved building codes and designs for school buildings. Why do you think the damage was so extensive?

Possible answer: There are several reasons why the damage from the 1933 earthquake was extensive.

The buildings probably had not been designed and built to withstand earthquakes. The buildings were built on soft soil rather than solid ground. The type of soil could not support the kinds of pipes and buildings that had been built in it and on top of it. The broken water pipes and gas lines would cause additional damage such as flooding and fires.

4. Volcanoes are often connected with destruction and death. What are some things that a volcano produces that are good and helpful? Explain.

Possible answer: The soil around volcanoes is rich in minerals and good for farming. Valuable gems can be found in and around volcanoes. Volcanoes also produce igneous rock which is used for many different tools, buildings, and other purposes.

Looking Ahead

Name _____

A. Mark the answer.

1. Weathering is the process of ____.
A. the rock cycle B. breaking down rocks C. predicting rain
2. An example of mechanical weathering is ____.
A. bedrock B. oxidation C. exfoliation
3. Stalactites and stalagmites may form in caves from dissolved ____.
A. calcite B. iron oxide C. carbon dioxide
4. An example of chemical weathering is ____.
A. an avalanche B. acid rain C. abrasion
5. The largest particle that makes up soil is ____.
A. silt B. sand C. clay
6. The layers of soil are called ____.
A. depositions B. sediments C. horizons
7. The action of weathered material moving from one location to another is called ____.
A. erosion B. evaporation C. exfoliation
8. The primary force behind the movement of weathered material is ____.
A. an explosion B. a chemical reaction C. gravity
9. An avalanche is most likely to occur ____.
A. on a high sand dune B. on a snowy mountain C. after a heavy rain
10. A delta may form at the mouth of a river as a result of ____.
A. deposition of sediment B. acid rain falling C. a sandstorm

- | | | |
|---------|-----|-----|
| 1. (A) | (B) | (C) |
| 2. (A) | (B) | (C) |
| 3. (A) | (B) | (C) |
| 4. (A) | (B) | (C) |
| 5. (A) | (B) | (C) |
| 6. (A) | (B) | (C) |
| 7. (A) | (B) | (C) |
| 8. (A) | (B) | (C) |
| 9. (A) | (B) | (C) |
| 10. (A) | (B) | (C) |

B. Write a question for something you would like to learn about the following:

- chemical weathering

- erosion

Weathering

Student Text pages 26–33

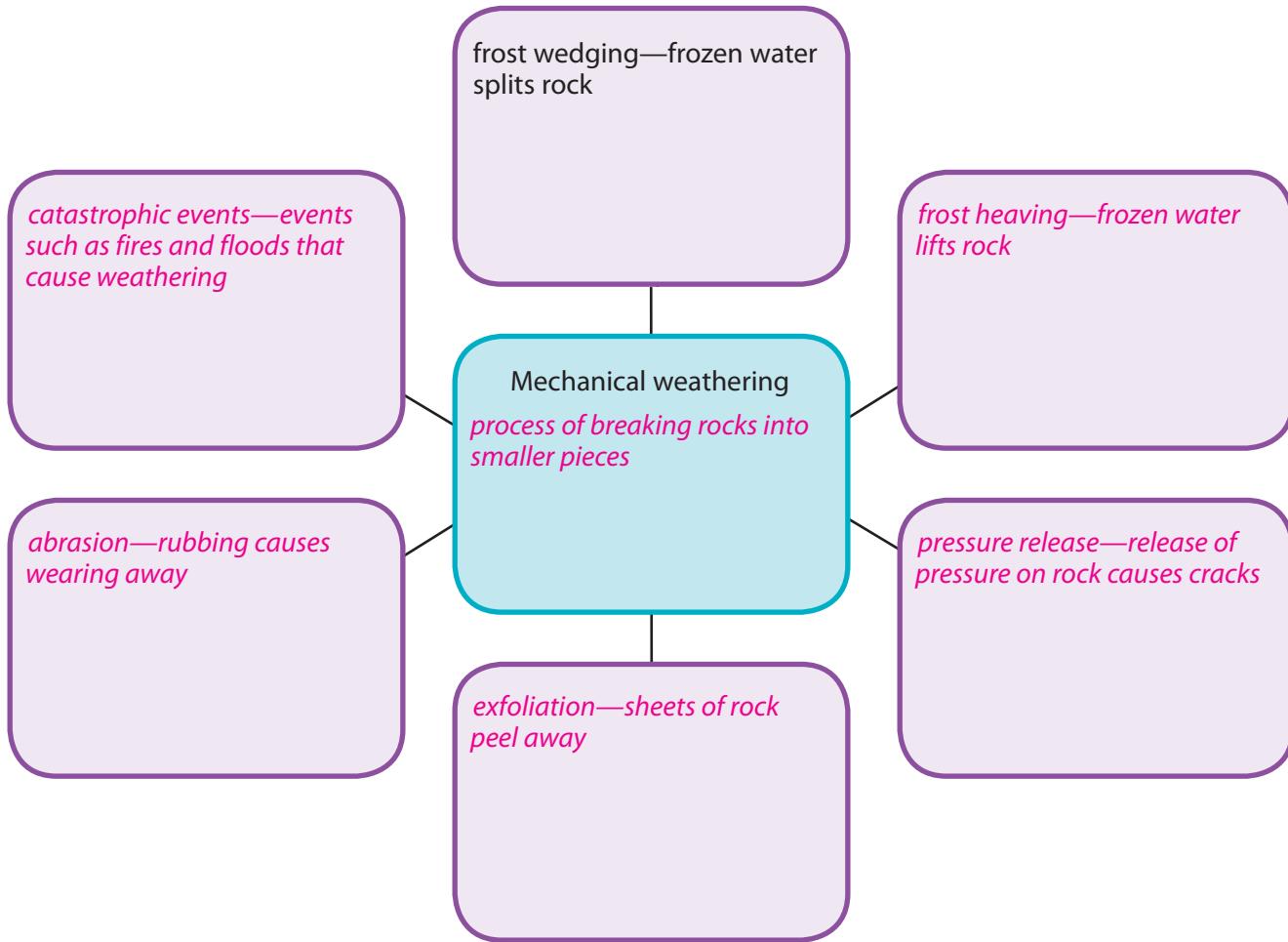
Name _____

Scientists often have differing viewpoints. How they interpret their observations and data reflects their viewpoints. For example, many scientists believe in an old Earth that is millions of years old. Others believe in a young Earth that is only thousands of years old.

A. Mark O if the statement reflects an old-Earth viewpoint. Write Y if the statement reflects a young-Earth viewpoint.

- Y 1. It does not take millions of years for rocks to change form.
- O 2. All rocks began as igneous and gradually changed to other forms.
- O 3. The materials that make up the earth have passed through the rock cycle.
- Y 4. During the Flood of Noah's day, some parts of the rock cycle probably occurred very quickly.

B. Complete the web.



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C. Make a web for chemical weathering on your own paper. *The web should include the two most common types of chemical weathering (oxidation and reaction of acids) with supporting details and/or examples under each.*

Study Guide

Student Text pages 26–33

Name _____



A. Write the letter of the correct answer.

- E 1. type of rock that forms from hardened sediment and tiny organisms
- B 2. type of rock that forms from cooled magma
- C 3. type of rock that forms by great heat and pressure
- A 4. forms when carbon dioxide dissolves in water
- H 5. the process of breaking down rocks
- D 6. name given to the changing of rock to different types
- F 7. forms from dissolved calcite and hangs from the ceiling of a cave
- G 8. builds up on the floor of a cave from dripping dissolved calcite

- A. carbonic acid
B. igneous rock
C. metamorphic rock
D. rock cycle
E. sedimentary rock
F. stalactite
G. stalagmite
H. weathering

B. Write **T** if the statement is true. If the statement is false, write a correction for the underlined words.

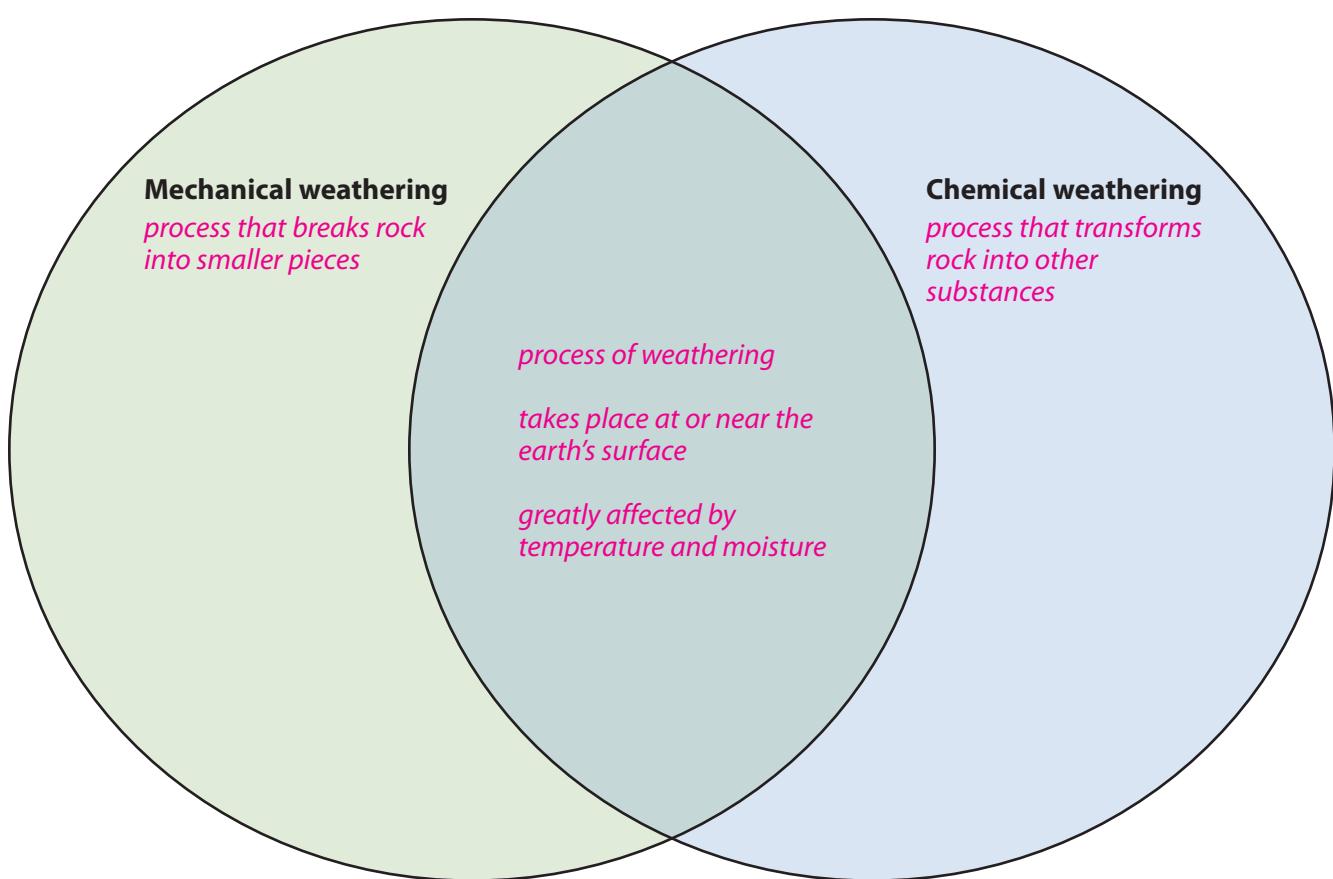
- T 9. Exfoliation is mechanical weathering that occurs when sheets of rock peel away.
- T 10. Mechanical weathering can occur as a result of catastrophic events such as fires and floods.
- under 11. The process of water freezing in the crack of a rock and expanding to push the rock up is called frost heaving.
- T 12. Abrasión is mechanical weathering that occurs when rocks rub against each other.
- Acid rain 13. Oxidation is chemical weathering that contains a solution of acids that weather rocks.
- T 14. The process of water freezing in the crack of a rock and expanding to split the rock is called frost wedging.
- T 15. Oxidation, a type of chemical weathering, happens when oxygen combines with what a rock is made of and forms new compounds. Sometimes the new compound is rust.
- pressure release 16. Frost action is a kind of mechanical weathering that occurs when a shift in the ground causes pressure to be removed and rock to expand and crack.
- T 17. Lichens and mosses can produce acids that weather rock.

C. Answer the question.

18. What are three ways weathering is a type of recycling in God's design for the earth?

to break down rocks, to form soil, to replenish minerals for plants to grow

D. Complete the Venn diagram to compare and contrast mechanical weathering and chemical weathering.



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Measuring Rocks

Name _____



- A. Follow these steps to measure the length and width of your rock. Then answer the question.**

1. Place your rock in the space provided below.
2. Mark the width of your rock by holding the pencil perpendicular to the paper and making one dot on each side of the rock at the widest place.
3. Follow the same procedure to mark the length of your rock.
4. Remove your rock from the paper.
5. Measure and record the rock's width and length in centimeters and millimeters.



1. width _____ cm _____ mm *Answers will vary.*

length _____ cm _____ mm

2. Which unit of measurement is more accurate—centimeters or millimeters? mm

- B. Circle the correct letter to answer the question. Then measure and record the mass of your rock.**

1. What is the mass of an object?

A. height and width of the object B. quantity of matter in the object

2. The mass of my rock is _____ grams. *Answers will vary.*

- C. Circle the correct letter to answer the question. Then measure and record the volume of your rock.**

1. What is the volume of an object?

A. the amount of space an object takes up B. the weight of an object

2. The volume of my rock is _____ milliliters. *Answers will vary.*

D. Follow the steps.

1. Trade rocks with someone else.
2. Measure the width, length, mass, and volume of the rock.
3. Record your measurements below.
4. Answer the question.

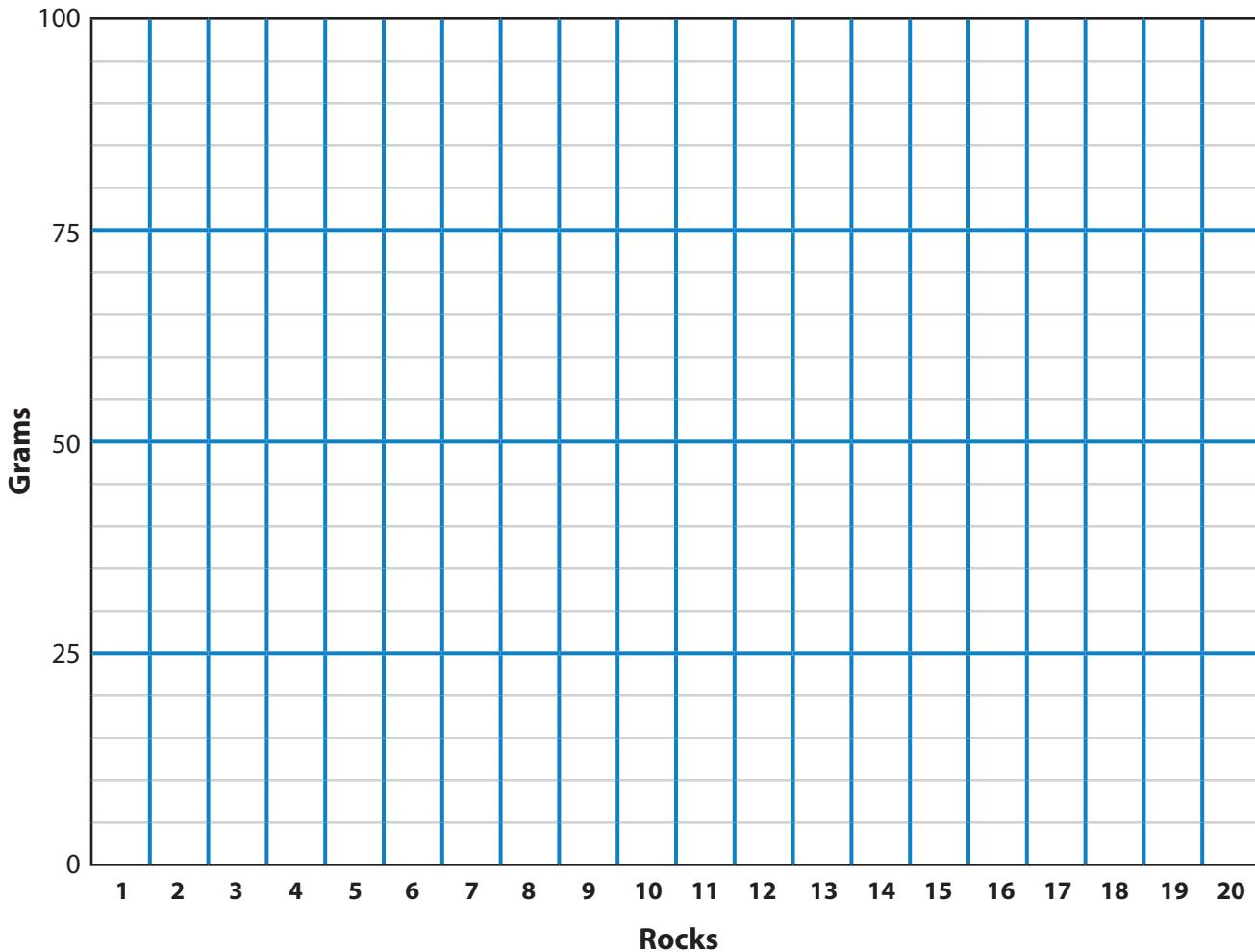
1. width _____ length _____ mass _____ volume _____

2. Why is it important for scientists to measure things more than once? *Possible answers: to verify results, to ensure accuracy*

E. Follow the directions.

1. Make a bar graph depicting the mass of each rock measured.
2. Answer the question. *Answers will vary.*

Rock Mass Bar Graph



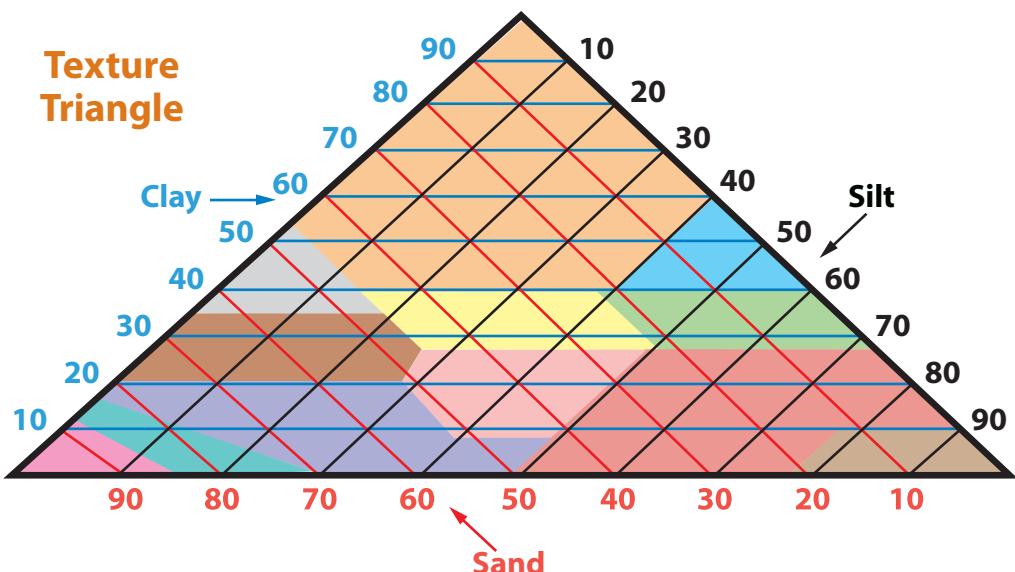
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What is the average mass of the rocks measured? _____

Pedologist in Training

Student Text pages 34–36

Name _____



Dr. Rock is conducting a training session on classifying different types of soil using the soil texture triangle. In a booming voice, Dr. Rock explains, “The soil you are classifying is 20% clay, 60% silt, and 20% sand. To find the soil’s texture class, follow these steps.

First, find the 20% clay number in blue.
Lightly trace along the blue line. Now, find the

60% silt number in black. Lightly trace along the black line. Last, locate the red 20% sand number. Lightly trace along the red line. The direction of the arrows can help you remember which line to read. The point where these three lines intersect is the texture class. Look at the color key. What is the texture class?” (silt loam)

A. Help Dr. Rock's pedologists classify these soil samples.

1. 10% clay; 30% silt; 60% sand sandy loam
2. 60% clay; 20% silt; 20% sand clay
3. 20% clay; 40% silt; 40% sand loam
4. 30% clay; 60% silt; 10% sand silty clay loam

B. A pedologist can classify soil samples with only two known percentages. Classify these soil samples.

5. 40% clay; 50% sand sandy clay
6. 90% silt; 10% sand silt





Study Guide

Student Text pages 34–36

Name _____

A. Write the letter of the correct answer.

- B** 1. The ___ of soil is the amount of each kind of particle in the soil sample.
A. horizon B. texture C. sediment
- C** 2. Decayed organic material contained in soil and subsoil is called _____.
A. silt B. loam C. humus
- A** 3. ___ is a fertile soil that has equal parts of sand and silt combined with about half as much clay.
A. Loam B. Texture C. Sediment
- C** 4. The particle that allows water and air to mix in the soil is _____.
A. sand B. clay C. silt
- A** 5. The largest kind of particle in soil, which allows soil to drain quickly, is _____.
A. sand B. clay C. silt
- C** 6. The smallest kind of particle in soil, which holds nutrients and water well, is _____.
A. silt B. sand C. clay

B. Write the answer.

7. What makes up soil? *water, air, humus, and small weathered particles of rocks and minerals*

8. What determines the composition and fertility of soil in a specific area? *the climate, the kinds of weathered rock, and the types of vegetation that decay to form the humus*

C. Write the letter of the correct answer.

- D** 9. loose material at the surface of the earth
C 10. a scientist who studies soil
F 11. layer in which plants germinate and roots grow
B 12. multiple layers of soil
A 13. unweathered rock that determines the texture of the soil above it
E 14. contains weathered minerals and some nutrients from the humus

- A. bedrock
B. horizons
C. pedologist
D. soil
E. subsoil
F. topsoil

Soil Detective

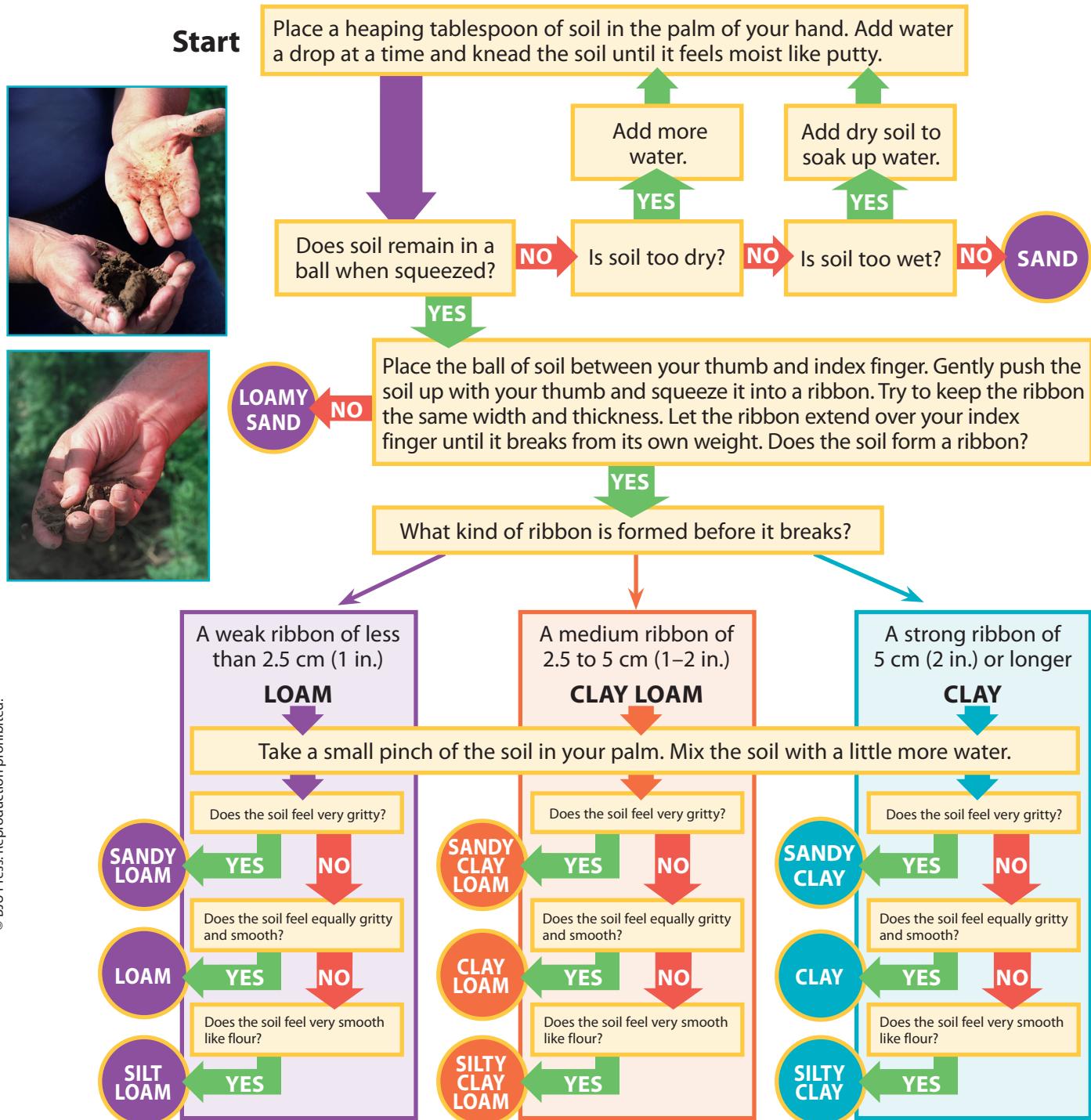
Name _____

Student Text page 37



- A. Collect a soil sample. Circle either yes or no to each question, and follow the flow chart to determine the texture of your soil sample. *All answers will vary.*

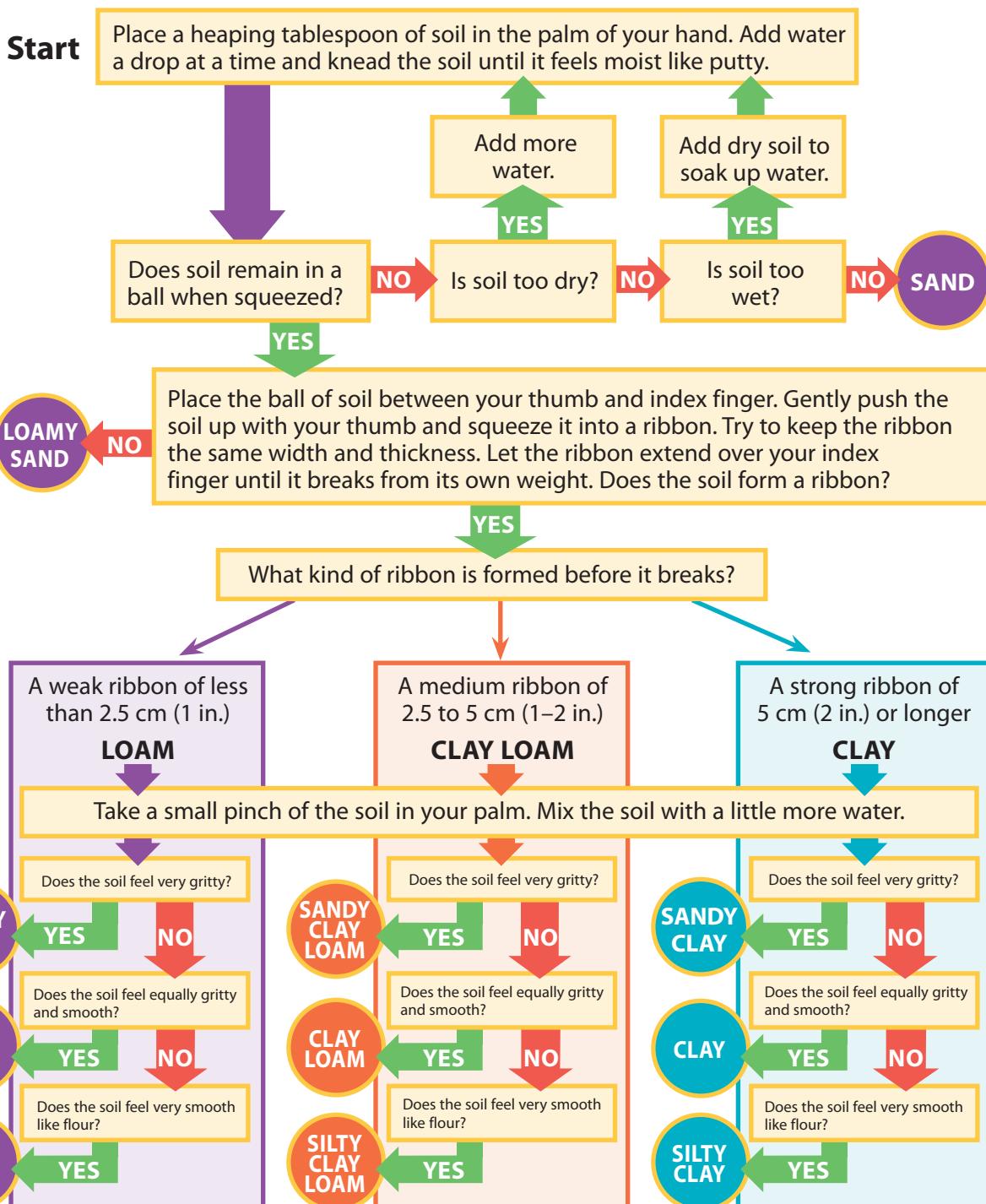
The soil sample was collected from _____.



The soil sample has _____ soil texture.

B. Follow the same procedure with a second soil sample. All answers will vary.

The soil sample was collected from _____.



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The soil sample has _____ soil texture.

Retaining the Right Amount

Student Text pages 38–39

Name _____



Problem

How can I mix clay, sand, and potting soil to obtain a soil sample that will retain 50% of the water it receives after 2 minutes?

Materials

small nail
4 foam cups, 12 or 16 oz
metric measuring cups
dry clay or clay cat litter (crushed)
sand
potting soil
4 clear plastic cups, 9 oz
water
stopwatch



Procedure—Part 1

	Water	Water drainage (amount of water in the plastic cup)	Water retention (160 mL — drainage)	Water retention		
				less	50%	more
250 mL of clay	160 mL					
250 mL of sand	160 mL					
250 mL of potting soil	160 mL					

Conclusions

- Which kind of soil allowed the most water to run through? Why? *Probably sand. Sand particles do not fit together tightly and sandy soil drains quickly.*
- Which kind of soil allowed the least water to run through? Why? *Probably clay. Clay particles stick close together and retain water.*

Problem

How can I mix clay, sand, and potting soil to obtain a soil sample that will retain 50% of the water it receives after 2 minutes?

Hypothesis (Be sure to include the amounts of your different soils when you state your hypothesis.)

Possible hypothesis:

100 mL each of sand and clay and 50 mL of potting soil (silt) will retain 50% of the water it receives after 2 minutes.

Procedure—Part 2

Record your measurements. (Be sure the total soil mixture is 250 mL.)

	Clay	Sand	Potting soil	Water	Water drainage (amount of water in the plastic cup)	Water retention (160 mL - drainage)	Water retention		
	less	50%	more						
soil mixture 1				160 mL					

Conclusions

1. Do your results support your hypothesis? Explain. _____

2. What mixture of soil had a water retention equal to or closest to 50%? *Answers will vary.* _____

3. If you had a plant that only needed 20% water retention, which type of soil would you probably use the most of? *probably sand* _____

Stream Erosion

Student Text pages 44–45

Name _____



Problem

How does the steepness of a slope affect the amount of erosion that is caused by a stream?



Materials

2 foil loaf pans
scissors
metric measuring cups
potting soil (dirt)
2 small rectangular baking pans
protractor
water
spray bottle
2 pieces of cheesecloth
2 clear plastic cups, 12 oz
balance

Hypothesis (Be sure to include the angle of your slope when you state your hypothesis.)

Possible hypothesis:

The loaf pan angled at 45° will have more eroded material than the pan angled at 20°.

Procedure

Record the measurements in the chart.

Angle of pan	Amount of dirt	Amount of water	Mass of eroded material
20°	250 mL	120 mL	_____ g
45°	250 mL	120 mL	_____ g

Conclusions

1. Do your results support your hypothesis? Which pan appeared to have more erosion?

Answers will vary. The pan with the steeper slope has more erosion.

2. Why would increasing the angle of the slope affect the amount of erosion? *The steeper the slope is, the faster the runoff will be, and the more erosion will occur.*

3. What do you think would happen if the water was poured rather than sprinkled?

Answers will vary. The poured water would increase the amount of the eroded dirt.

Study Guide

Student Text pages 40–43 and 46–49

Name _____



A. Write the answers.

1. Identify the difference between weathering and erosion. *Weathering is the breaking down of rocks, and erosion is the moving of weathered material from one place to another.*
2. Describe why depositions often look layered. *Sediment settles according to its weight. The heaviest sediment drops first, and the lightest sediment drops last, causing layers.*
3. List three agents of erosion. *water, wind, and ice*
4. Describe some problems wave erosion can cause for shipping and commerce. *Areas of land and sea channels may shift. Sandbars may cause shoals where ships may run aground. Channels fill with sediment and have to be dredged.*

B. Fill in the blanks.

5. Small particles produced by weathering are called *sediment*.
6. When weathered material moves from one place to another, *erosion* takes place.
7. *Deposition* occurs when water, wind, or ice drops rocks in a new location.
8. The sediment that a stream carries is called its *load*.
9. A *delta* is an area of sediment rich in nutrients that has been deposited at the mouth of a river.
10. A *glacier* forms where layers of unmelted snow have compacted into ice.
11. The process of *plucking* happens when a glacier pulls pieces of bedrock loose and carries them along.
12. Piles of rocks and soil deposited by a glacier are called *moraines*.



C. Write T if the statement is true. If the statement is false, write a correction for the underlined words.

T

13. The primary force behind erosion is gravity.

T

14. During a dust storm the wind can blow clouds of clay and silt particles high into the air.

mass movement

15. When gravity is the primary factor in movement of sediment, the movement is called deflation.

faster

16. The slower a stream moves, the more sediment it can pick up and move.

T

17. When blowing wind picks up loose sediment and carries it away, the process is called deflation.

T

18. The shoreline constantly changes as water erosion and deposition take place.

Wind

19. Water is the agent of erosion in dry areas, such as deserts.

sandstorm

20. A sand dune is a storm in which the wind blows sand close to the ground.

D. Match each mass movement with its description.

- D 21. gravity pulls huge slabs of rock down a mountain

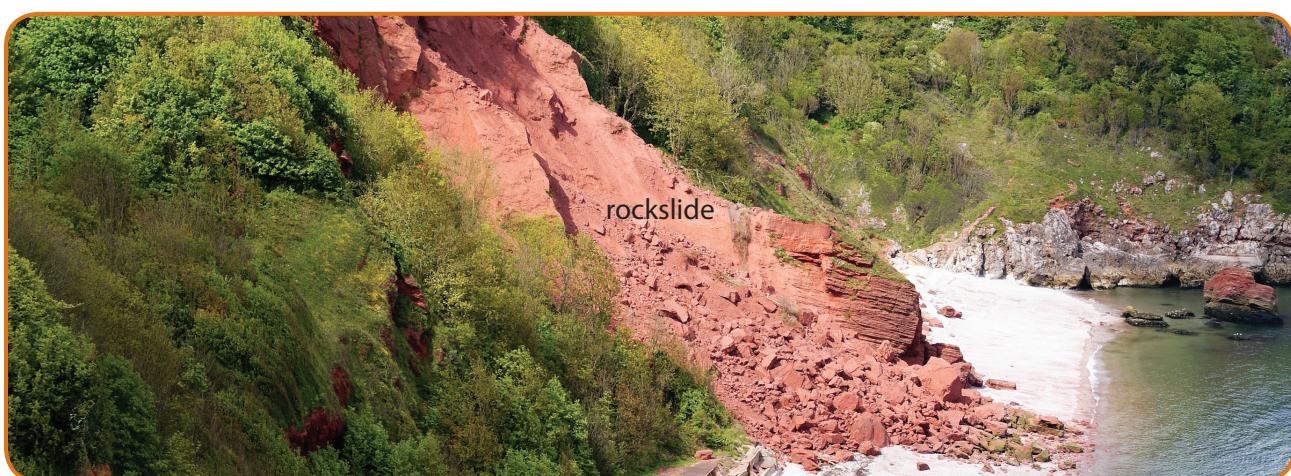
- A. avalanche
B. earth flow
C. mudflow
D. rockslide
E. soil creep

- E 22. gravity slowly pulls soil down the slope of a hill

- B 23. gravity pulls rock and sediment down a hill

- C 24. gravity pulls a combination of water and soil down a hill

- A 25. gravity pulls huge amounts of snow down a mountain



Study Skill: PQ3R

Name _____

- A. Practice the PQ3R study method as you read “Devils Postpile National Monument” from the page your teacher gives you. Begin by using the *Preview* step. Check each box as you complete the step.

Preview (Skim)

1. What do you look at during your preview?

*title, subheadings, illustrations, captions, bold words,
and italicized words*

Study Skill

P review	Skim the text.
Q uestion	Ask questions.
R ead	Look for answers.
R ecite	Answer your questions.
R eview	Reread and think about what you have learned.

2. What do you think this article is about? *Devils Postpile National Monument*

- B. Follow the middle three steps (*Question*, *Read*, and *Recite*) for the first section of the article.

Question

3. Make a question from the title of the article “Devils Postpile National Monument.” *Possible answers: What is Devils Postpile National Monument? Where is Devils Postpile National Monument?*

4. Look at the first illustration. Make a question from the caption under the map. *Possible answers: Where is Mammoth Lakes? What is the monument?*

Read

5. Think about your questions as you silently read the first section of the article.

Recite

6. Tell yourself the answers to the questions you wrote in numbers 3–4.

- C. Repeat the *Question*, *Read*, and *Recite* steps for the “Volcanic Formation” part as you read the next section.

Question

7. Make a question from the subheading “Volcanic Formation.” *Possible answers: What volcanic formation is part of the monument? How was the volcanic formation formed?*

8. Make a question from the caption under the second picture. *Possible answers: What made the columns? How did the columns appear?*

9. Make a question with the word *basalt*. *Possible answer: What is basalt?*

10. Make a question with the words *columnar basalt*. *Possible answers: What is columnar basalt? How did columnar basalt form?*

Read

11. Think about your questions as you read silently.

Recite

12. Tell yourself the answers to the questions you wrote in numbers 7–10.

D. Repeat the Question, Read, and Recite steps for the “Glacier Erosion” section.

Question

13. Make a question from the subheading “Glacier Erosion.” *Possible answers: What did glaciers erode? What was formed by glacier erosion? What is glacier erosion?*

14. Make a question from the caption under the picture. *Possible answer: What is glacier polish?*

15. Make a question with the word *striations*. *Possible answer: What are striations?*

Read

16. Think about your questions as you read “Glacier Erosion” silently.

Recite

17. Tell yourself the answers to the questions you wrote in numbers 13–15.

E. Repeat the Question, Read, and Recite steps as you read the last section.

Question, **R**ead, **R**ecite Again

18. On your own paper, make questions for the next section, “Rainbow Falls.” Read the section and recite your answers. *Answers will vary.*

F. Complete the last step in the PQ3R study method.

Review

19. Look back at the title, subheadings, captions, bold words, and italicized words. Think about the information you have learned.

Thinking It Through

Student Text pages 26–50

Name _____



Plan and write a paragraph answering each question.

- Drake and Cole took a hike near their campsite to collect leaves for a project. They found interesting trees growing among the boulders and rocks that formed a ridge. From the top of the ridge, they looked back at their camp in the bottom of a wide, curved valley. Describe how the ridge and valley were possibly formed through erosion and deposition.

Answer should include the following: They were possibly formed by erosion from a glacier. Gravity causes the heavy mass of ice to slide downhill. As it moves, it gouges out the ground under it and picks up bedrock in a process called plucking. The movement erodes rock to form a U-shaped valley. A melting glacier forms a moraine from the deposition of rock that has been picked up.

- The Grant Memorial in Washington, DC, consists of bronze statues on white marble bases. Something has caused some of the bronze to dissolve and thus discolor the marble. Describe what may have caused the weathering of these bronze statues.

Answer should include the following: Acid rain may have caused the weathering. Smoke, exhaust, and pollution in the air combine to form acid rain. The acid in the rain would cause the bronze to dissolve and run down to stain the marble.

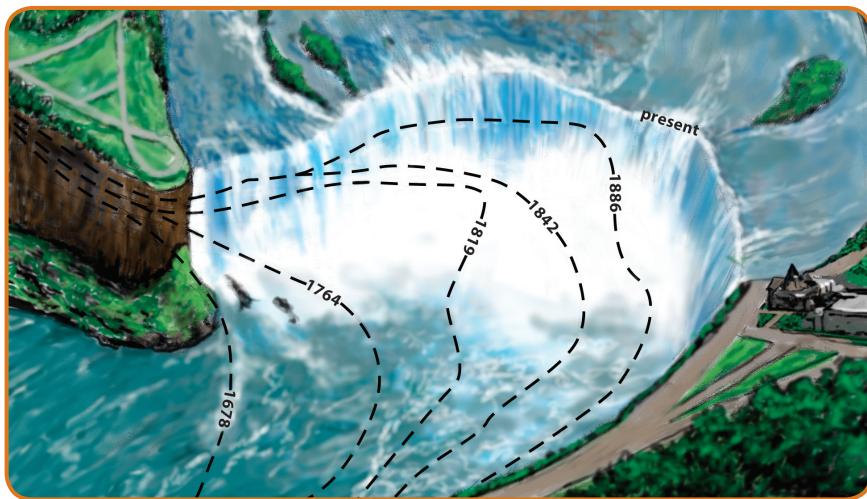
3. Julio needed to change the path of a stream in his pasture. The old stream was wide and shallow. He dug a new streambed that was much narrower. How would the difference in width affect the flow of the water and the erosion of the stream?

Answer should include the following: A narrower streambed would cause the water to flow faster. Erosion would be greater as the water and load moved faster. Because there would be less sediment deposition, the streambed would probably deepen or become wider.

4. The Great Lakes and the Niagara River were formed by glaciers. The brink, or edge, of Niagara Falls has moved over the years. Look at the diagram showing the changes in the location of the brink of Horseshoe Falls from 1678 until 2005. Describe the processes that caused the changes of location.

Answer should include the following: The rushing water has eroded the rocks that form the falls. The erosion caused the brink of the falls to move. As the brink erodes, the length of the brink gets wider.

Horseshoe Falls Erosion



Looking Ahead

Name _____

A. Mark the sentence that uses the bold term correctly.

1. The newly drilled natural gas wells provide a **renewable resource** of energy to our community.
 The county is building a wind farm as a **renewable resource** for electricity.
2. Tanker ships transport the crude oil to a **refinery** in another state.
 The **refinery** makes the wood into useable lumber.
3. **Nuclear energy** from uranium produces steam to run turbines.
 Fossil fuels such as uranium provide much of our **nuclear energy**.
4. **Hydroelectric** power plants are found near rivers.
 Anthracite coal from the mine is burned to produce **hydroelectric** power.
5. The **smelting** process is used to mine minerals from the earth.
 Some minerals are purified for use through a process known as **smelting**.
6. Aluminum cans are easy to crush because the metal is **malleable**.
 Sturdy **malleable** metals are used to make armored military vehicles.
7. The **ground cover** crop of corn produced a good fall harvest.
 The **ground cover** crop of clover prevented erosion during the winter.
8. The round **hydrosphere** tanks hold water at treatment plants.
 The **hydrosphere** contains all of the water used on Earth.
9. An underground **aquifer** provides water to the lake in the desert.
 Fishing boats find an abundance of fish in the **aquifer** offshore.
10. The thin saltwater **ice sheet** in the Arctic Ocean is easily broken by ships.
 The fresh water in Antarctica is contained in a large, thick **ice sheet**.

B. Write a question for something you would like to learn about the following:

- the water cycle

- conservation

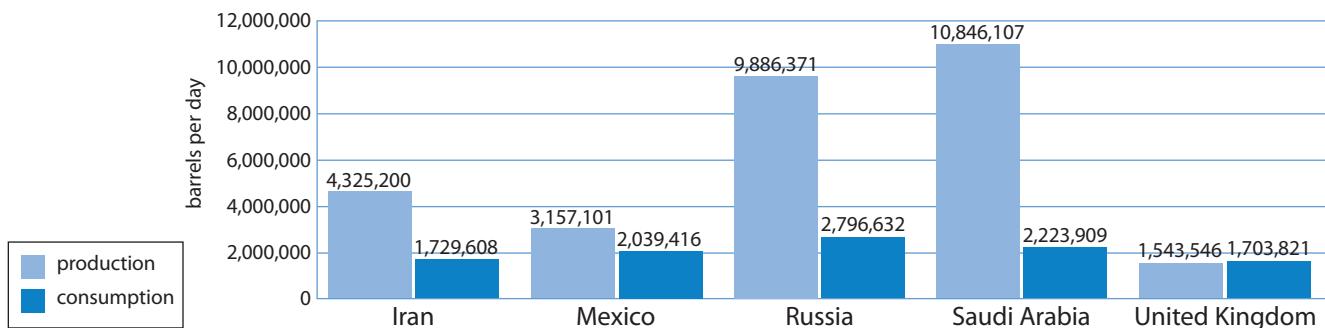
Nonrenewable Energy

Name _____

Student Text pages 52–55

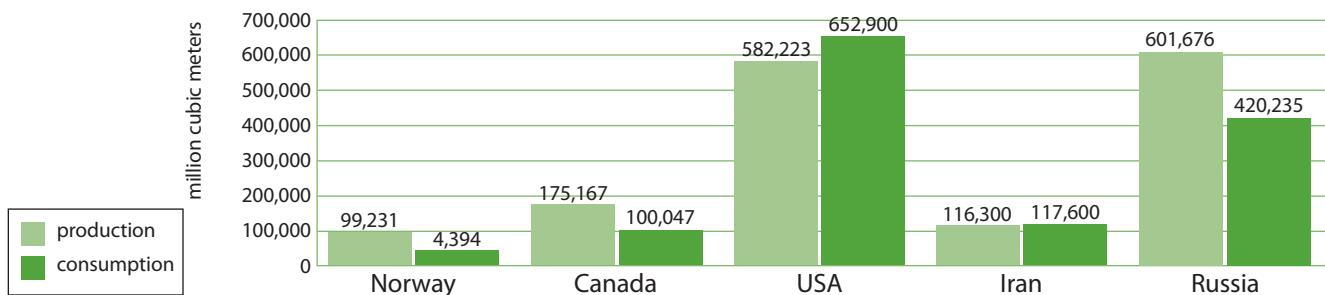
Use the graphs to answer the questions.

Oil production and consumption in 2009



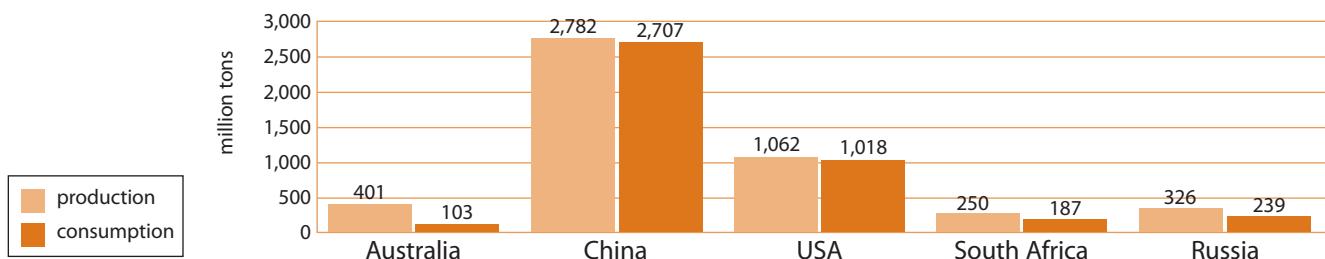
- Which country in this group had the largest oil production in 2009? *Saudi Arabia*
- Which country in this group used more oil than it produced in 2009? *the United Kingdom*
- Would countries that use more oil than they can produce need to export or import oil? *import*

Gas production and consumption in 2009



- What unit of measurement does this graph use to compare gas production and consumption? *million cubic meters*
- Based on the information in this graph, which countries would need to import natural gas? *Iran and the USA*

Coal production and consumption in 2009



- Which two countries in this group produced the most coal in 2009? *China and the USA*
- How much more coal did South Africa produce than it used? *63 million tons*

Clean Up the Spill

Student Text pages 56–57

Name _____



Problem

What is the most effective method of removing an oil spill?

Materials

baking pan
100 mL cooking oil
water
waste pan for oil
paper towels
spoon
10–15 cotton balls
liquid dish soap
medicine dropper



Hypothesis

(Include both the method you think is most effective and the amount of the material you think will clean up the oil spill.)

Possible hypotheses:

1. Ten paper towels will absorb and pick up the oil off the top of the water in the pan.
2. Twenty spoonfuls could remove the oil from the top of the water.

Procedure

Cleanup material	Success of the material and method
1.	
2.	
3.	
4.	
5.	

Conclusions

1. How successful was your chosen method for cleaning up the spill?

Explain your answer. _____

2. How did the method and materials you chose to clean up the spill represent a method that is actually used to clean up an oil spill? _____

3. How successful were other methods and materials for cleaning up the spill? _____

4. Do you think any of the methods you chose to use would pose harm to wildlife living around the spill? Explain. _____

5. Which method took the most time to clean up the spill? _____

6. Which method do you think might cost the least if there were a large spill? _____

Study Guide

Student Text pages 52–55 and 58–61

Name _____



A. Write the correct term for each description.

- | | |
|--------------------------|---|
| <u>crude oil</u> | 1. unrefined oil, petroleum |
| <u>natural resources</u> | 2. the materials available on Earth for man's use |
| <u>uranium</u> | 3. mineral used to produce nuclear energy |
| <u>nonrenewable</u> | 4. resources that cannot be replaced easily |
| <u>refinery</u> | 5. a factory that processes crude oil for use |
| <u>coal</u> | 6. solid fossil fuel that is often used to generate electricity |
| <u>petroleum</u> | 7. liquid form of fossil fuel that can be refined to produce products such as gasoline and kerosene |
| <u>renewable</u> | 8. resources that can be replaced by natural means in a relatively short period of time |
| <u>natural gas</u> | 9. fossil fuel that is used to produce heat and light |
| <u>pollution</u> | 10. possible result of burning or spilling crude oil products |
| <u>fossil fuels</u> | 11. nonrenewable resources formed when the remains of plants and animals are buried quickly |
| <u>petrochemical</u> | 12. a chemical produced from oil for use in other products |

B. Identify the types of energy resources. Write **N** if it is nonrenewable and **R** if it is renewable.

- | | |
|----------|--------------------------|
| <u>N</u> | 13. coal |
| <u>R</u> | 14. geothermal energy |
| <u>R</u> | 15. hydroelectric energy |
| <u>N</u> | 16. natural gas |
| <u>N</u> | 17. petroleum |
| <u>R</u> | 18. solar energy |
| <u>N</u> | 19. nuclear energy |
| <u>R</u> | 20. wind energy |



C. Write the kind(s) of renewable resources for each description.

21. uses hot water geothermal, solar
22. may require large land areas solar, wind
23. uses steam to turn turbines to produce electricity geothermal, solar
24. uses water to turn turbines hydroelectric

D. Write **T if the sentence is true. If the statement is false, write a correction for the underlined words.**

T

25. The grades of coal burn differently and cause different levels of pollution.

hydroelectric

26. To produce nuclear energy, a dam is built across a river to form a reservoir.

renewable

27. Most nonrenewable energy sources are clean and efficient but are too expensive to use on a large scale.



E. Choose one of the energy resources. Write a paragraph to identify and describe advantages and disadvantages of using that resource.

hydroelectric energy geothermal energy wind energy solar energy

Answers should include the following:

Hydroelectric energy: Advantages—reservoirs provide water for irrigation and serve as recreational lakes.

Disadvantages—reservoirs require a large river and require the flooding of large land areas.

Geothermal energy: Advantages—power plants are inexpensive to build and produce no air pollutants or radioactive hazards. Disadvantages—Power plants must be close to areas of hot magma; water pollutants must be disposed of.

Wind energy: Advantages—windmills do not cause pollution and require little maintenance.

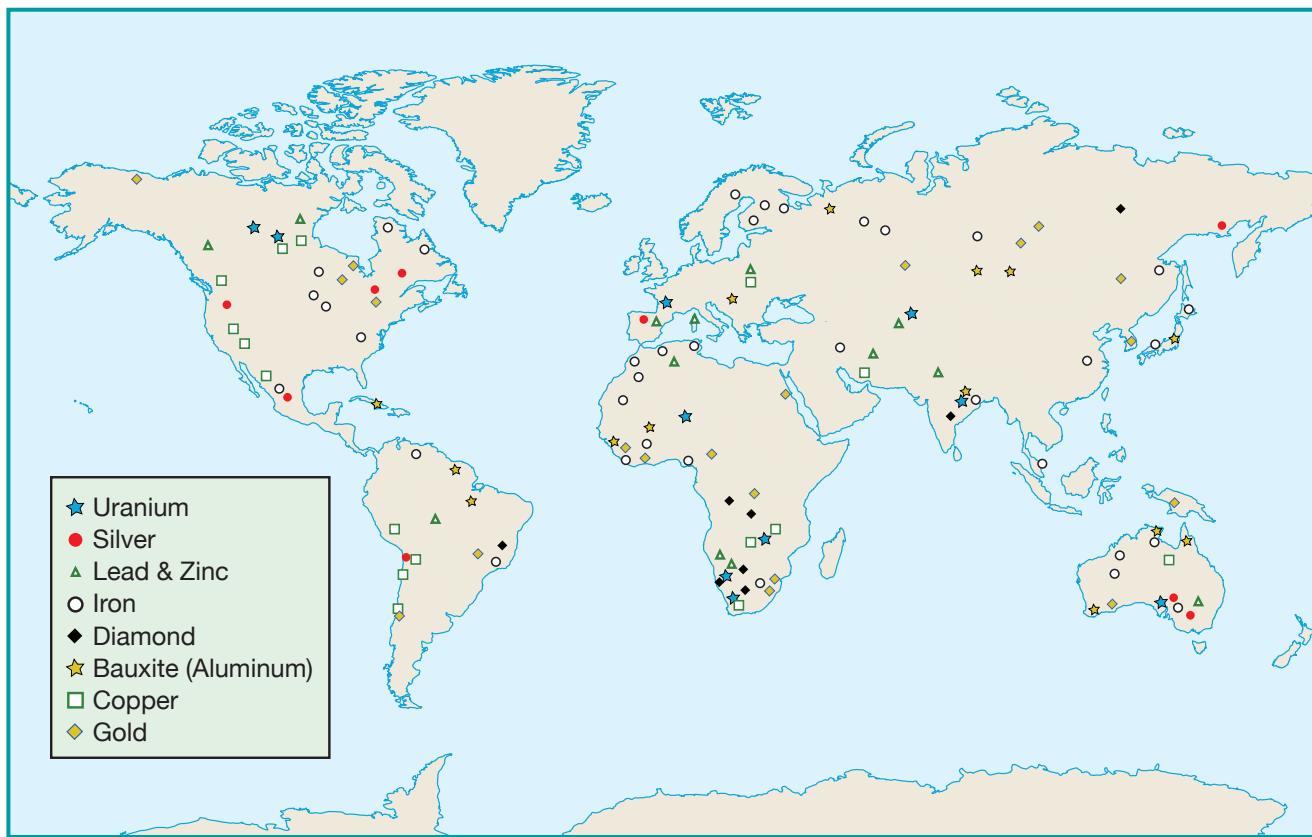
Disadvantages—windmills take up much space and require steady winds; the energy cannot be stored.

Solar energy: Advantages—solar fields use little water and produce no pollution. Disadvantages—power collection cannot happen after sunset; solar collection cells are expensive; require large amounts of land.

Mineral Resources

Student Text pages 62–63

Name _____



Use the map to answer the questions.

1. What kind of information is found on this map? *location of mineral resources*
2. Which kinds of minerals are found near where you live? *Answers will vary.*
3. Which continent has more silver resources—Africa or North America? *North America*
4. Which minerals are found along the west coast of North America? *lead, zinc, copper, silver, and iron*
5. Most nuclear energy depends on the mineral uranium. Based on this map, which continents have uranium resources? *North America, Europe, Asia, Africa, and Australia*
6. Aluminum comes from the mineral bauxite. Which continent has more bauxite resources—South America or Australia? *Australia*



Study Guide

Student Text pages 62–65

Name _____

A. Match the metal with its description.

- D** 1. a strong, durable metal that is able to attract magnets
- A** 2. a strong, lightweight metal that is the most abundant metal in the earth's crust
- E** 3. a useful malleable metal that is easily scratched and tarnished
- C** 4. a valuable malleable metal that often indicates wealth
- B** 5. a malleable red-orange metal that conducts electricity and is resistant to rust

- A. aluminum
B. copper
C. gold
D. iron
E. silver

B. Write the word for each definition.

- mineral** 6. a substance found naturally in the earth's surface that has never been alive
- vein** 7. a concentrated area of specific minerals, often found near volcanic areas
- ores** 8. materials that have usable amounts of metal in them
- smelting** 9. a process used to separate metal in an ore from the other materials
- malleable** 10. able to be dented or shaped

C. Write the letter(s) of the ways each farmer could improve his soil and his crops.

- B** 11. Mr. Green has several acres of flatland that he uses at certain times of the year. The rain and wind cause serious erosion on these acres when he does not have crops planted on them. What can he do to prevent this erosion?
- A** 12. Mr. Stevenson has added fertilizers to his crops and has changed the crops planted in each field, but still the crops are not growing well. What can he do next year to help increase the amount of nutrients in the soil for a future crop?
- B, C** 13. Mrs. Sloane's neighbor complains about rain washing his crops and topsoil downhill. Which method can Mrs. Sloane recommend to her neighbor to prepare the ground for planting?
- A, D** 14. The Carter family has planted wheat and corn on the same two fields for several years. Now the crops are not as plentiful as they were in previous years. What could they do to improve crop production?

- A. let the ground lie fallow for a season
B. use ground cover
C. contour plowing
D. rotate crops

Erosion Prevention

Student Text pages 66–67

Name _____



Problem

How can you reduce the amount of erosion on a 20° slope?

Materials

2 foil baking pans (9"×13")
scissors
potting soil
containers for runoff
protractor
water
watering can
balance
cheesecloth
4 clear plastic cups, 12 oz

Erosion prevention materials

Hypothesis

Write or draw your plan to help Farmer Brown reduce erosion.

Procedure

Pans	Mass of eroded material
pan with erosion protection	
pan without erosion protection	

Conclusions

1. Which pan had more erosion? *most likely the pan without erosion protections*

2. What prevented the soil in one pan from eroding as much as the soil in the other pan? _____

3. What else could you have done to the soil to help prevent erosion? _____



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Water Facts

Student Text pages 68–73

Name _____

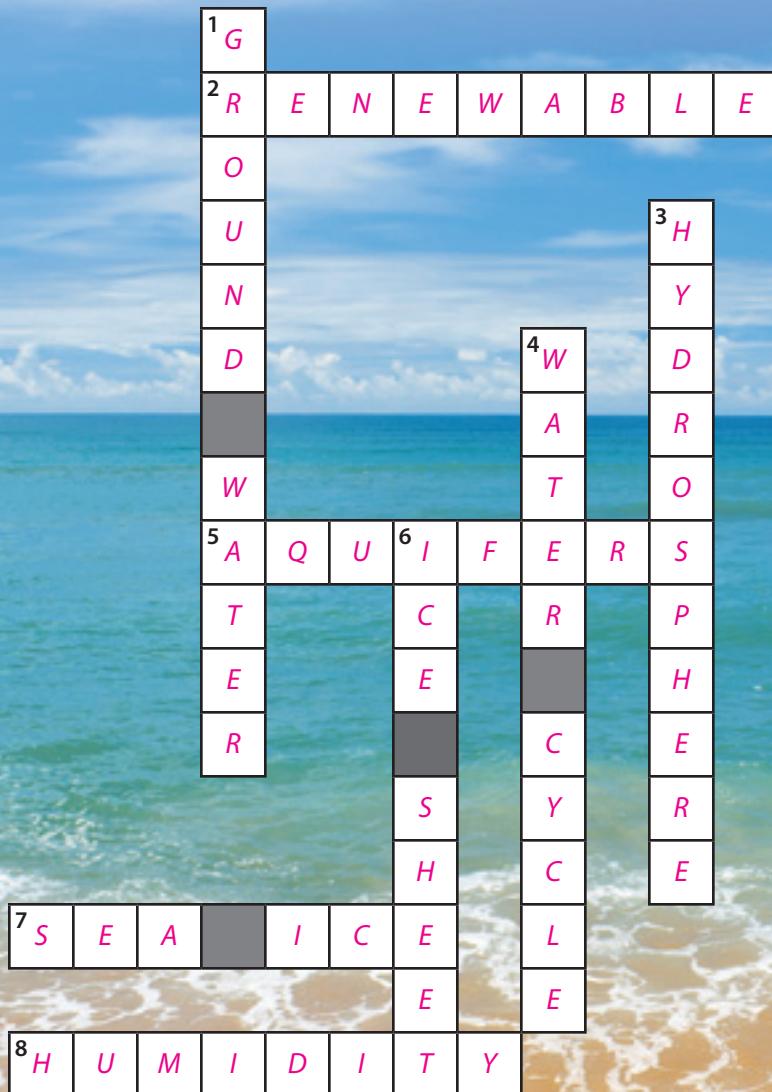
Complete the puzzle.

Across

- 2. the kind of resource water is
 - 5. layers of sand, gravel, or bedrock that hold and move ground water
 - 7. frozen ocean water
 - 8. water vapor in the air

Down

- water located under the surface of the earth
 - all of Earth's water
 - describes the path water takes between land and sky
 - frozen fresh water covering Antarctica



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Study Guide

Student Text pages 68–73

Name _____

A. Match the description with the correct term.

- D 1. all of Earth's water
A 2. layers of sand, gravel, or bedrock that hold and move ground water
C 3. water vapor in the air
E 4. tiny ocean organisms that carry on photosynthesis
B 5. water stored beneath the surface of the earth

- A. aquifer
B. ground water
C. humidity
D. hydrosphere
E. phytoplankton

B. Fill in the blanks.

6. Water falls to the earth as precipitation and returns to the sky through transpiration and evaporation.
7. Condensation happens when water vapor cools and changes back to a liquid.
8. An ice sheet is frozen fresh water, but sea ice is frozen salt water from the ocean.
9. The frozen fresh water covering Antarctica is an ice sheet, but when an ice sheet reaches the ocean and floats, it is called an ice shelf.
10. Floating pieces of glaciers, ice sheets, or ice shelves are called icebergs.

C. Complete the section.

11. List three ways that the oceans provide for man. Possible answers: The oceans provide fresh water through the water cycle, play a key role in the carbon dioxide-oxygen cycle, provide oxygen by photosynthesis of phytoplankton, and influence climates.
12. Explain three things you can do to help conserve natural resources. Reduce the amount of energy used. Reuse materials that would otherwise get thrown away. Recycle those resources that can be made into other products.

How Much Water?

Name _____



A. Follow the steps.

1. Put a tally mark for each time your family uses water in one day.
2. Multiply the number of times water is used by the number of gallons of water to get the total number of gallons used.
3. Add the total number of gallons to find out how much water your family uses in one day.

	Tally marks	Number of times water is used	Gallons	Total (number of times water is used × gallons)
Drinking 8 oz of water			1/16	
Washing a load of clothes			25 per load	
Running dishwasher			10 per load	
Washing dishes by hand			15	
Taking a bath			30	
Taking a shower			20	
Washing face and hands			1	
Flushing toilet			7	
Brushing teeth			1.5	
			Total	

B. How many baths are in a rainstorm?

Have you ever wondered how many bathtubs full of water fall on your yard during a rainstorm? It is not hard to figure out!

On your own paper, use your calculator and follow these steps to figure out how many gallons of water fall on your yard.

1. Determine the size of your yard.
2. Determine how many inches of rain you want to fall on your yard.
3. Convert the feet to inches and multiply to find the volume of your yard.
4. Convert the cubic inches back to cubic feet. To do this, you need to divide your total by how many inches are in one cubic foot ($12 \times 12 \times 12$). Round your number to the nearest hundredth.
5. Each cubic foot can hold approximately 7.48 gallons of water. Multiply your total cubic feet by 7.48 to get the number of gallons that fell on your yard. Round to the nearest gallon.
6. An average five-foot bathtub holds about 40 gallons of water. How many complete bathtubs could you fill up from your rainstorm?

Example

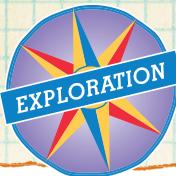
10 feet × 10 feet
1 inch of rain

$$120 \times 120 \times 1 = 14,400 \text{ cubic inches}$$

$$14,400 \div 1,728 = 8.33 \text{ cubic feet}$$

$$8.33 \times 7.48 = 62 \text{ gallons (rounded)}$$

$$62 \div 40 = 1.55 \\ 1 \text{ complete bathtub}$$

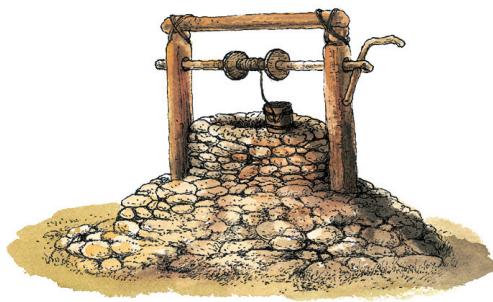


Water in Israel

Name _____

Answer the questions after you read “Water in Israel” from the pages your teacher gives you. You will need to use your Bible.

1. What does modern-day Israel use to help supplement its water supply? desalination plants
2. Read Genesis 26:12–15. What happened to the wells that Abraham had dug? The Philistines filled them with dirt.
3. Read Genesis 29:1–3. What was the water used for in the land of Haran? to water the sheep
4. What was the cleanest source of water in ancient Israel? The wells that people dug supplied the cleanest water.
5. Why do you think a woman went to get water in the early morning and evening? Answers will vary. It was cooler at those times of the day.
6. Since water was not easy to obtain, what activities do you think the people in Bible times did not do as often as you do? Possible answers: They did not wash their clothes as often. They did not take baths as often.
7. How are cisterns different from wells? Wells often had a spring or source of water flowing into them. Cisterns were storage places for rainwater.
8. What was the Living Water that Jesus offered the Samaritan woman in John 4:1–15? eternal life; everlasting life



To prepare for the attack of the Assyrians, King Hezekiah built a water tunnel. It went from the Gihon Spring, beneath the city walls, and into Jerusalem. Because of the tunnel, there would be enough water even if the city were surrounded. This tunnel emptied into the Pool of Siloam. People came there to draw water. It was probably used for bathing as well. Read John 9:6–7.

9. Where did Jesus tell the blind man to wash in order to receive his sight? the Pool of Siloam

The city of Jerusalem had a big water problem. There was little rain, and the Jordan River was many miles away. The Israelites solved the problem by building tunnels and aqueducts to channel spring water into Jerusalem. Large pools were built to collect the water. The Pool of Bethesda was one of these pools. It was near the sheep market and was used to wash the sheep that were to be sacrificed at the temple. Read John 5:1–9.

10. What else happened at this pool? Jesus healed a man who had been sick for 38 years.

AUVs

Student Text pages 74–75

Name _____



A. Complete the puzzle.

1.	B	A	T	H	Y	S	C	A	P	H	E
2.	S	E	A	G	L	I	D	E	R		
3.	P	I	C	T	U	R	E	S			
4.	T	E	T	H	E	R	E	D			
5.	M	I	S	S	I	O	N	S	C	R	I
6.	O	I	L								
7.	G	L	O	R	Y						
8.	A	U	T	O	N	O	M	O	U	S	
9.	G	P	S								
10.	B	A	T	T	E	R	Y				

1. William Beebe and Otis Barton used a _____ to explore deep in the sea.
2. Scientists at the University of Washington developed the ____, a type of AUV.
3. AUVs can be programmed to take ____ of the changes on the ocean floor.
4. AUVs are not _____ to a ship when underwater.
5. AUVs can operate by themselves because _____ are programmed into them.
6. AUVs are sometimes used to check undersea _____ lines.
7. People should maximize the usefulness of the earth for God's _____.
8. The A in AUV refers to the word _____, meaning independent or self-contained.
9. When an AUV comes to the surface, it can determine its location by using _____.
10. Most AUVs operate by using a _____.



B. The shaded letters in the puzzle reveal an important word. Write that word and its definition.

Technology is the tools we invent, develop, and use in order to solve problems or get things done.



Thinking It Through

Student Text pages 52–75

Name _____

Plan and write a paragraph answering each question.

1. What are some advantages and disadvantages of nuclear energy?

Answer should include the following: Nuclear power is efficient and clean but can be dangerous if not carefully controlled. Radiation can escape from a nuclear plant and cause pollution and health problems. Used fuel needs special storage to keep it from harming the environment.

2. What is the relationship between geothermal energy and volcanic activity?

Answer should include the following: Volcanic activity occurs where magma rises to the surface. Geothermal energy is most often available where magma is closer to the surface. Consequently, geothermal energy tends to occur in areas where there is volcanic activity.

3. How would you respond to someone who told you that technology is dangerous and sinful? Your answer should include a definition of what technology is and some biblical principles.

Answers will vary but should include that technology is taking what God has created and designed and using it to do work and meet the needs of people. Technology includes tools that we invent, develop, and use to solve problems or get things done. God gave Adam and all people after him the responsibility to maximize the usefulness of the earth to the glory of God and for the benefit of mankind (Gen. 1:28). Man is sinful and sometimes uses technology in sinful ways, but technology itself is not sinful. Rakes and fishing poles are just as much technology as cell phones and computers. A Christian should seek to use technology in ways that glorify God (1 Cor. 10:31) and benefit others.

Looking Ahead

Name _____

A. Circle the word or phrase that best completes each sentence.

1. (Cell theory / Reproduction) allows the life cycle to begin again.
2. Every living thing is made up of at least one (organism / cell).
3. A microscope is an instrument that uses lenses to (enlarge) / reduce the appearance of objects.
4. Organs in the body work together to form (tissues / systems).
5. Cell walls are part of (plant) / animal cells.
6. (Phyla / Organelles) are structures within cells that help the cells function as they were designed.
7. Bacteria are microscopic organisms that live (alone / in colonies).
8. The process of photosynthesis allows plants to release useful (oxygen) / chlorophyll).
9. Man was created in God's image and can have a personal relationship with Him. This makes humans (different from) / the same as animals.
10. The (common / scientific) name of an organism is made up of its genus name and its species name.

B. Write a question for something you would like to learn about the following:

- cells

- classification of organisms

Using a Microscope

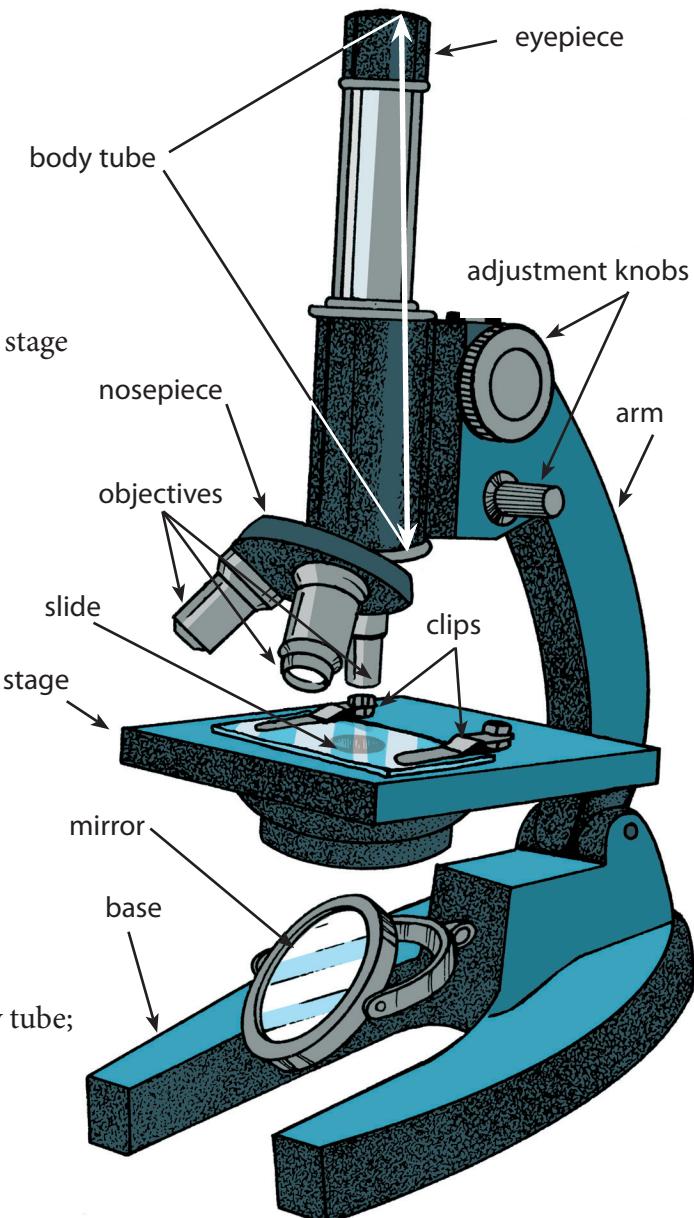
Name _____

Cells come in all shapes and sizes. Using a microscope allows us to appreciate the small details and design of God's creation.

Match the microscope parts with their descriptions.

- A. adjustment knobs
- B. base
- C. clips
- D. eyepiece
- E. mirror
- F. nosepiece
- G. objectives
- H. slide

- C** 1. hold the slide in place on the stage
- B** 2. bottom of the microscope; supports the microscope
- A** 3. turn these to move the body tube up and down to focus the image of the object
- E** 4. reflects light up through the stage
- F** 5. a rotating disc that holds objective lenses of different magnification
- H** 6. a thin, small piece of glass where a sample is placed
- D** 7. located at the top of the body tube; holds magnification lens
- G** 8. extensions under a revolving disc; contain microscope lenses



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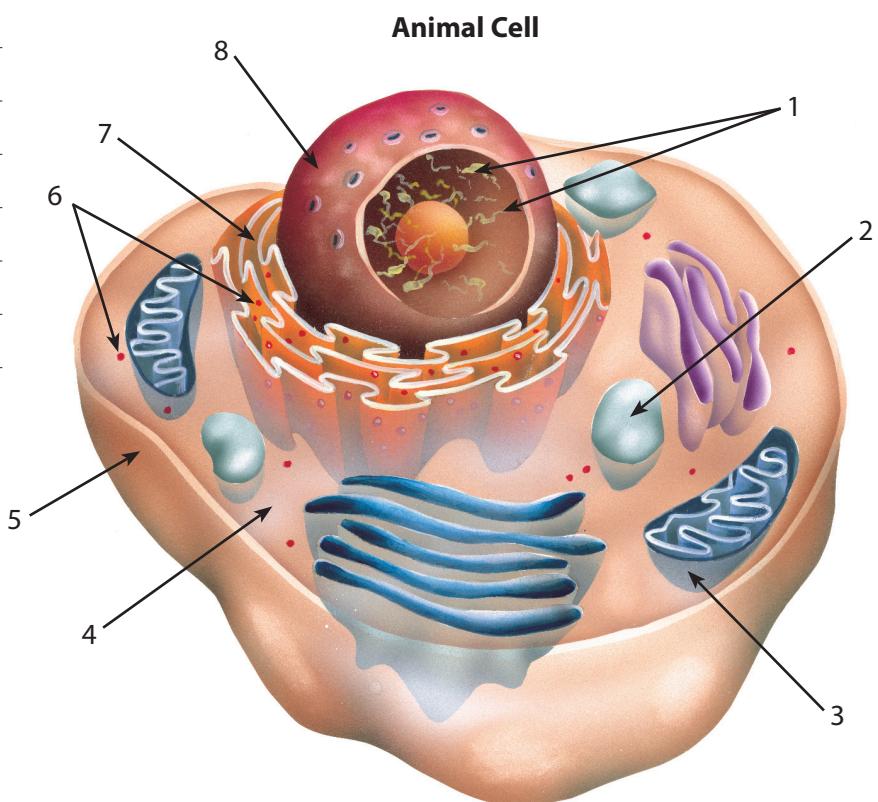
Animal Cell

Student Text pages 85–87

Name _____

A. Label the parts of the animal cell.

1. chromosomes
2. vacuole
3. mitochondrion
4. cytoplasm
5. cell membrane
6. ribosome
7. endoplasmic reticulum
8. nucleus



B. Answer the questions.

9. What is the relationship between systems, organs, tissues, and cells? Systems are made up of organs. Organs are made up of tissues. Tissues are made up of cells.
10. What name is given to the structures in the cytoplasm of cells? organelles

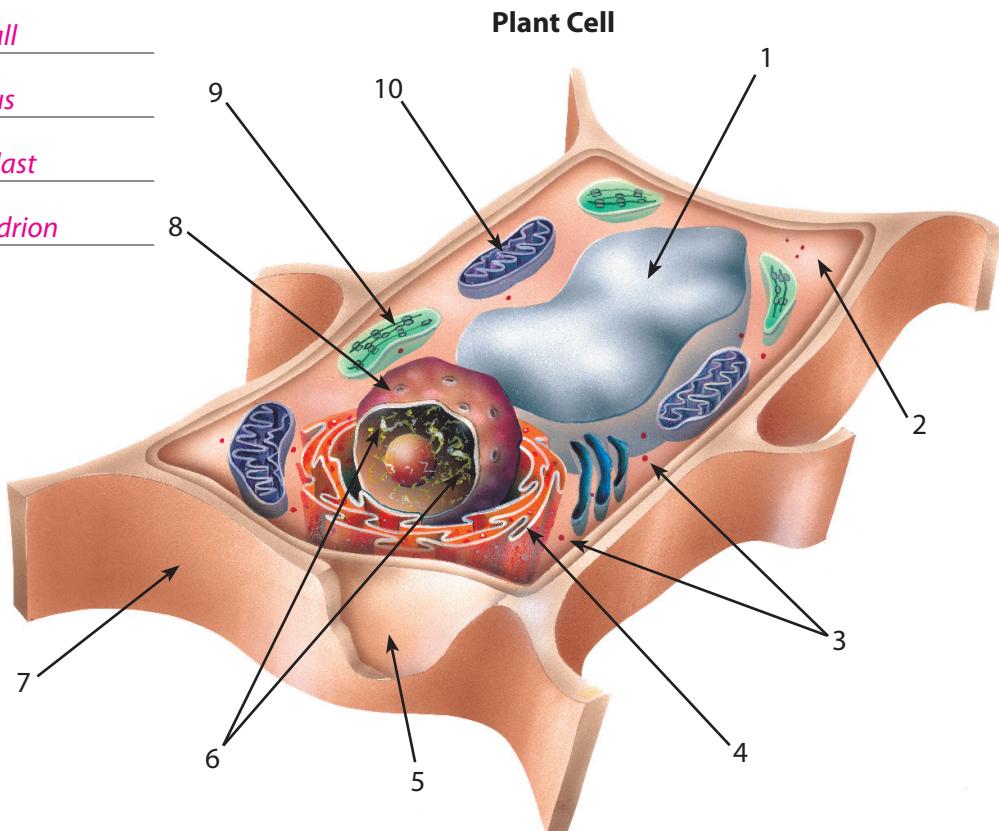
Plant Cell

Name _____

Student Text pages 85–87

A. Label the parts of the plant cell.

1. vacuole
2. cytoplasm
3. ribosome
4. endoplasmic reticulum
5. cell membrane
6. chromosomes
7. cell wall
8. nucleus
9. chloroplast
10. mitochondrion



B. Answer the questions.

11. What is the function of a cell wall? to provide support for the plant
12. How are plant vacuoles different from animal and human vacuoles? Plant cells usually have one central vacuole that holds about half of the cell's volume. Animal and human vacuoles are small and often temporary.

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Study Guide

Student Text pages 80–87

Name _____



A. Fill in the blanks.

1. An organism is a complete living thing.
2. An organism's life span includes its birth, growth, reproduction, and death.
3. A microscope is an instrument that uses lenses to magnify objects.
4. A green pigment found in the chloroplasts of plant cells is chlorophyll.
5. Structures in the cytoplasm of a cell are called organelles.
6. The term *cell* was first used by Robert Hooke.
7. The cell follows the DNA code as it grows, reproduces, and builds substances.
8. The conclusions of Theodor Schwann and Matthias Schleiden form the basis of the cell theory.

B. Write the letter of the correct answer.

- B 9. provides support for plant cells
- E 10. cell engines that break down food and release energy
- G 11. bubble-like storage organelle
- A 12. external boundary for the material inside a cell
- C 13. structure found in plant cells that contains green pigment
- D 14. jellylike substance inside cell membrane
- F 15. large circular structure containing DNA

- A. cell membrane
- B. cell wall
- C. chloroplast
- D. cytoplasm
- E. mitochondria
- F. nucleus
- G. vacuole

C. Write the answers.

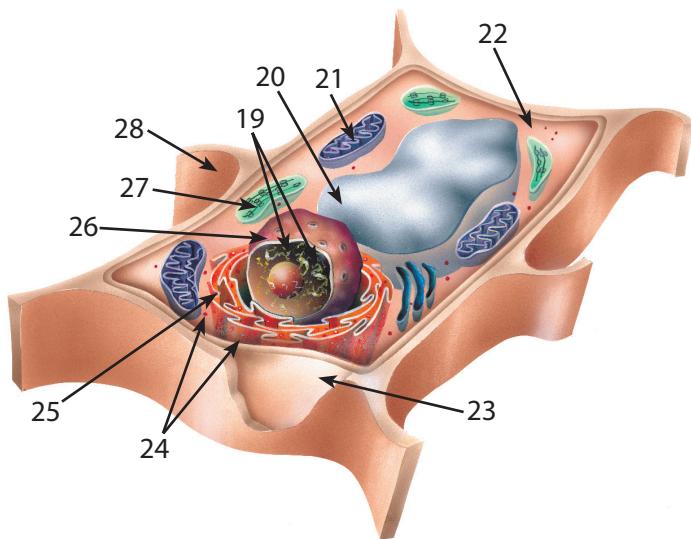
16. List three characteristics of living things. *Possible answers: Living things grow and develop, reproduce, respond to their environments, use energy, and are made of cells.*

17. Explain the cell theory. *All living things are made of cells. Nonliving things are not made of cells. Cells can function as independent organisms or as part of larger organisms.*

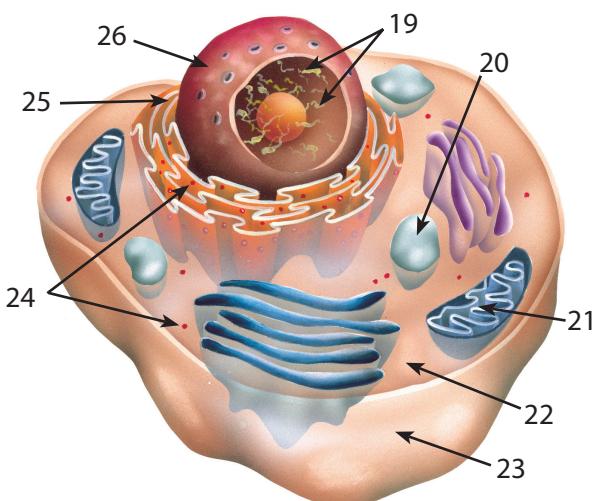
18. List in order from smallest to largest: cells, systems, organs, tissues. *cells, tissues, organs, systems*

D. Label the parts of the cells.

19. chromosomes
20. vacuole
21. mitochondrion
22. cytoplasm
23. cell membrane
24. ribosome
25. endoplasmic reticulum
26. nucleus
27. chloroplast
28. cell wall



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An Organized Cell

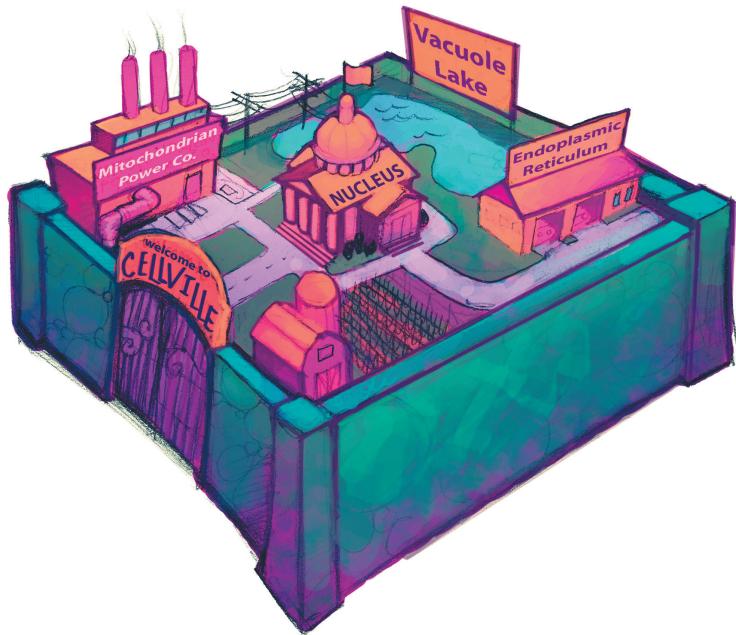
Name _____

Student Text page 89



Follow these steps as you plan.

1. Decide what kind of organization (city, business, country, factory, school, or other) that you are comparing the cell to. Choose a name for your organization.
2. Write the cell function for each cell part in the chart.
3. Decide what department or position in your organization has a function similar to each cell structure.
4. Write the department or position and function in the line of the chart corresponding to the similar cell structure.



Name of your organization _____

Cell part	Function	Related department or position	Function
Example: Nucleus	controls rest of cell	city hall	control center for city
Nucleus			
Chromosomes			
Cell membrane			
Endoplasmic reticulum			
Mitochondria			
Vacuoles			
Ribosomes			



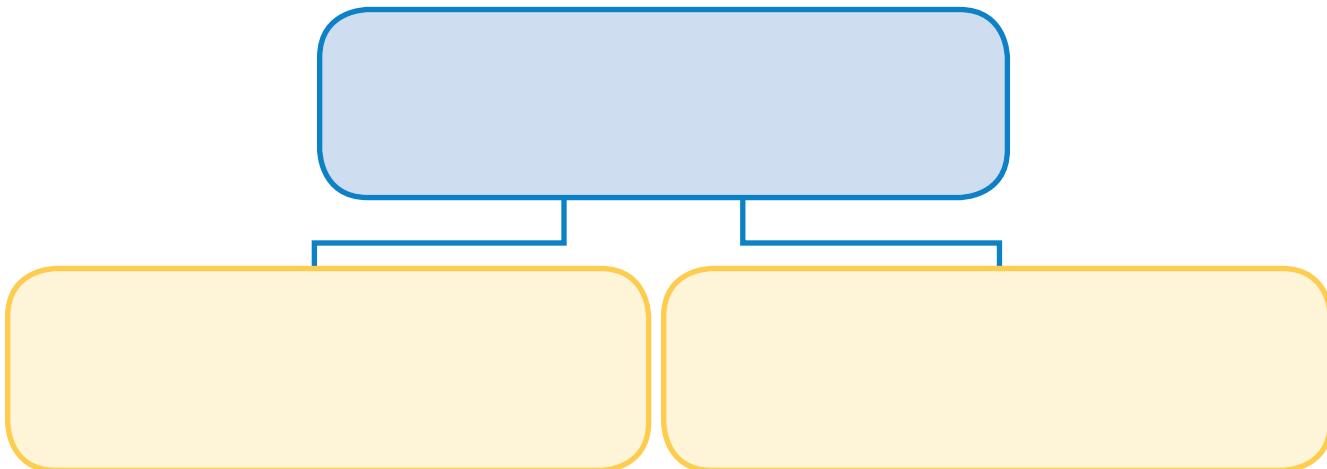
Classifying

Student Text page 92

Name _____

Materials

Procedure



Conclusions

1. What other ways might you classify your pasta? _____

2. Compare your chart to the chart of another group. Were the same criteria used? _____

The Living Kingdoms

Student Text pages 93–97

Name _____

Complete the information about each kingdom.

<p>Kingdom: Eubacteria</p> <p><input checked="" type="checkbox"/> unicellular <input type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>organisms called bacteria</i> <i>smallest living things known</i> <i>live in colonies</i> <i>do not have a true nucleus</i></p> <p>examples:</p> <p><i>some bad bacteria can cause sickness or pain</i> <i>some good bacteria help digestion</i></p>	<p>Kingdom: Achaebacteria</p> <p><input checked="" type="checkbox"/> unicellular <input type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>live in extreme or harsh environments</i> <i>do not have a true nucleus</i></p> <p>examples:</p> <p><i>some live in sulfur springs near volcanoes</i> <i>some live in the Dead Sea</i></p>
<p>Kingdom: Protista</p> <p><input checked="" type="checkbox"/> unicellular <input type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>contains unicellular organisms that do not fit in any other category</i> <i>have a true nucleus</i> <i>reproduce by cell division</i> <i>algae have chlorophyll and may live in colonies</i></p> <p>examples:</p> <p><i>protozoan (paramecium, amoeba)</i> <i>algae</i></p>	<p>Kingdom: Fungi</p> <p><input checked="" type="checkbox"/> unicellular <input checked="" type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>some live in colonies</i> <i>cannot make own food, but absorb it from surroundings</i> <i>some can be poisonous or cause illness</i></p> <p>examples:</p> <p><i>mushroom</i> <i>mold</i> <i>yeast</i> <i>athlete's foot fungus</i></p>
<p>Kingdom: Plantae</p> <p><input type="checkbox"/> unicellular <input checked="" type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>have chloroplasts with chlorophyll</i> <i>produce sugar and oxygen needed by other living things through the process of photosynthesis</i> <i>have cell walls for support</i> <i>organs include bark, leaves, and roots</i></p> <p>examples:</p> <p><i>Indian paintbrush</i> <i>maple</i> <i>sunflower</i></p>	<p>Kingdom: Animalia</p> <p><input type="checkbox"/> unicellular <input checked="" type="checkbox"/> multicellular</p> <p>characteristics:</p> <p><i>many have a skeletal system for support</i> <i>have tissues, organs, and systems</i> <i>cannot make own food</i></p> <p>examples:</p> <p><i>jellyfish</i> <i>flatworms</i> <i>collie</i> <i>beetle</i></p>

Answer the question.

What makes humans different from animals? *Man was created in God's image (Gen. 1:27) and can have a personal relationship with God.*

Organism Names

Name _____

Student Text pages 98–99

A. Fill in the blanks.

1. Carolus Linnaeus proposed an ordering system to help classify plants and animals by common characteristics.

2. The classification system from the largest level to the smallest level is
kingdom, phylum,
class, order,
family, genus, and
species.

3. The parts of the classification system that make up the scientific name of an organism are
genus and species.

B. Answer the questions.

4. What is the difference between the common and scientific names of an organism? Common names for organisms are widely used and recognized and often change between languages. Scientific names consist of two Latin words and are unique to each specific type of organism.

5. Why are scientific names important? Each name does not belong to any other organism. This makes learning about organisms easier. It helps us to appreciate the orderliness of God's creation.

C. *Equus* is the genus name for horses and their close relatives. *Panthera* is the genus name for cats and other closely related animals. Mark the correctly written scientific name for each common name.

- | | | |
|---------------|--|---|
| 6. lion | <input checked="" type="radio"/> <u>Panthera leo</u> | <input type="radio"/> <u>Panthera Leo</u> |
| 7. donkey | <input checked="" type="radio"/> <u>Equus asinus</u> | <input type="radio"/> <u>Equus asinus</u> |
| 8. tiger | <input type="radio"/> <u>Panthera Tigris</u> | <input checked="" type="radio"/> <u>Panthera tigris</u> |
| 9. pinto pony | <input checked="" type="radio"/> <u>Equus caballus</u> | <input type="radio"/> <u>Equus caballus</u> |
| 10. zebra | <input type="radio"/> <u>Equus Burchelli</u> | <input checked="" type="radio"/> <u>Equus burchelli</u> |

Study Guide

Name _____

Student Text pages 90–91 and 93–99



A. Mark all the kingdoms that apply.

	Animalia	Archaeabacteria	Eubacteria	Fungi	Plantae	Protista
1. always multicellular	X				X	
2. live in poisonous conditions		X				
3. does not have a true or well-defined nucleus		X	X			
4. mushrooms, yeasts, and molds				X		
5. may have chlorophyll in their cells					X	X
6. always unicellular organisms		X	X			X
7. some are unicellular, some are multicellular				X		

B. Match the description with the term.

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- A 8. the smallest living thing
C 9. group of the same kind of organism
E 10. protozoans and algae
F 11. paramecium and amoeba
D 12. process of converting sunlight into sugar
B 13. one cell divides into two

- A. bacteria
B. cell division
C. colony
D. photosynthesis
E. protista
F. protozoan

C. Choose the correct answer.

14. An organism produces reproductive cells by the process of _____.
 meiosis mitosis
15. An organism grows and replaces cells by the process of _____.
 meiosis mitosis
16. A reproductive cell has _____ chromosomes as the parent cell.
 half as many the same number of
17. Putting organisms with similar characteristics into groups is called _____.
 cell theory classification

D. Write T if the statement is true. If the statement is false, write a correction for the underlined words.

- T 18. The process of creating new life using cells from male and female organisms is called sexual reproduction.
- T 19. Carolus Linnaeus developed a system of classification.
- order 20. The scientific names of classification from the largest group to the smallest group is kingdom, phylum, class, type, family, genus, and species.
- T 21. Some helpful bacteria are found in yogurt and in your intestines.
- genus 22. Scientific names have two names, class and species.

E. Choose all the correct answers.

23. Mark the correctly written scientific name.
 Panthera Leo panthera leo Panthera leo panther leo
24. Mark the living kingdoms.
 Protista Eubacteria Plantae Algae
 Archaebacteria Linnaea Animalia Fungi

F. Answer the question.

25. How is man different from animals? Man was created in God's image and can have a personal relationship with God.

Thinking It Through

Name _____

Student Text pages 80–100



Plan and write a paragraph answering each question.

1. Why are scientists always trying to find tools to improve man's senses?

Answer should include the following: Science is based on observation. Observation requires the use of man's senses. Tools that improve man's senses allow man to learn more about God's creation.

2. Use the circulatory system to explain the relationship between systems, organs, tissues, and cells.

Answer should include the following: Systems are made up of organs. The heart and blood vessels work together in the circulatory system. Organs are made up of tissues. The heart is an organ made up of nerve and muscle tissues. Tissues are made up of cells. Nerves, muscles, and blood are tissues made up of cells.

3. Choose two living kingdoms and contrast them. Include at least three differences in your answer.

Answers should include information from Activity Manual page 65.

4. What is the difference between the common name and scientific name of an organism?

Common names for organisms are widely used and recognized and often change between languages.

Scientific names consist of two Latin words and are unique to each specific type of organism.

Looking Ahead

Name _____

A. Mark the answer.

1. An animal with a backbone is classified as ____.
A. an invertebrate B. a vertebrate C. an exoskeleton
2. An animal without a backbone is classified as ____.
A. an invertebrate B. a vertebrate C. an exoskeleton
3. A bivalve is a kind of ____ with two shells.
A. crustacean B. mollusk C. nautilus
4. A ____ is an animal that displays radial symmetry.
A. seahorse B. centipede C. starfish
5. Some livestock suffer from ____, such as roundworms, that live on or in them.
A. parasites B. insectivores C. spicules
6. Flatworms that live independent of other organisms are called ____.
A. leeches B. hosts C. free-living
7. ____ are animals that have jointed legs and segmented bodies.
A. Arthropods B. Phyla C. Nematocysts
8. Some animals ____ their outer coverings in a process known as molting.
A. shed B. strengthen C. camouflage
9. ____ is a bonelike substance that is softer and more flexible than bone.
A. Pupa B. Cartilage C. Scale
10. Nocturnal animals are ones that come out ____.
A. during the winter B. after a storm C. at night

- | |
|-----------------|
| 1. (A) (B) (C) |
| 2. (A) (B) (C) |
| 3. (A) (B) (C) |
| 4. (A) (B) (C) |
| 5. (A) (B) (C) |
| 6. (A) (B) (C) |
| 7. (A) (B) (C) |
| 8. (A) (B) (C) |
| 9. (A) (B) (C) |
| 10. (A) (B) (C) |

B. Write a question for something you would like to learn about the following:

- metamorphosis

- amphibians and reptiles

Invertebrates

Name _____

Student Text pages 102–5 and 109–11

Complete the web.

Invertebrates
animals
without
backbones



Phyla

Examples

Sponges

- have pores on outside of bodies
- gather food from water pumped through their bodies

corals

jellyfish

sea anemones

Stinging animals (Cnidaria)

- use tiny organelles called nematocysts to capture their food

Mollusks

- soft body and mantle that sometimes forms a shell
- can include bivalves, gastropods, univalves, and cephalopods

nudibranchs

octopuses

oysters

snails

slugs

Echinoderms

- radial symmetry
- live in water
- move using tube feet
- have hard skeletons

sand dollars

sea stars

Flatworms

- flat
- bilateral symmetry
- parasites or free-living

planaria

Roundworms

- round and smooth
- parasites or free-living

ascaris worms

Segmented Worms

- called annelids
- have segments
- use setae to move

leeches

sea worms

earthworms

Arthropods

Continued on page 76.

Fiber Optic Sponges

Name _____

Student Text pages 106–7



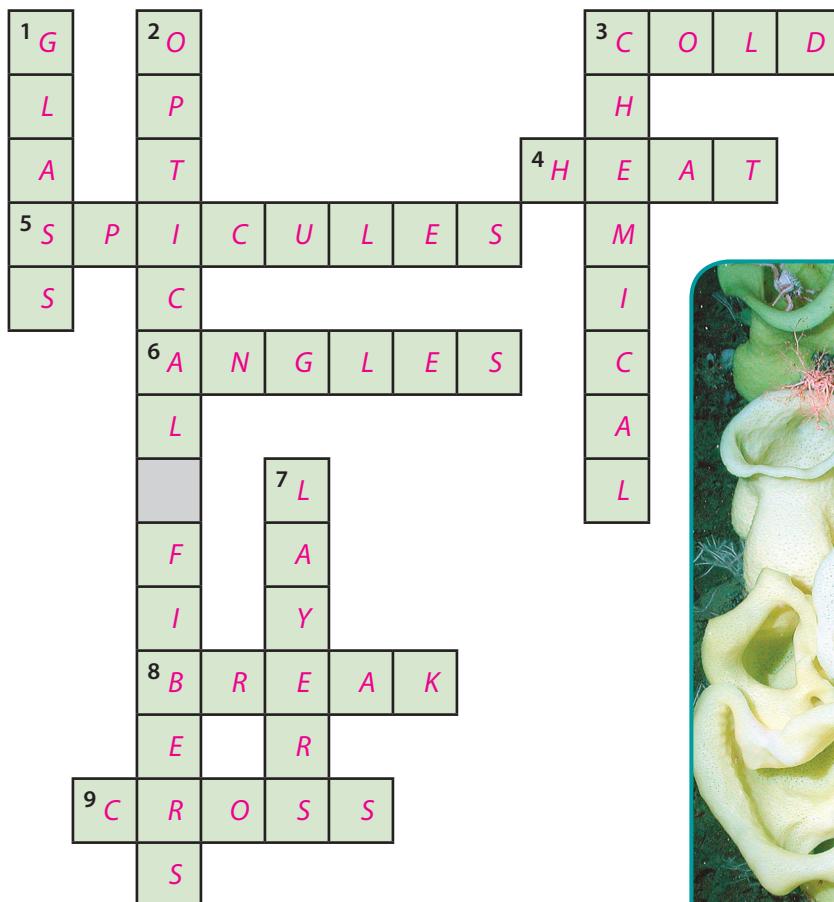
Complete the puzzle.

Across

3. The *Rossella racovitzae*'s environment is very dark and ____.
4. Manmade fibers must be formed under high ____.
5. Some sponges have thin, glassy spines called ____.
6. Spicules can gather light from many different ____.
8. Cracks in manmade fibers often cause the entire fiber to ____.
9. Scientists found a ____-shaped cap at the top of each spicule.

Down

1. Sponges whose skeletons are made of silica are ____ sponges.
2. The spicules of a glass sponge act like ____.
3. Manmade fibers need special ____ treatments to work in cold environments.
7. Spicules have ____, which allow them to bend and gather light even when cracked.





Snail Terrarium

Student Text page 108

Name _____

Record your observations about land snails.

1. Locate the tentacles, or feelers, on the top of the snail's head. How many feelers did you find? 4

2. Where did you find the eyes?
at the tips of the upper tentacles

3. Use a pencil to gently touch the tentacles. What does the snail do when the tentacles are touched gently? The snail retracts its tentacles.

4. Touch the tentacles again with a little more force. What does the snail do? retreats into its shell

5. Tap the shell of the snail. What does the snail do? tucks its foot and head into the shell

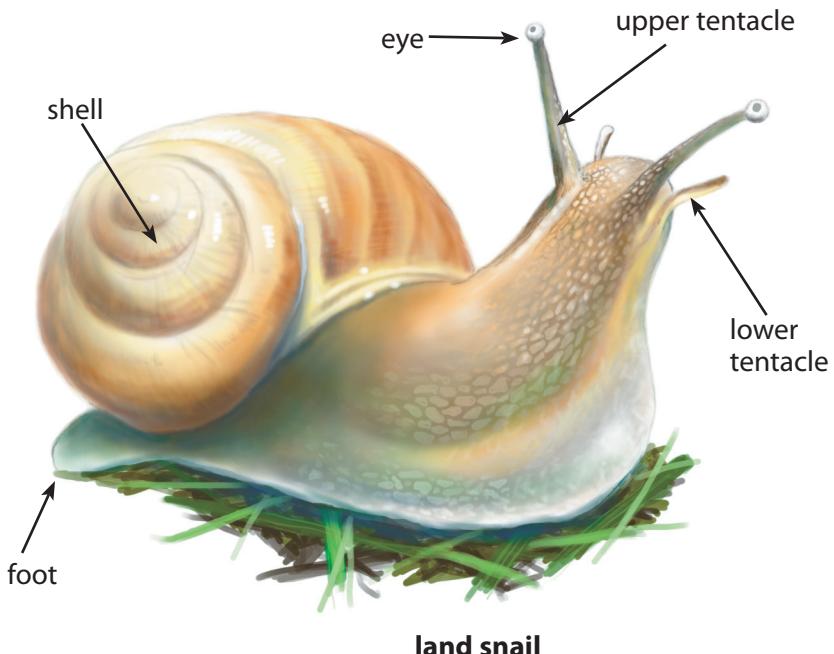
6. Describe the way the snail moves. Answers will vary.

7. Feed your snail some lettuce. Watch closely with a magnifying glass. What do you see?
Its mouthparts move.

8. Put your snail on black paper. What does it leave behind?
slime

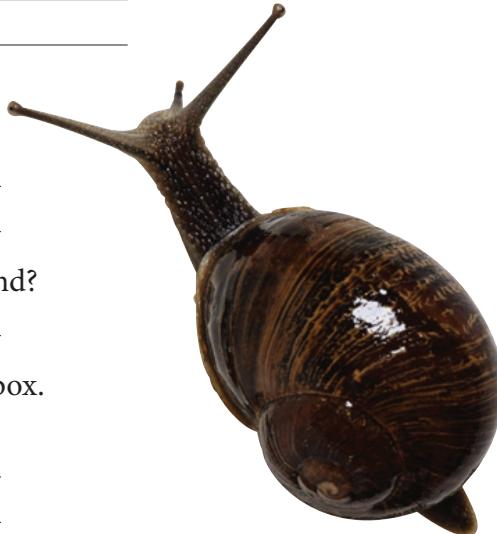
9. Put your snail in a shoebox. Put the lid on half of the box. Does the snail move away from or toward the light?
It probably moves away from the light.

10. On your own paper design and write a short pet store advertisement for land snails. Include a picture of your snail.



land snail

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Study Guide

Name _____

Student Text pages 102–5 and 109–11



A. Write the letter of the correct answer.

- E 1. tiny stinging organelle found on some animals
- B 2. describes an animal that eats organisms that float through the water
- H 3. describes an animal with a backbone
- A 4. having two sides the same when divided down the middle
- D 5. describes an animal without a backbone
- F 6. lives on or in another living organism (host) and depends on the host for nourishment
- C 7. describes the ability to exist independent of another organism
- G 8. having body parts that repeat around a central part

- A. bilateral symmetry
B. filter feeder
C. free-living
D. invertebrate
E. nematocyst
F. parasite
G. radial symmetry
H. vertebrate

B. Complete the chart.

(possible answers)

Phylum	Characteristics	Example
9. <i>echinoderm</i>	has radial symmetry and moves using tube feet	10. <i>sand dollar, sea star</i>
11. <i>segmented worm (annelid)</i>	has segments and uses hairlike setae to move	12. <i>leech, earthworm</i>
13. <i>mollusk</i>	has a soft body and a mantle that sometimes forms a shell	14. <i>octopus, oyster, snail</i>

C. Write the answers.

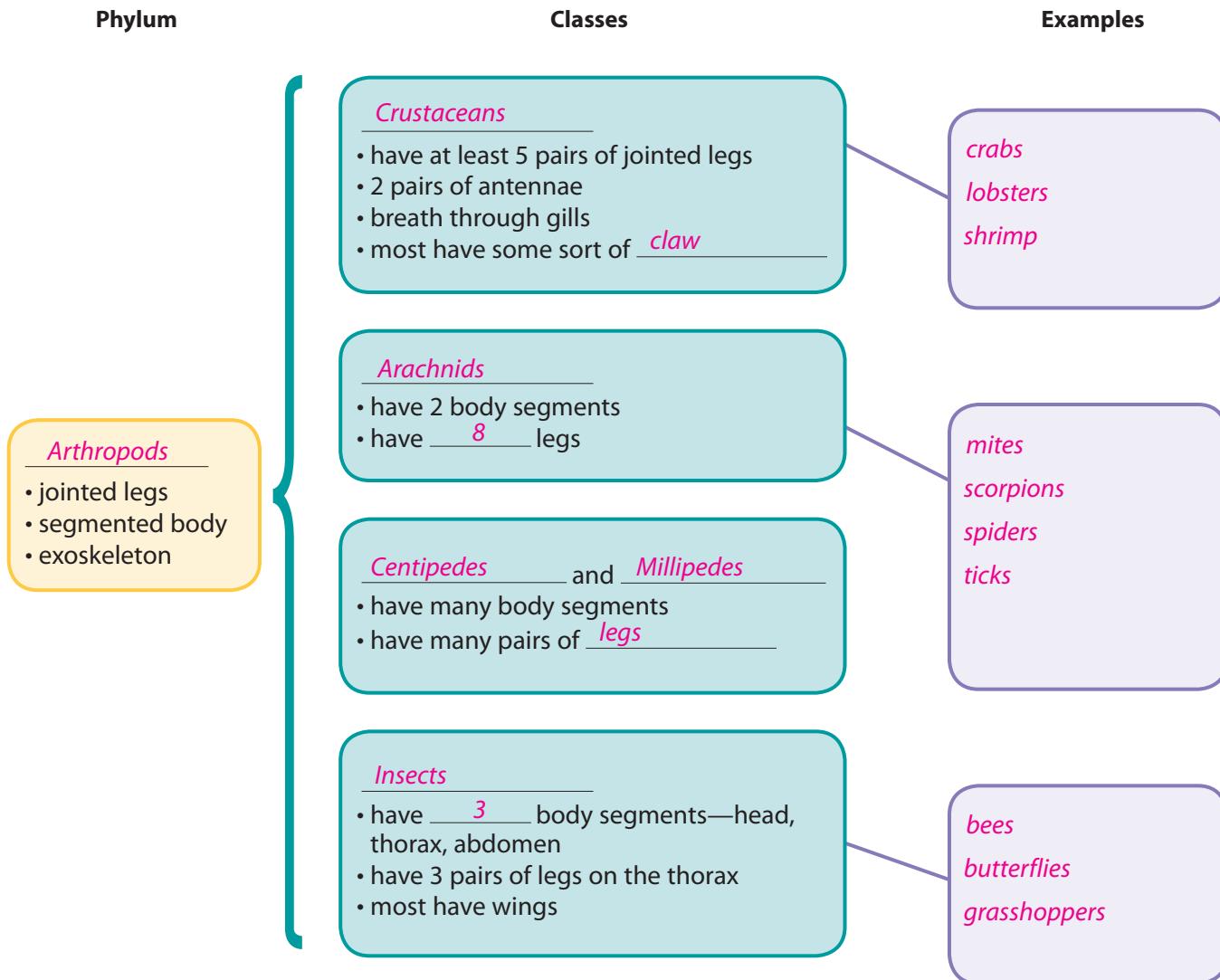
15. What characteristic do most of the animal phyla have in common? They are invertebrates.
16. Describe how sponges and stinging animals get their food. Sponges gather food from water that flows through their bodies. Stinging animals use nematocysts to capture their food.
17. What are three phyla of worms? flatworms, roundworms, segmented worms

Arthropods

Student Text pages 112–15

Name _____

A. Complete the web.



B. Write the answers.

- What are some ways that spiders detect their prey? by vision, smell, sound, touch, and vibrations of their webs

- What body part of a spider produces silk? the spinnerets

Study Guide

Student Text pages 112–15

Name _____



A. Complete the chart.

(possible answers)

Class	Characteristics	Example
1. <i>arachnid</i>	has 2 body segments and 8 legs	2. <i>mite, scorpion, spider, tick</i>
3. <i>crustacean</i>	has 5 pairs of legs, 2 pairs of antennae, breathes through gills, and most have a claw	4. <i>crab, lobster, shrimp</i>
5. <i>insect</i>	has 3 body segments, 3 pairs of legs, and most have wings	6. <i>bee, butterfly, grasshopper</i>

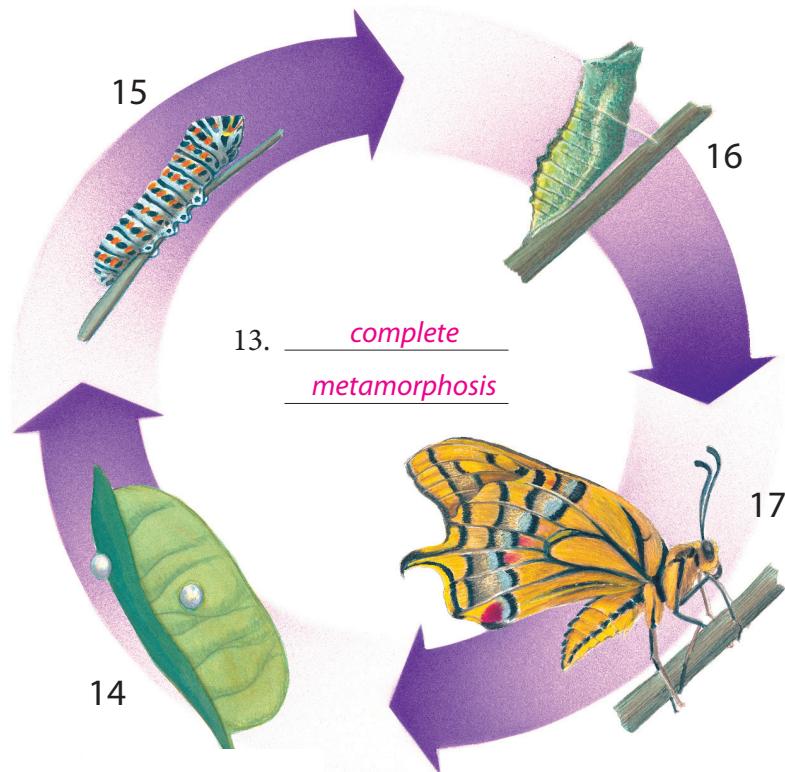
B. Write the answers.

7. What are the characteristics of animals in the arthropod phylum? *An arthropod has jointed legs, a segmented body, and an exoskeleton.*
8. Why do arthropods molt? *As an arthropod grows, it must shed, or molt, its smaller exoskeleton and grow a new one.*
9. Why can some ticks cause serious human health problems? *Ticks are parasitic and use both animals and humans as hosts. Their bites can spread diseases, such as Rocky Mountain spotted fever and Lyme disease.*
10. Why is a spider classified as an arachnid and not as an insect? *A spider has two body segments and eight legs, which fits the arachnid description. Insects have three body segments and six legs.*
11. What characteristics do centipedes and millipedes have in common? *Both have many body segments and many pairs of legs.*
12. How are insect mouthparts specially designed for the insects' diets? Give two examples.
Possible answers: Beetles have chewing mouthparts because they chew the food they eat. Mosquitoes and some other insects have piercing and sucking mouthparts to effectively suck blood. Butterflies and moths have siphoning mouthparts to get the nectar out of flowers.

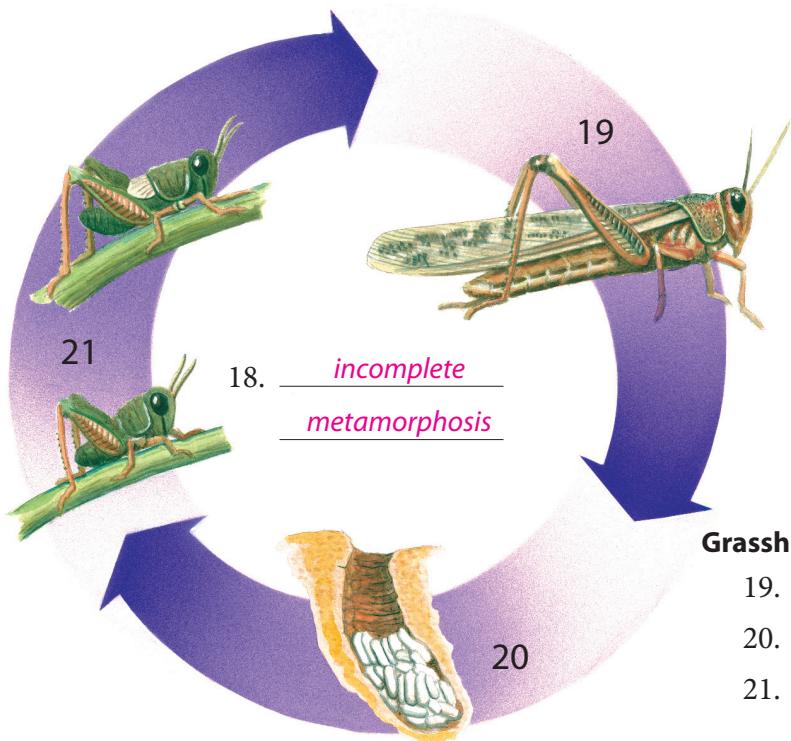
C. Label each diagram as incomplete metamorphosis or complete metamorphosis.
Write the stage of metamorphosis next to each number.

Butterfly

14. egg
 15. larva
 16. pupa
 17. adult



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**Grasshopper**

19. adult
 20. egg
 21. nymph

Mealworm Movement

Student Text pages 116–17

Name _____



Problem

How does a mealworm respond to different stimuli?

Materials

large-mouth glass jar
100 mL oatmeal or
wheat bran
apple or potato slice
4–6 mealworms
magnifying glass
ruler

toothpick
white paper
black paper
plastic cup
lamp
ice
cotton swabs

water
ammonia or vinegar
blocks or other materials
to make a maze
cheesecloth
rubber band
observation log

Procedure

Characteristics of mealworms

	1	2	3	4	5	6
Number of Legs						
Width						
Length						



Light and dark

	Test 1	Test 2	Test 3
White			
Black			

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Warmth and coldness

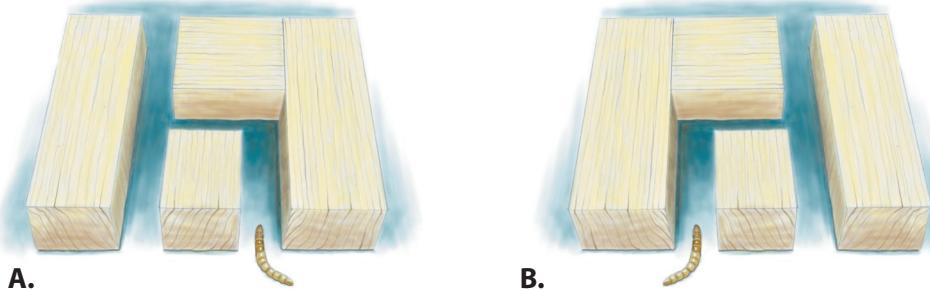
	Test 1	Test 2
Placed over light bulb		
Placed over ice cube		

Smell

	Test 1	Test 2
Water		
Ammonia/Vinegar		

Direction

	Test 1 observations	Test 2 observations
Maze A		
Maze B		



Conclusions

Summarize the reaction of mealworms to different stimuli. Include any patterns of behavior you noticed.

Vertebrates

Student Text pages 118–21

Name _____

A. Write the answers.

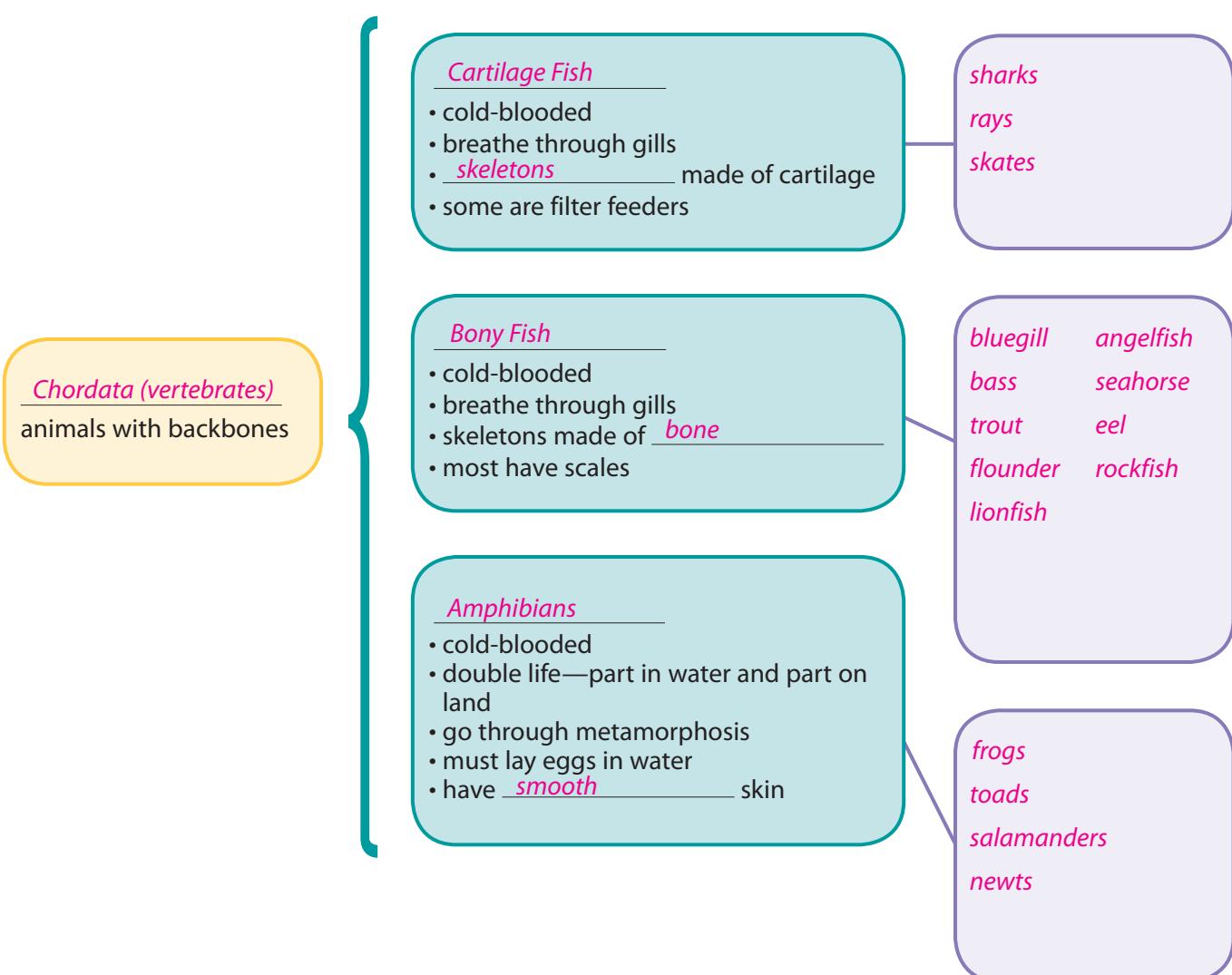
1. How do most vertebrates compare in size with invertebrates? *Vertebrates are larger.*
2. What gives a vertebrate support for its greater weight? *its backbone*
3. Describe what it means for an animal to be cold-blooded. *A cold-blooded animal's blood does not maintain a constant temperature. It finds warmth and coolness from its environment.*

B. Complete the web.

Phylum

Classes

Examples



More Vertebrates

Name _____

Student Text pages 122–31

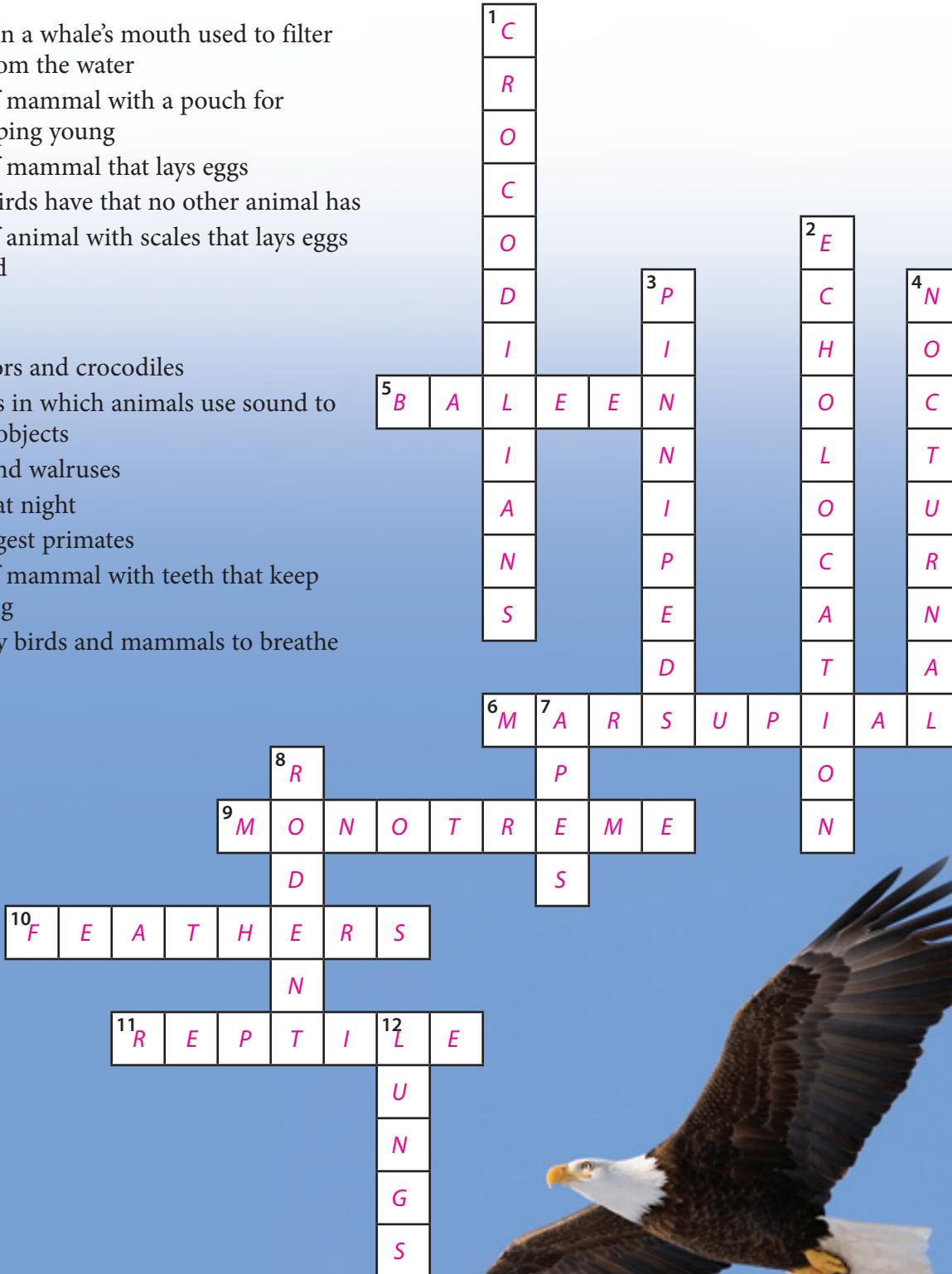
Complete the puzzle.

Across

5. plates in a whale's mouth used to filter krill from the water
6. type of mammal with a pouch for developing young
9. type of mammal that lays eggs
10. what birds have that no other animal has
11. type of animal with scales that lays eggs on land

Down

1. alligators and crocodiles
2. process in which animals use sound to locate objects
3. seals and walruses
4. active at night
7. the largest primates
8. type of mammal with teeth that keep growing
12. used by birds and mammals to breathe



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Study Guide

Student Text pages 118–31

Name _____



A. Write the letters of all that apply.

A, C, E 1. cold-blooded

B, D 2. warm-blooded

B 3. has feathers

A 4. spends part of life in water and part on land, has smooth skin

D 5. has hair, most bear live young, feeds young milk, has four-chambered heart

A, C 6. breathes through gills

E 7. has scaly skin, lays eggs on land

- A. amphibian
- B. bird
- C. fish
- D. mammal
- E. reptile

B. Fill in the blanks.

8. Bats and dolphins use echolocation to find the location of objects.

9. Animals that are active at night are nocturnal.

10. Animals that eat both plants and animals are called omnivores.

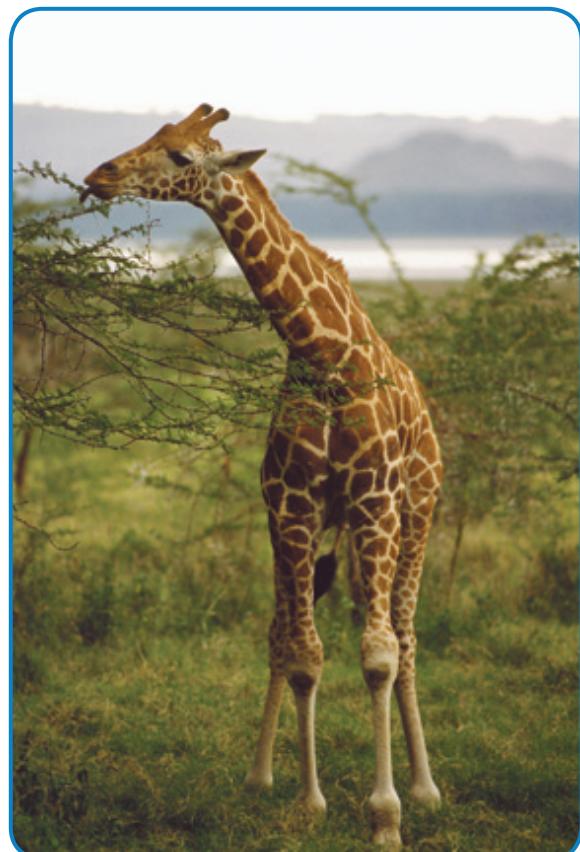
11. Some fish have skeletons made of cartilage, a substance like bone but softer and more bendable.

12. Animals that eat only plants are called herbivores.

13. Animals that eat only animals are called carnivores.

14. Some animals have a layer of a fatty substance called blubber that insulates them from the cold.

15. Animals that eat only insects are called insectivores.



C. Complete the section.

16. Why are vertebrates able to grow larger than invertebrates? *Their backbones provide support for a greater amount of weight.*

17. What are the stages of frog metamorphosis? *egg, tadpole or larval stage, and adult*

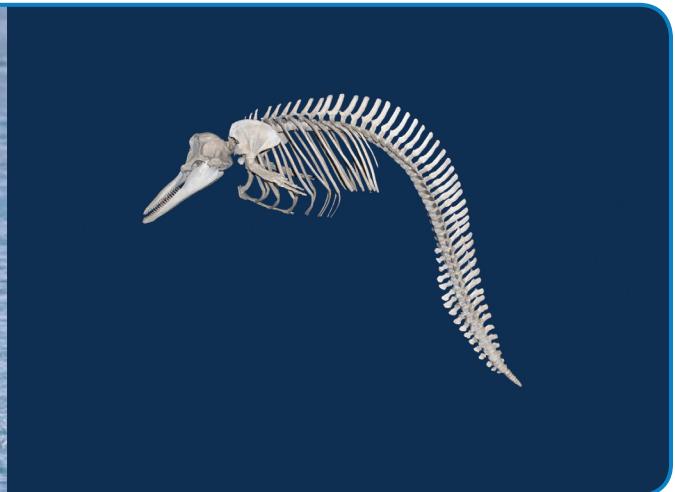
18. Why are some mammals classified as monotremes? Give one example. *A monotreme is a mammal that lays eggs. Examples: platypus, echidna.*

19. What makes a marsupial different from other mammals? Give one example. *A marsupial has a pouch for the developing baby to grow big enough to function. Examples: kangaroos, koalas, wallabies.*

20. Why are lions, wolves, and whales considered to be social animals? *These animals live in groups and communicate with each other. Lions live in prides, wolves live in packs, and whales live in pods.*



dolphin



dolphin skeleton

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Blubber Mitts

Student Text pages 132–33

Name _____



Problem

What materials best insulate against cold?

Materials

- 6 resealable bags
- 15 cm × 30 cm piece of quilt batting,
1 cm thick
- 500 mL solid shortening or lard
- metric measuring cup
- rubber spatula
- masking tape (optional)
- deep dishpan
- ice cubes
- water
- 4 thermometers
- clock or timer



Hypothesis

Include the material you think will insulate the most and the one you think will insulate the least.

Possible hypothesis:

The blubber-insulated mitt will insulate best against the cold, and the non-insulated mitt will insulate least against the cold.

Procedure

Record your observations on the chart.

A Room temperature (original temperature of each thermometer)	B Location of thermometer	B Temperature at 2 minutes	C Temperature at 4 minutes	D Temperature at 6 minutes	E Temperature at 8 minutes
	water				
	non-insulated mitt				
	batting-insulated mitt				
	blubber-insulated mitt				

Conclusions

1. Compare the final temperatures on the chart. Did your results support your hypothesis?

2. Which mitt had the highest temperature after being in the ice water? _____

3. Which mitt had the lowest temperature after being in the ice water? _____

4. Did the temperatures inside the mitts change as the mitts stayed in the water longer?

Why or why not? _____

5. How do your results help you understand the way blubber helps insulate a walrus?

6. Why do you think manufacturers do not use blubber to insulate things such as jackets and sleeping bags? What kind of materials could they use? _____

Animal Robotics

Name _____

Student Text pages 134–35



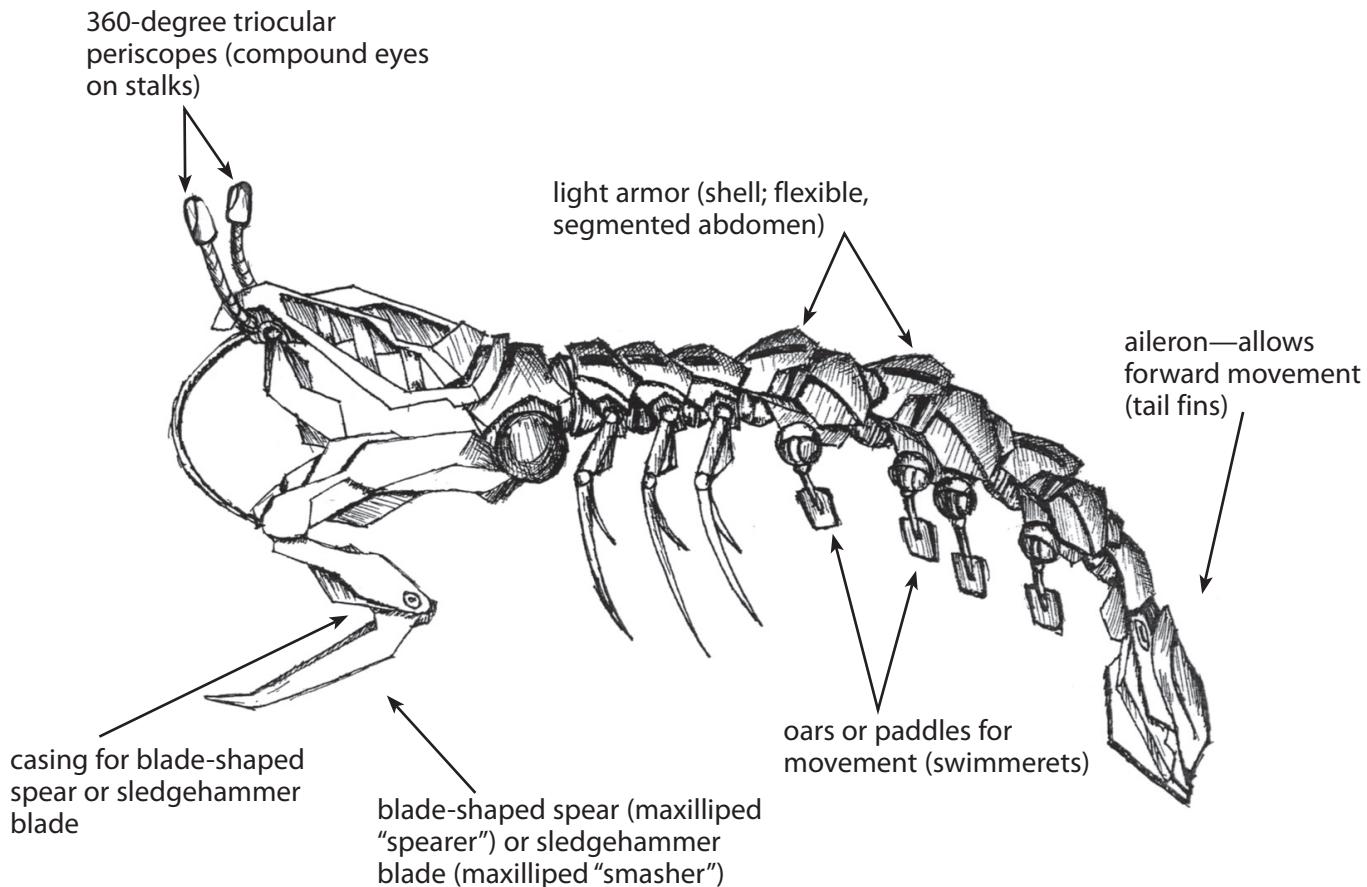
A. Check off each step as you complete it.

- Choose
- Research
- Write
- Design
- Label
- Present



B. Use this picture of a robotic mantis shrimp as a reference when you design your own robotic animal.

Robotic Mantis Shrimp





Thinking It Through

Student Text pages 102–36

Name _____

Plan and write a paragraph answering each question.

- How do worms contribute to soil improvement?

Answer should include the following: They fertilize soil by decomposing dead organisms; the holes from their burrowing allow air to get into the soil; they break down complex plant material into nutrients that plants can use.

- Why would cold-blooded animals have difficulty surviving in polar regions?

Answer should include the following: Cold-blooded animals depend on the environment for warmth. Polar regions are cold environments. Cold-blooded animals could not keep enough body warmth to survive in continuously cold conditions.

- Penguins have blubber, solid bones, and small wings. How does God's design for penguins help them function in their natural habitat of Antarctica?

Answer should include the following: The blubber helps penguins stay warm. The solid bones help penguins sink deeper in the water. Their small wings are useful for swimming.

Looking Ahead

Name _____

A. Mark the sentence that uses the bold term correctly.

1. Mosses are small **vascular** plants with deep roots that grow in moist areas.
 Dandelions are **vascular** plants that ooze a milky liquid when picked.
2. Roland cut the **rhizome** knots from the tree branches.
 When Lucy dug up a fern, it was connected to the next fern by a **rhizome**.
3. Lime trees and pear trees are **angiosperms** that produce food.
 White pine and redwood are two **angiosperms** used for lumber.
4. Gus planted **annual** flowers such as mums that grow and bloom year after year.
 Every spring Aunt Ruby plants **annual** flowers such as petunias and marigolds.
5. The stem of a **dicot** separates into only two branches.
 A pea plant is an example of a **dicot** that has two seed leaves in its seeds.
6. **Monocots**, such as daisies and sunflowers, have broad leaves with branching veins.
 Monocots, such as grasses and grains, have narrow leaves with parallel veins.
7. A plant's **vascular system** transports water and nutrients throughout the plant.
 The **vascular system** of a plant expels wastes through the seeds.
8. A plant stem grows wider as the **cambium** divides to form the xylem and phloem.
 The stiff outer **cambium** of a plant protects the stem from breakage.
9. Rose bushes have tough brown **herbaceous stems**.
 Many flowers have soft green **herbaceous stems**.
10. A **taproot** is a main root that generally grows straight down.
 A **taproot** joins other taproots to form a cluster of fibrous roots.

B. Write a question for something you would like to learn about the following:

- gymnosperms

- products made from plants

Vascular and Nonvascular Plants

Name _____

Student Text pages 138–41

A. Define each term.

1. vascular plants *plants that have tubelike structures that transport water from the roots to the stems and leaves*
2. nonvascular plants *plants that do not have tubelike structures to transport water*

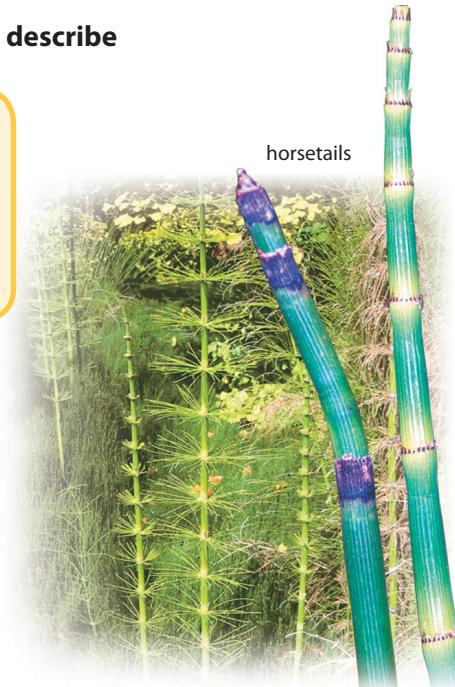
3. rhizoids *thin, rootlike structures*
4. rhizomes *underground stems*
5. fronds *the leafy branches of a fern*
6. fiddlehead *a coiled-up frond*

B. Match the characteristics to the plant groups. Characteristics may describe more than one plant group.

- | | | |
|----------------|--|----------------|
| <i>D</i> | 7. flat, platelike leaves | A. club mosses |
| <i>B</i> | 8. fronds | B. ferns |
| <i>D</i> | 9. liver-shaped leaves | C. horsetails |
| <i>C</i> | 10. mostly tall, hollow, jointed stems | D. liverworts |
| <i>E, D</i> | 11. nonvascular plants | E. mosses |
| <i>A</i> | 12. look like small evergreen trees | |
| <i>E, D</i> | 13. have rhizoids | |
| <i>B, C</i> | 14. have rhizomes | |
| <i>B</i> | 15. have fiddleheads | |
| <i>A, B, C</i> | 16. vascular plant | |

C. Answer the question.

17. What is a main difference in classification between a moss and a fern? *A moss is a nonvascular plant, and a fern is a vascular plant.*
-
-



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Fact or Opinion

Name _____

Succulents are plants that can store water in their stems or leaves. To some, the word *succulent* immediately brings an image of a cactus. However, cactuses are not the only succulents. The aloe is a genus with over 400 species of succulents. These plants are native to South Africa, Madagascar, the Arabian Peninsula, and the islands of Africa.

The aloe vera is a well-known succulent in that genus. Its horn-shaped leaves are thick and fleshy with sharp points at the ends and small spines or teeth at the edges. Some aloe vera can grow up to 100 centimeters (39 in.) tall.

The aloe vera has many uses. It is often grown as an ornamental plant, but it can be more than just a decoration. Many ancient writings record its benefits. The Greeks and Romans used it to treat wounds. In medieval times the yellowish liquid inside its leaves was used to treat digestive problems.

Today the gel from the aloe vera is used for skin care. It is known to soothe burns, wounds, and some skin conditions. Aloe gel is often found in creams, lotions, and wipes. Facial tissue companies promote its moisturizing capabilities and say that it reduces soreness of the nose from colds. For this reason, aloe is often an additional ingredient in tissues.

Aloe vera may be found as an additive to some foods and beverages. However, the medical benefits are not clear. Some research studies have indicated that aloe vera may be useful in the treatment of diabetes or other health conditions. But not all studies have shown the same results. Some uses of the aloe vera have been scientifically proven. Others are still being tested.

A **fact** is a statement that can be proven true or false. You can make sure it is true by checking the information in a reliable source. An **opinion** is a statement that a person believes or thinks. Words like *think*, *best*, and *believe* are clues that the statement is an opinion.

Circle F if the statement is a fact. Circle O if the statement is an opinion.

- F O 1. A succulent is a plant that stores water in its leaves and stems.
- F O 2. Many people think of a cactus when they hear the word *succulent*.
- F O 3. The aloe vera is a beautiful ornamental plant and is very easy to grow.
- F O 4. Uses for aloe vera include skin care.
- F O 5. The burn on her finger felt much better after Meghan dabbed aloe gel on it.
- F O 6. Some facial tissue companies promote the moisturizing capabilities of aloe.



Vascular Plants

Name _____

Student Text pages 142–45

- A. Using the clues below, fill in the blanks. Read the shaded letters to complete number 12.

1.	G	N	E	T	O	P	H	Y	T	E
2.	C	Y	C	A	D					
3.	E	M	B	R	Y	O				
4.	G	I	N	K	G	O				
5.	C	O	N	I	F	E	R	S		
6.	L	E	A	V	E	S				
7.	P	A	P	E	R					
8.	E	V	E	R	G	R	E	E	N	
9.	R	E	S	I	N					
10.	A	N	G	I	O	S	P	E	R	M S
11.	B	U	N	D	L	E	S			

1. a gymnosperm usually found in deserts or rain forests
2. a gymnosperm that is often mistaken for a palm tree
3. contained in each seed of a vascular, seed-bearing plant
4. a gymnosperm with fan-shaped leaves
5. the largest group of gymnosperms
6. a quick way to identify conifers involves looking at this part
7. a product made from pine trees
8. a term that means a tree does not lose its leaves; enables it to make food year-round
9. a part of a conifer; used to make adhesives
10. vascular plants with flowers and seeds that are protected inside a fruit
11. how pine needles are grouped

12. Vascular plants that do not have flowers are called **gymnosperms**.

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- B. Label the pictures as *spruce needles* or *white pine needles*.



13. spruce needles



14. white pine needles

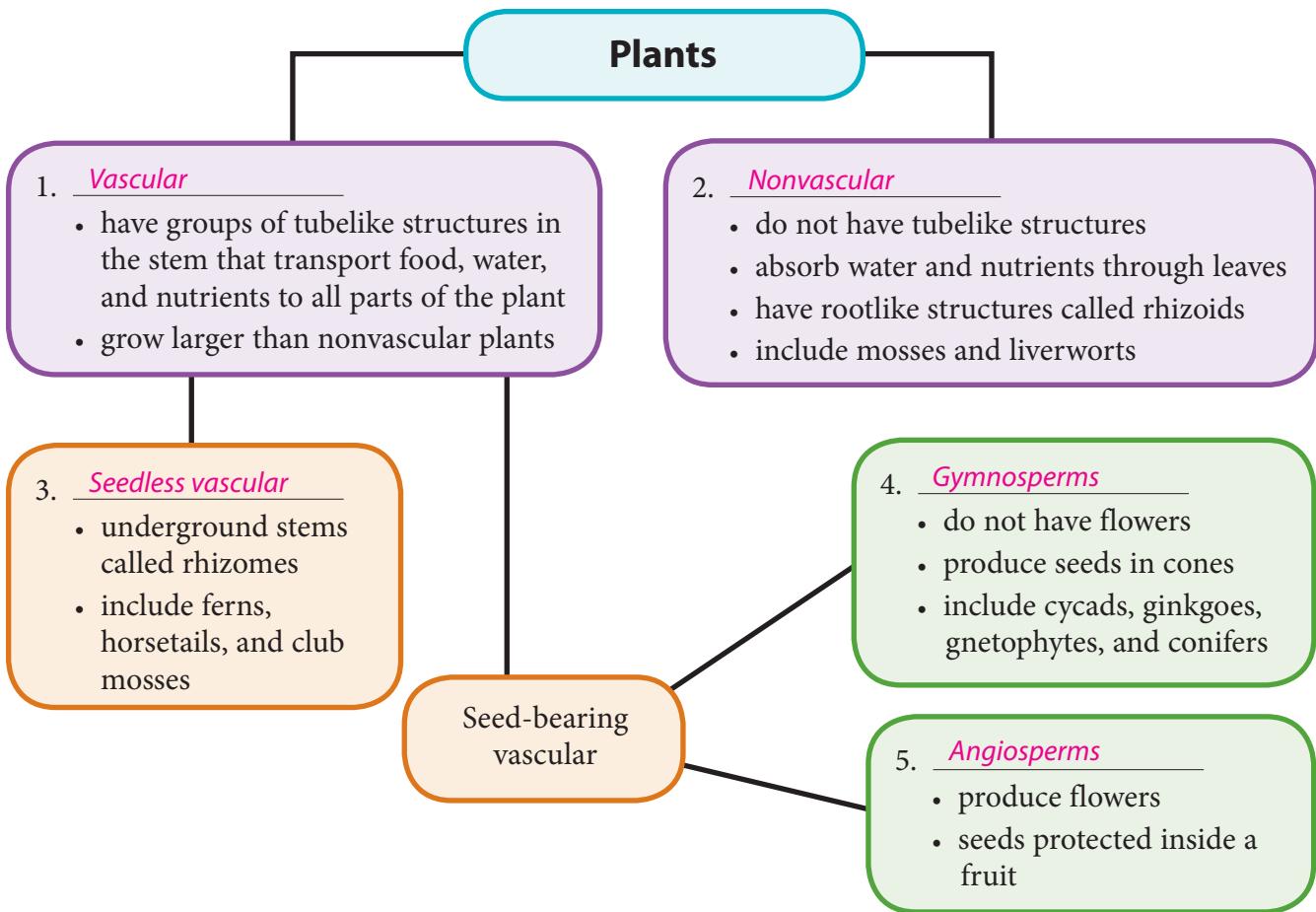
Study Guide

Student Text pages 138–45

Name _____



A. Complete the classification diagram.



B. Write the letter of the correct answer.

- D 6. have tall, hollow, jointed stems
C 7. have leafy branches called fronds
A 8. can resemble small evergreen trees; often called ground pines
B 9. almost all are evergreen and have needlelike leaves

- A. club mosses
B. conifers
C. ferns
D. horsetails

C. Write T if the statement is true. If the statement is false, write a correction for the underlined words.

- ferns 10. Coiled-up fronds of club mosses are called fiddleheads.
T 11. Each seed contains the embryo of a new plant.
leaves 12. The easiest way to identify a conifer is to look at its cones.
T 13. When a pine tree branch is broken, resin protects the break from diseases and insects.



Study Guide

Student Text pages 146–49

Name _____

A. Mark the correct answer.

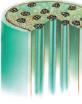
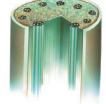
1. ___ are angiosperms that can live for three or more years.
 Annuals Biennials Perennials

2. ___ are angiosperms that live for two growing seasons to fully develop.
 Annuals Biennials Perennials

3. ___ are angiosperms that live for only one growing season.
 Annuals Biennials Perennials

4. The tiny seed leaves of the plant embryo are called _____.
 fronds cotyledons dicots

B. Compare monocotyledons with dicotyledons.

	Monocotyledons	Dicotyledons
5. shortened name	monocot	dicot
6. seed structure	one cotyledon	 two cotyledons 
7. stem	vascular tissue <i>in scattered bundles</i>	 vascular tissue <i>arranged in circle</i> 
8. leaf	parallel veins	 branching veins 
9. root	<i>fibrous root</i>	 taproot 
10. flower	petals in groups of 3 or 6	 petals in groups of 4 or 5 

C. Write the answer.

11. List five products that are made from angiosperms. *Possible answers: coffee, hot chocolate, cola, medicine, rubber, cork, rope, chewing gum*

Classification Check

Name _____

Student Text page 150



Plan

A. Describe and draw your plan.

Materials

B. Write a list of materials needed for your visual aid. Check off each item as you gather it.

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Construct

C. Check off each category as you include it in your model.

- nonvascular
- vascular
- seedless vascular
- seed-bearing vascular
- gymnosperms
- angiosperms

D. Find a picture of a plant for each subcategory. Write the name of each plant next to its subcategory. Be as specific as possible.

mosses _____

liverworts _____

ferns _____

horsetails _____

club mosses _____

cycads _____

ginkgoes _____

gnetophytes _____

conifers _____

dicotyledons _____

monocotyledons _____

Present

E. Explain how scientists classify plants.

Plant Parts

Student Text pages 152–55

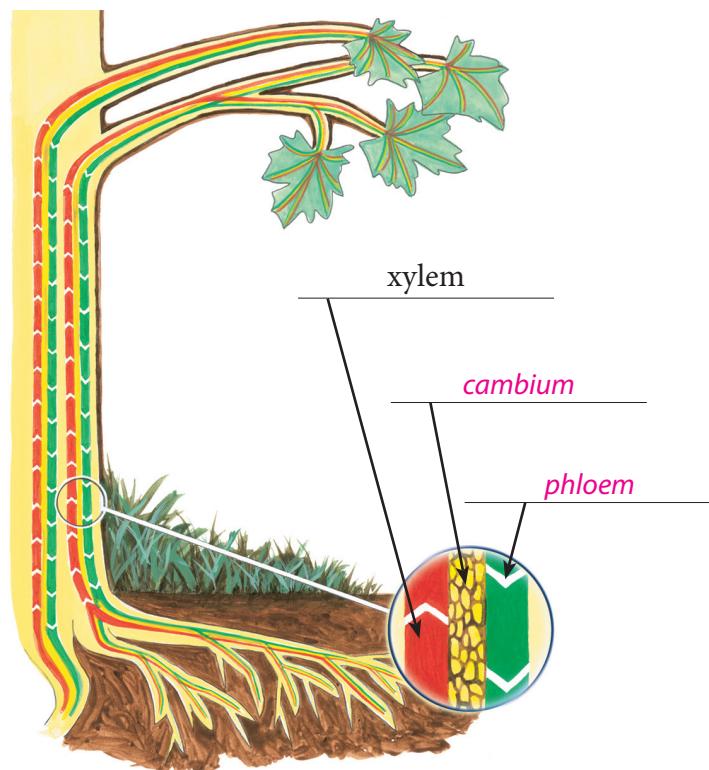
Name _____

Define the terms. Label the diagram using terms 1–3.

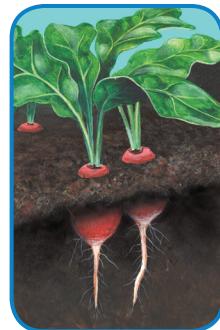
1. xylem *tubes that carry water and minerals from the roots to the top of the plant*

2. phloem *tubes that carry sugars and food throughout the plant*

3. cambium *a layer of cells that divide and reproduce to make more xylem and phloem, allowing the plant to grow wider each year*



4. taproot *a root that continues to grow straight down into the soil*



5. fibrous roots *many thin roots that spread out in all directions; usually found near the top of the soil*



6. aerial roots *roots that never touch soil*





Study Guide

Student Text pages 152–55

Name _____

A. Write the term to complete each statement.

herbaceous

- Many flowers and vegetables have soft green ___ stems.

vascular

- The grouping of tubes that carry water and food to all parts of the plant is called a ___ bundle.

xylem

- The ___ tubes carry water and minerals from the roots to the top of the plant.

phloem

- The ___ tubes carry sugars and food through the plant.

B. Write **T** if the statement is true. If the statement is false, write a correction for the underlined words.

T

- Cells in the cambium divide and reproduce to make more xylem and phloem, allowing the tree to grow wider each year.

taproot

- A fibrous root is a main root that generally grows straight down.

aerial roots

- Some plants have taproots that never touch the soil.

fibrous roots

- Some plants have many aerial roots that spread out in all directions near the top of the soil.

T

- The first root that emerges from the seed is called a primary root.

C. Answer the questions.

10. What can you learn about a tree by looking at its rings? how old the tree is, how much water the tree received each year, the climate, the general health of the tree

11. Identify two important jobs of stems. Stems provide support to hold plants upright, and they provide the transportation system for food, water, and minerals.



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How Big Is My Tree?

Student Text pages 156–57

Name _____



Problem

How can you measure the circumference, height, and crown of a tree?

Procedure

- Identify the type of tree you are measuring. Is this tree an angiosperm or a gymnosperm? How do you know? _____

- Follow the measuring procedures in your textbook. Record your measurements. (A sample has been done for you.)

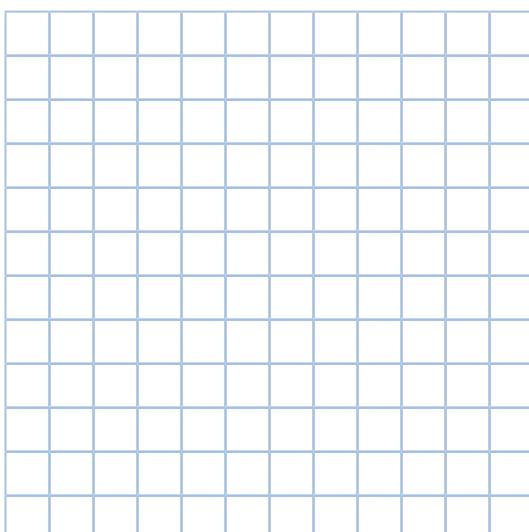
Note: When calculating the points, use only the numerals from the measurements. Round to the nearest whole number. Do not convert the circumference to feet.

Species of tree (ex.: maple, spruce, oak)	Circumference (inches)	Height (feet)	Crown (feet)	Point value Add together the numbers from the following measurements. (circum. + height + $\frac{1}{4}$ crown)
white pine	34 in.	36 ft	21½ ft	$34 + 36 + 5 = 75$ points

3. Graph the measurements from your chart. Be sure to number your graphs.

Comparing Height and Circumference

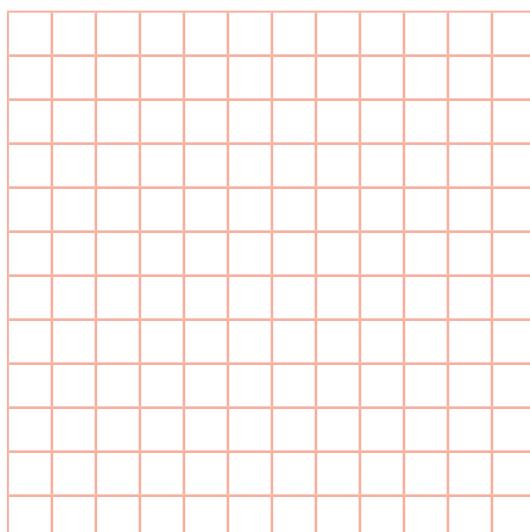
height (feet)



circumference (inches)

Comparing Crown and Circumference

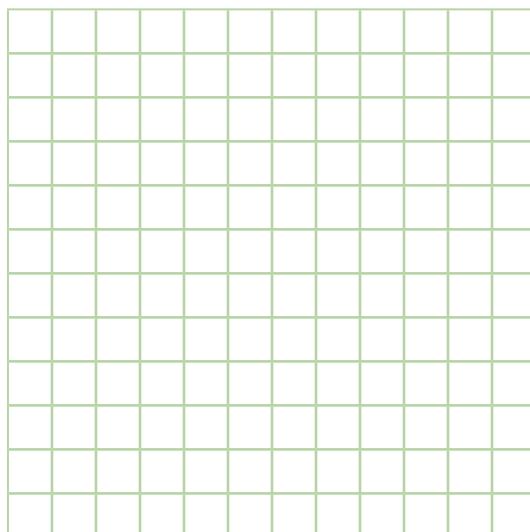
crown (feet)



circumference (inches)

Comparing Crown and Height

crown (feet)



height (feet)

Conclusions

Using the graphs, what general relationship do you see between the height and circumference? *The taller the tree is, the greater the circumference is.*

Thinking It Through

Student Text pages 138–58

Name _____



Plan and write a paragraph answering each question.

1. Why would plants such as mosses and ferns in tropical rainforests grow larger than similar plants in Canada?

Answer should include the following: The plants are very dependent on easily accessible water.

The answer may also include that the warmer climate allows the plants to grow year-round.

2. Your mother really likes a spruce for the family Christmas tree. Your dad has given your older brother and you the task of choosing one this year. How can you be certain to choose a spruce and not a pine or fir?

Answer should include the following: Look at the needles. The needles of pines grow in bundles.

The needles of firs are flat and flexible, and each is attached directly to a branch. The needles of a spruce are stiff, prickly, and four sided. Each is attached to the branch with a woody peg.

3. Your little sister just opened a packet of bean seeds. She discovered that they have two parts, so she broke them apart. She said she did it so that twice as many bean plants will grow. Will her idea work?

Answer should include the following: Breaking the seeds in half will not work because a dicot needs both cotyledons to sprout.

4. A new road cut through the mountains is almost finished. The highway crew is planting a ground cover along a section of the steep bank rising above the road. The plants chosen for this project all have fibrous roots. Why do you think they chose plants with fibrous roots?

Answer should include the following: The roots grow near the surface of the soil. The many thin roots can better hold soil in place. Fibrous roots help prevent soil erosion.

Looking Ahead

Name _____

A. Circle the word or phrase that best completes each sentence.

1. Chemistry is the study of (matter / forces) and how substances change.
2. (A neutron / An element) is a substance, such as oxygen, that contains only one kind of atom.
3. The (outer / center) section of an atom is called the nucleus.
4. The (protons / electrons) and neutrons are part of the nucleus of an atom.
5. Chemical symbols are (pictures / abbreviations) of the names of elements.
6. The periodic table of the (elements / atoms) is a classification system developed by Dmitri Mendeleev.
7. Atoms can join with other atoms to form (periods / molecules).
8. A chemical change usually produces (a compound / an indicator).
9. An atom that has gained or lost electrons is called (covalent / an ion).
10. The (pH / CO₂) scale is used to determine the amount of an acid or a base in a solution.

B. Write a question for something you would like to learn about the following:

- atomic theory

- kinds of chemical bonds

Atomic Models

Name _____

Student Text pages 162–65

A. Fill in the blanks.

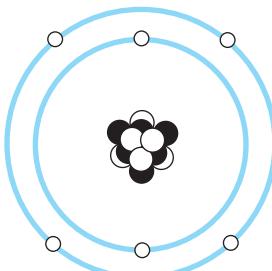
- The smallest recognizable piece of an element is an atom.
- Substances that have only one kind of atom are called elements.
- The three main parts of an atom are protons, neutrons, and electrons.
- Protons and neutrons are found in the nucleus, the center of the atom.
- Negatively charged electrons travel around the nucleus.
- The space that represents the average distance that electrons are from the nucleus is called a shell.

B. Use the atom descriptions to identify each Bohr atomic model. Write the name of the correct element in each blank.

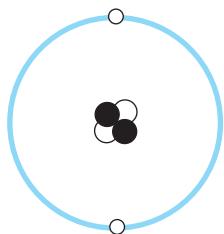
Atom description			
Element	Protons	Neutrons	Electrons
argon	18	22	18
carbon	6	6	6
fluorine	9	10	9
helium	2	2	2
oxygen	8	8	8

atom key

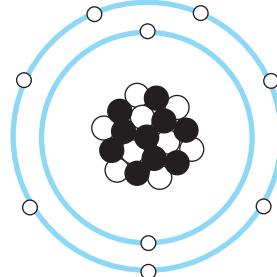
- protons
- neutrons
- electrons



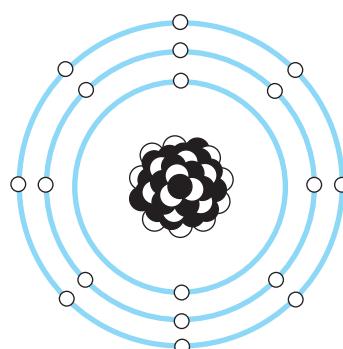
7. _____ helium _____



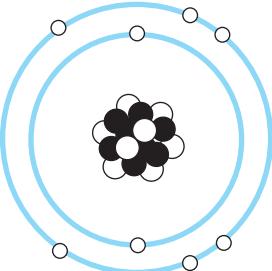
8. _____ fluorine _____



10. _____ argon _____



11. _____ oxygen _____



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Study Guide

Student Text pages 162–69

Name _____



A. Write the letter of the correct answer.

- D 1. the study of matter—what it is made of, what its usual characteristics are, how it reacts to other matter
- G 2. classification system for elements
- A 3. what scientists think atoms are like, based on repeated observations
- C 4. abbreviation for the name of an element
- F 5. special machine that smashes atoms
- B 6. man who developed a simplified model of the atom
- E 7. man who developed a classification system for elements

- A. atomic theory
B. Niels Bohr
C. chemical symbol
D. chemistry
E. Dmitri Mendeleev
F. particle accelerator
G. periodic table of the elements

B. Write the correct word.

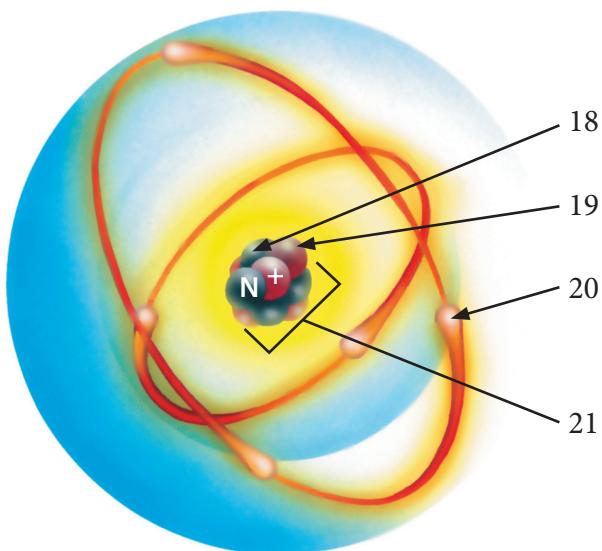
- mass 8. The sum of the number of protons and neutrons results in an atom's approximate atomic ____.
- group 9. A column on the periodic table of the elements is called a ____.
- period 10. A row on the periodic table of the elements is called a ____.
- atom 11. An ____ is the smallest piece of an element that can be recognized as that element.
- element 12. A substance that contains only one kind of atom is called an ____.
- number 13. The atomic ____ of an atom is based on the number of protons in the nucleus.
- shell 14. The space that represents the average distance from the nucleus that electrons travel is called a ____.

C. Complete the chart with the names and descriptions of the main parts of an atom. *The order of answers may vary.*

	Part	Charge	Location
15.	<i>proton</i>	<i>positive</i>	<i>in the nucleus</i>
16.	<i>neutron</i>	<i>no charge</i>	<i>in the nucleus</i>
17.	<i>electron</i>	<i>negative</i>	<i>travels around the nucleus</i>

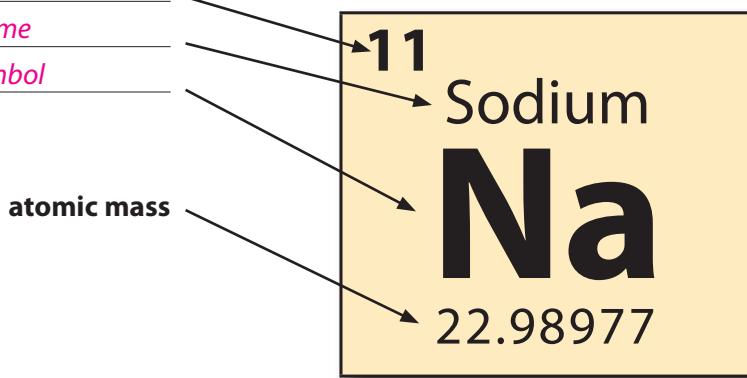
D. Label the parts of the atom.

18. neutron
19. proton
20. electron
21. nucleus



E. Fill in the blanks.

22. atomic number
23. element name
24. chemical symbol



25. The periodic table of the elements classifies elements in categories showing which elements possess similar characteristics and react similarly with other elements.
26. The horizontal rows are called periods.
27. The vertical columns are called groups.

F. Write the answers.

28. If the element carbon has 6 protons, how many electrons does it have? 6
How do you know? Atoms have the same number of protons and electrons.
29. Identify two advantages for scientists to use chemical symbols. Symbols are easier and quicker to write than entire words. All scientists around the world can use the same symbols.

Wanted: U or Your Element

Student Text page 170

Name _____



Case File

Name of element: _____

AKA (also known as)—abbreviation, nicknames: _____

DESCRIPTION

Number of protons: _____

Number of neutrons: _____

Number of electrons: _____

Atomic number: _____

Atomic mass: _____

What does it look like in its normal state? _____

LAST KNOWN LOCATION (position on the periodic table of the elements)

Period (row number): _____

Group (column number): _____

Family: _____

HOW IS IT USED?

HISTORY

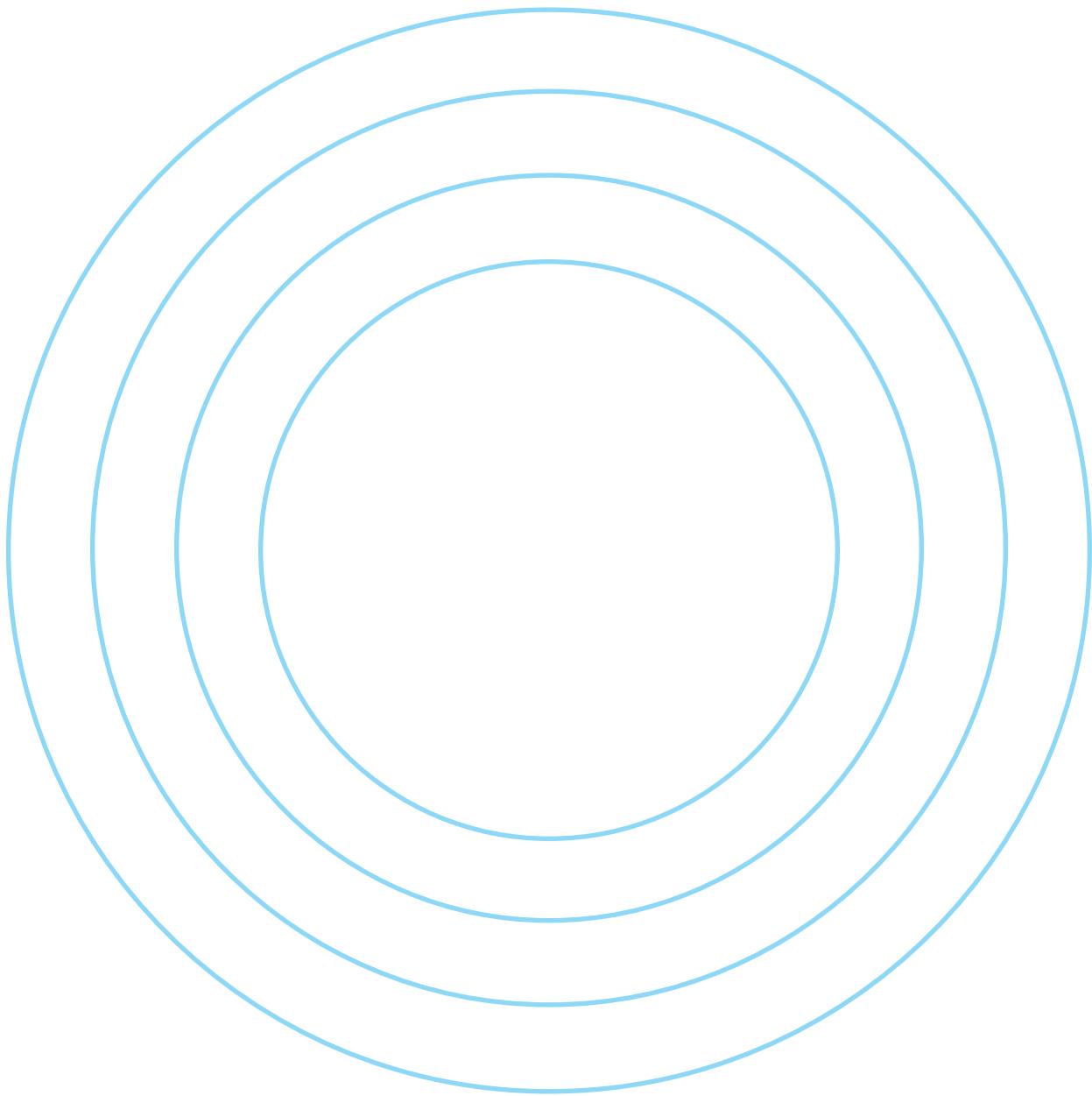
When was it discovered? _____

Who discovered it? _____

ADDITIONAL INFORMATION

Draw a diagram of your atom.

name of element



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Compounds and Atomic Bonds

Student Text pages 171–75

Name _____

A. Write the letter of the correct answer.

- D** 1. atoms joined together
B 2. process that joins together different types of atoms
C 3. substance formed as a result of a chemical change
A 4. the atomic symbols and numbers used to abbreviate the name of a compound

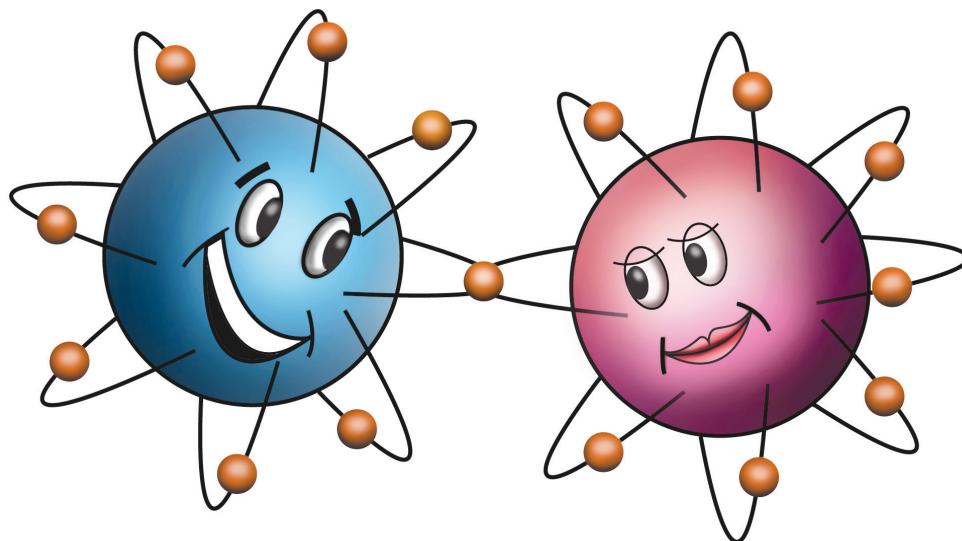
- A. chemical formula
B. chemical change
C. compound
D. molecules

B. Write the chemical reaction.

- decomposition reaction* _____ 5. a compound breaks apart into two or more simpler compounds
synthesis reaction _____ 6. molecules combine to form a new substance

C. Answer the questions.

7. What does the chemical formula H_2O tell a scientist? What is the common name for H_2O ?
This formula tells us that there are two atoms of hydrogen and one atom of oxygen. It is water.
8. How is the compound H_2O different from the elements hydrogen and oxygen?
Hydrogen is flammable. Oxygen is needed to make things burn. Water, or H_2O , is used to put out fires.
9. Why do noble gases rarely undergo chemical reactions?
They are stable atoms. Their outermost shell is completely filled with electrons, and they are not likely to form compounds with other atoms.
10. What is the difference between covalent bonding and ionic bonding?
Covalent bonds occur when atoms share electrons. Ionic bonds form when negative and positive ions are attracted to each other. Atoms with ionic bonds are held together by their opposite charges.





Study Guide

Student Text pages 171–75

Name _____

A. Write the letter of the correct answer.

- E 1. a reaction in which molecules combine to form a new substance
- A 2. the process in which different types of atoms join and form a new substance
- C 3. a reaction in which a compound is broken down into simpler compounds
- B 4. chemical symbols and numbers abbreviating the name of a compound
- D 5. an atom that has gained or lost electrons (number of electrons not equal to number of protons)

- A. chemical change
B. chemical formula
C. decomposition reaction
D. ion
E. synthesis reaction

B. Write **T** if the statement is true. If the statement is false, write a correction for the underlined words.

- T 6. In a stable atom, the outermost shell is completely closed or filled up.
- attract 7. An ionic bond forms when positively and negatively charged ions repel each other.
- electrons 8. In a covalent bond the atoms share ions.

C. Answer the questions.

9. Explain why all compounds are molecules but not all molecules are compounds. *Answer should include the following: There are different types of molecules. Some molecules are produced when atoms of the same element combine. Others are produced when atoms of two or more different elements combine through a chemical reaction. Compounds are a kind of molecule produced as a result of a chemical change (chemical reaction).*
10. Why do some atoms bond with other atoms? *so that each atom completes its outer shell of electrons*
11. What does the chemical formula H_2CO_3 tell you about the compound known as carbonic acid? *This compound has two atoms of hydrogen, one atom of carbon, and three atoms of oxygen.*

Hot or Cold

Student Text pages 176–77

Name _____



Problem

How can I use temperature to determine whether a chemical reaction has occurred?

Materials

goggles	stopwatch
3 plastic cups	30 mL water
metric measuring spoons	5 mL salt
30 mL 3% hydrogen peroxide	30 mL vinegar
thermometer	5 mL baking soda
5 mL yeast	green, red, and blue colored pencils
3 stirring sticks	

Hypothesis

Record your predictions by placing an X in the appropriate column.

Solutions	Will be a chemical reaction			Will not be a chemical reaction
	Temperature will rise	Temperature will drop	Temperature stays the same	
Hydrogen peroxide and yeast				
Water and salt				
Vinegar and baking soda				

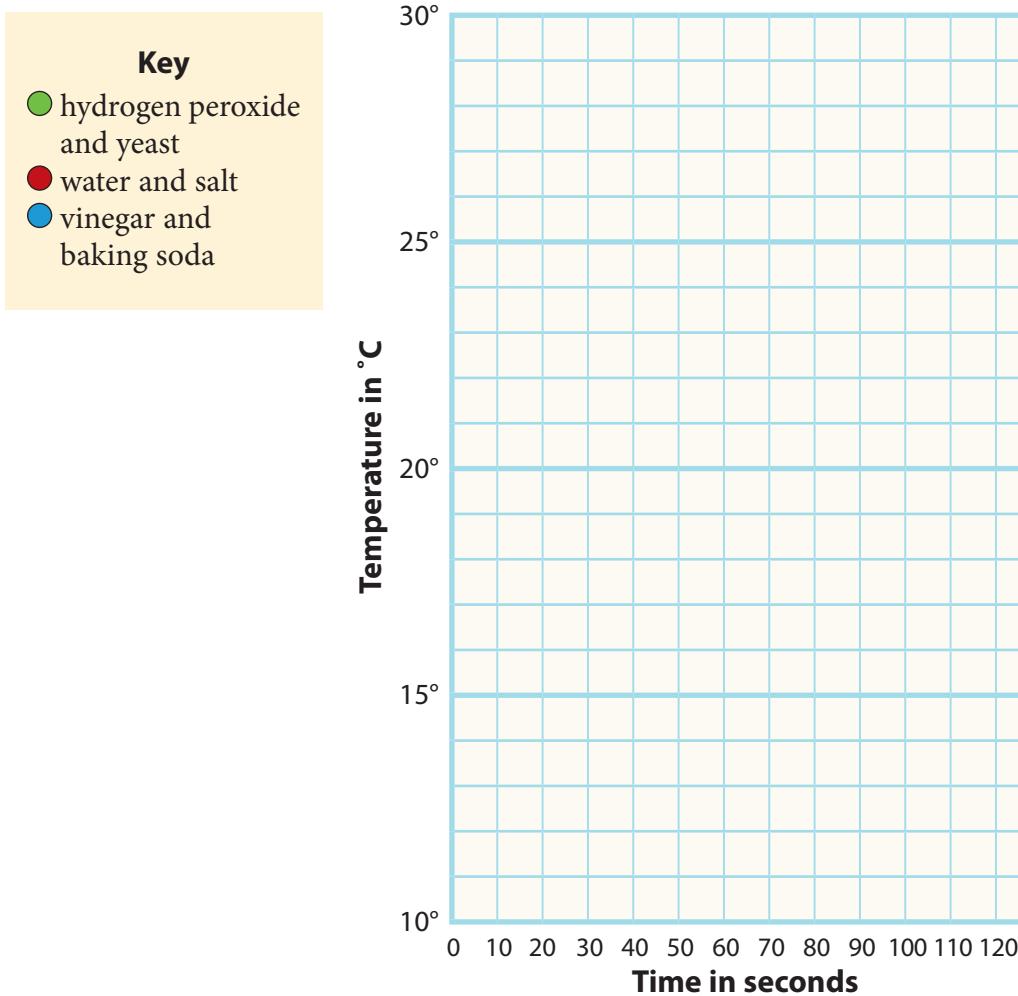
Procedure

Record the temperatures. Write yes if it was a chemical reaction.

Write no if it was not.

Observation chart															
			Time in seconds												
	Starting temp.	Add	10	20	30	40	50	60	70	80	90	100	110	120	Reaction occurred
hydrogen peroxide		yeast													yes
water		salt													no
vinegar		baking soda													yes

Graph your results using the key and colored pencils.



Conclusions

1. Which solution(s) produced a chemical reaction? hydrogen peroxide and yeast; vinegar and baking soda
2. How do you know whether a chemical reaction occurred? The temperature of the hydrogen peroxide rose when yeast was added. The temperature of the vinegar dropped when baking soda was added.
3. Were the reaction(s) you observed exothermic or endothermic? The hydrogen peroxide and yeast solution was an exothermic reaction. The vinegar and baking soda solution was an endothermic reaction.

Study Guide

Student Text pages 178–81

Name _____



A. Fill in the blanks.

1. The **pH scale** is used to determine the concentration of acids or bases in a solution.
2. When **acids** are dissolved in water, hydrogen ions are formed.
3. Bases that dissolve in water are called **alkalis**.
4. A solution that is neither basic nor acidic is **neutral**.
5. Acids that can burn skin and dissolve metals are called **corrosive** acids.
6. An **indicator** is a substance that changes color when exposed to acid or base solutions.
7. A **salt** is an ionic compound produced from a reaction between an acid and a base.
8. Common salts include **table salt**, salt substitute, and **chalk**.

B. Complete the chart.

	Acid	Base
9. type of ions formed when dissolved in water	<i>hydrogen</i>	<i>hydroxide</i>
10. taste	<i>sour</i>	<i>bitter</i>
11. feel	<i>can burn, can be corrosive</i>	<i>slippery</i>
12. example	<i>Possible answer: hydrochloric acid in stomach</i>	<i>Possible answer: soap</i>



Nothing by Mere Authority

Name _____

Robert Boyle has been called the Father of Modern Chemistry. He was born in Ireland and educated by tutors. His teachers avoided all experiments and taught him through books only. But Boyle believed that advances in science would come only through experimenting. His motto was “nothing by mere authority,” meaning that he did not want to accept science as true just because he read it in a book. Instead, he wanted to experiment and find things out for himself.

Boyle wrote a book called *The Skeptical Chymist*, in which he defined an element. In this book, Boyle explained that elements are substances that cannot be separated into simpler components by chemical methods. This was the beginning of the study of the elements and chemistry as we know it today.

Robert Boyle was a Christian. He learned Greek, Hebrew, and other ancient languages so he could study the Bible in the original languages. He also supervised and paid to have the Bible translated into Irish Gaelic, a language spoken in Ireland. Toward the end of his life, he wrote a book called *The Christian Virtuoso*. In this book, he explained the God-given responsibility that man has to study nature. In many of his writings, Robert Boyle showed that science and faith in God go hand in hand. He gave the glory to the Lord for all of his scientific discoveries.



All scripture is given by inspiration of God, and is profitable for doctrine, for reproof, for correction, for instruction in righteousness: That the man of God may be perfect, throughly furnished unto all good works.

2 Timothy 3:16–17

- What source should man look to for the authority that God has given him (2 Tim. 3:16–17)?

the Bible, or Scripture

- In Genesis 1:28, what responsibility has God given to all men? *God has given all men the responsibility to subdue and have dominion over the earth.*

- What was Boyle's motto? *"nothing by mere authority"*

- What did Boyle mean by his motto? *He did not accept science as true just because he read it in a book. He experimented to find things out for himself.*

- Why is it important for us to study nature like Boyle did? *Possible answer: Without studying and understanding the earth, we cannot properly maintain and subdue it.*

pH Indicator

Student Text pages 182–83

Name _____



Problem

How will acid and base solutions change the color of red cabbage juice?

Materials

250 mL prepared red cabbage juice	15 mL household ammonia
goggles	15 mL baking soda solution
5 labeled cups	15 mL distilled water
metric spoons and measuring cups	15 mL white vinegar
15 mL lemon juice	

Table of Colors			
Result color	Acid	Base	Approximate pH
bright red/pink	X		0–2 (strong)
red	X		3–4 (medium)
reddish-purple	X		5–6 (weak)
purple			7 (neutral)
blue-green		X	8–9 (weak)
green		X	10–11 (medium)
yellow/yellow-green		X	12–14 (strong)



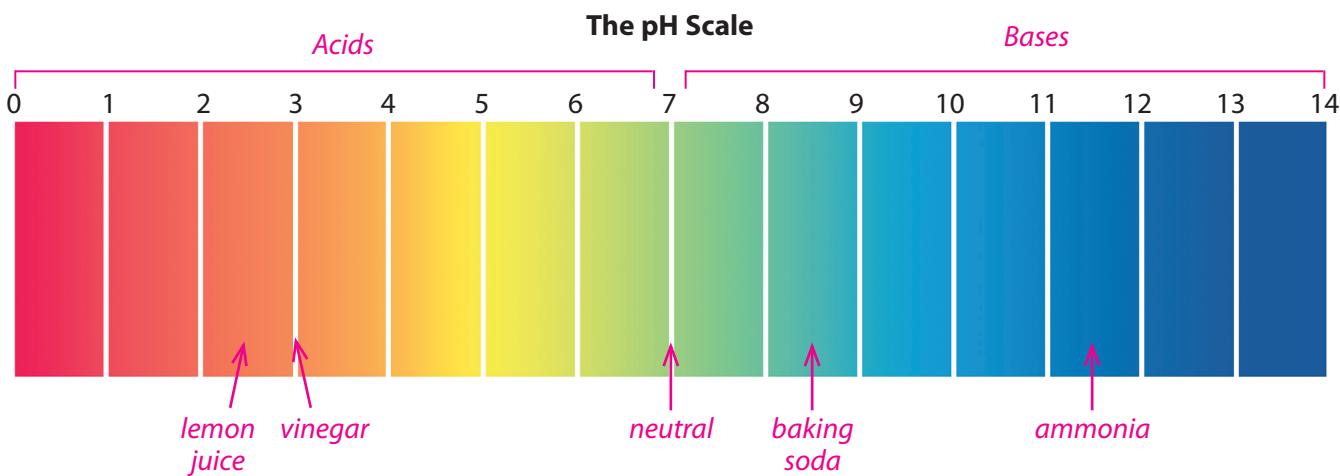
Procedure

Observation Chart							
Solution name	Predicted pH			Solution color	Actual pH		
	acid	base	pH value		acid	base	pH value
1. <i>lemon juice</i>				bright red/pink	X		strong
2. <i>ammonia</i>				yellow/yellow-green		X	strong
3. <i>baking soda</i>				blue-green		X	weak
4. <i>distilled water</i>				purple			neutral
5. <i>vinegar</i>				red	X		medium

Conclusions

1. Which solution was the most acidic? lemon juice
2. Which solution was the most basic? ammonia
3. Did the color of the cabbage juice change when distilled water was added to it? no
Why or why not? Distilled water is neutral.
4. How did your predictions compare with the results?

5. Label the pH scale to show which numbers indicate acids and bases. Label neutral. Then mark where the solutions you tested would be on the pH scale.



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Which Antacid Is Best?

Student Text pages 184–85

Name _____



Problem

Which antacid works best to neutralize an acid?

Materials

goggles
metric measuring cups and spoons
80 mL water
40 mL vinegar
200 mL or larger container
pH indicator paper
6 clear plastic cups
6 spoons or stirring sticks
5 mL baking soda
80 mL milk

Antacids used



Hypothesis

Possible hypothesis: Maalox will neutralize the acid the best.

Procedure

1. What is the pH level of the upset-stomach mixture? _____
2. Record which antacid is in each cup.
3. Test the pH level after adding the antacid. Record your results.

Cup	Antacid name	pH level after adding the antacid
1.		
2.		
3.		
4.		
5.	baking soda	
6.	milk	

Conclusions

1. Which antacid worked best to neutralize the acid? _____

2. Did your results support your hypothesis? Explain. _____

3. How is this model like or unlike a human stomach? _____

4. Do you think this is a valid test of the effectiveness of an antacid? Why or why not? _____

Thinking It Through

Student Text pages 162–86

Name _____



Plan and write a paragraph to answer each question.

1. The periodic table of the elements is an easy way for us to understand characteristics of different elements. Name at least two things that you can tell about an element based on its location on the table. (Hint: Use the words *periods* and *groups*.)

Answer should include the following: Periods (the horizontal rows) tell how many shells of electrons the element has, and groups (the vertical columns) tell how many electrons are in the element's outer shell. Elements in the same group have similar physical and chemical properties.

2. Which kind of atomic bonding is somewhat like magnetism? Why?

Ionic bonding is similar to magnetism because positive and negative ions attract each other in a way similar to the way the north and south poles of a magnet attract each other.

3. Since most cleaners used to clean up spills in the kitchen are bases, what can you assume about the pH of most foods?

Answer should include the following: Since bases neutralize acids, we can assume that most foods are acidic.

4. You find an unknown substance spilled on the table after your little cousin got into your chemistry set. You have some litmus paper and some indicator paper. Which one would give you more information about the spilled substance?

Answer should include the following: Litmus paper tells only whether something is an acid or a base. Indicator paper changes colors to tell how strong or weak the acid or base is. Indicator paper would give more information.

Looking Ahead

Name _____

A. Mark the answer.

1. In 1879 the electric light bulb was invented by ____.
A. Alexander Bell B. Thomas Edison C. Isaac Newton
2. Static electricity occurs when electrical charges build up on ____ of an object.
A. the circuit B. the outlet C. the surface
3. Current electricity is the flow of electrons around ____.
A. a circuit B. an outlet C. a surface
4. ____ allows electricity to flow through it easily.
A. A conductor B. An insulator C. A resistor
5. ____ does not allow electricity to flow through it.
A. A conductor B. An insulator C. A resistor
6. The electric meter on an apartment building measures the ____ of electricity used.
A. amperes B. volts C. kilowatts
7. A battery uses ____ to produce an electrical current.
A. a chemical reaction B. expanding gases C. binary code
8. A ____ converts motion into electrical energy.
A. battery B. generator C. power grid
9. An electronic device uses electricity to ____.
A. resist change B. connect insulators C. communicate information
10. Another name for an integrated circuit is ____.
A. memory B. metalloid C. microchip

- | | | |
|---------|-----|-----|
| 1. (A) | (B) | (C) |
| 2. (A) | (B) | (C) |
| 3. (A) | (B) | (C) |
| 4. (A) | (B) | (C) |
| 5. (A) | (B) | (C) |
| 6. (A) | (B) | (C) |
| 7. (A) | (B) | (C) |
| 8. (A) | (B) | (C) |
| 9. (A) | (B) | (C) |
| 10. (A) | (B) | (C) |

B. Write a question for something you would like to learn about the following:

- current electricity

- electromagnets

Static and Current Electricity

Student Text pages 188–91

Name _____

A. Complete the sentences.

negative

1. The three types of electrical charges are positive, ___, and neutral.

static electricity

2. When electrical charges build up on the surface of an object, ___ occurs.

electrons

3. Some objects have a negative charge because they have gained ___.

repel

4. Objects with like charges push against, or ___, each other.

attract

5. Objects with unlike charges pull toward, or ___, each other.

static

6. Lightning is a kind of ___ electricity.

current electricity

7. The continuous flow of electrons around a circuit is called ___.

closed

8. When a switch is closed and the circuit is complete, electricity flows through a(n) ___ circuit.

open

9. When a switch is open and the circuit breaks, electricity cannot flow through a(n) ___ circuit.

B. Write the letter of the correct answer.

C 10. a material that does not allow electricity to flow through it

A 11. a continuous unbroken path

E 12. a conductor that can be moved to either bridge or not bridge the gap in a circuit

D 13. a material that reduces the flow of electrons

B 14. a material that allows electricity to flow through it easily

- A. circuit
B. conductor
C. insulator
D. resistor
E. switch

C. Complete the section.

15. What two things are necessary to make current electricity? a circuit and a power source

16. What causes a short circuit? Some of the electricity traveling along a wire takes an unexpected path.

17. What are two devices that help prevent short circuits? fuses and circuit breakers

18. Why are metals good conductors? They hold their electrons loosely.

19. Name two good insulators. Answers will vary but may include plastic, wood, and glass.

20. Explain why wires are covered in plastic. Uncovered wire connected to a power source would expose anyone who touches it to electrical current. Plastic protects from electric shock.

21. Name two household items that have resistors. Answers will vary but may include a light bulb and a toaster.

An “Unbreakable” Circuit

Student Text pages 192–93

Name _____



Problem

How can you set up a circuit with two light bulbs so that you can unscrew one while keeping the other lit?

Materials



Hypothesis

Sketch a circuit that you think will be unbreakable.

Procedure

1. Build and test your circuit.
2. Use a colored pencil to follow the path of electricity in the diagram you sketched for your hypothesis. Place an X on any place where the circuit broke.
3. Explain why your circuit did or did not work. *Answers will vary but should mention that it worked because there was a complete path, or it did not work because the circuit had a break and no alternate path.*

4. If your circuit did not work, sketch another hypothesis and repeat steps 2–4.
Continue experimenting as time allows.

Hypothesis 2	Hypothesis 3	Hypothesis 4
Drawing of circuit	Drawing of circuit	Drawing of circuit
Reason circuit did or did not work:	Reason circuit did or did not work:	Reason circuit did or did not work:

Conclusions

1. Did your results support your hypothesis? Were you able to build an “unbreakable” circuit?

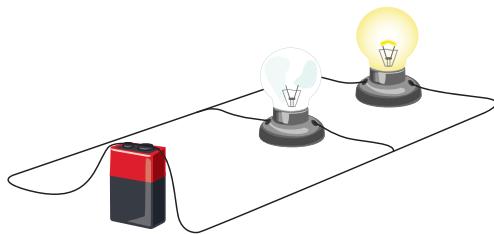
2. How did using a diagram help determine whether the electricity would flow or not?

Circuits and Batteries

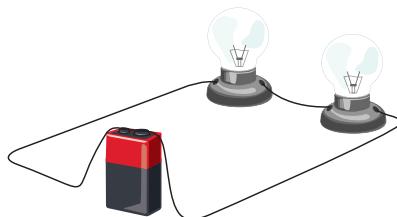
Student Text pages 194–97

Name _____

A. Identify the circuits as *series* or *parallel*.



1. parallel



2. series

B. Mark the sentence that uses the bold term correctly.

3. X The measurement of the amount of electrical push in the circuit is called **volts**.
 Dad threw away the old battery that was leaking **volts**.
4. **Amperes** are the push of the current through the circuit at switches.
 Amperes are the unit of measurement of the amount of current flowing through a circuit in one second.
5. The number of **watts** on a light bulb tells how much current flows through the circuit in one second.
 X The number of **watts** on a light bulb tells the measurement of the amount of power it uses.
6. X An **electrolyte** is the liquid or paste in a battery that conducts electricity.
 The **electrolyte** in a circuit measures the electrical push.

C. Identify each as *wet-cell* or *dry-cell*.

7. car battery wet-cell
8. flashlight battery dry-cell
9. phone battery dry-cell

D. Complete the section.

10. Explain how a battery works. *Answer should include the following: A chemical reaction between two metals and an electrolyte produces electrons that move from the negative terminal along a wire to the positive terminal to complete the circuit and produce an electrical current.*

11. What causes a “dead” battery? *The metals no longer react with the electrolyte.*

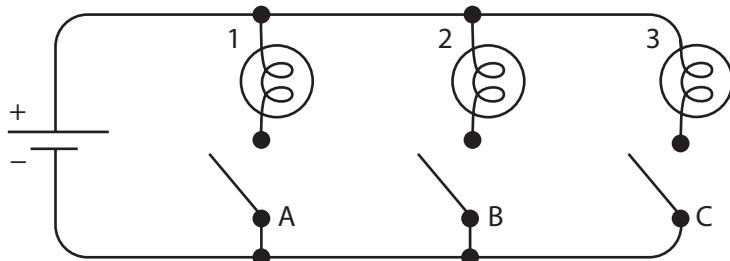
Schematic Drawings

Name _____

Student Text pages 186–90

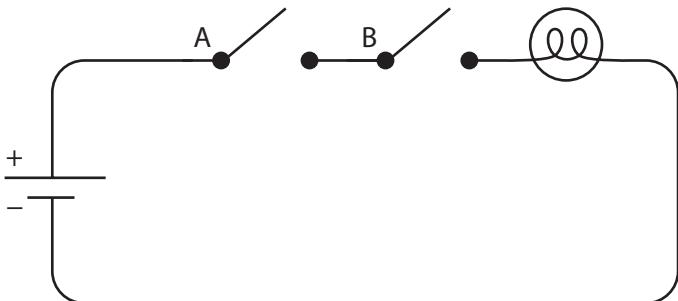
A schematic drawing of an electrical circuit is similar to a map. Electricians and engineers use schematic drawings to diagram the path of electricity. The key shows some of the symbols used on schematic drawings.

Use the key to read the symbols on the drawings and answer the questions.

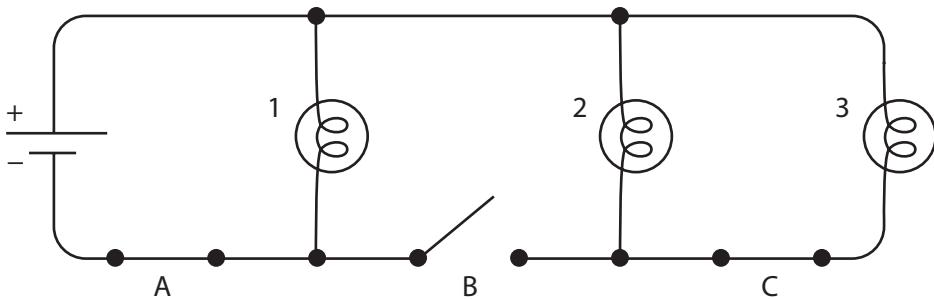


KEY	
wire	—
open switch	— •
closed switch	• —
light bulb	(OO)
battery	

1. Which switches would you have to close to light bulbs 1 and 3? A and C



2. Which switch(es) would you have to close to light the light bulb? A and B



3. If switches A and C are closed, which light bulbs will be lit? 1 only

Why? A circuit is completed when switch A is closed and bulb 1 is lit. Switch B is open, breaking the path to bulbs 2 and 3; therefore, bulbs 2 and 3 cannot be lit.

Study Guide

Name _____

Student Text pages 188–91 and 194–97



A. Mark the answer that completes each sentence.

1. A conductor is a material that allows
 - electrons to back up and thus cause heat.
 - electricity to flow through it easily.
2. When electricity takes an unexpected path,
 - a short circuit occurs.
 - an open switch is a circuit.
3. A volt is
 - a measurement of the amount of electrical push, or force, in a circuit.
 - how fast work is done.
4. An insulator
 - does not allow electricity to flow through it.
 - allows electricity to flow freely through it.
5. An ampere is the unit used to measure
 - how much current flows through a given part of a circuit in one second.
 - the amount of electrical push.
6. An electric cell uses chemical reactions
 - to stop a flow of power.
 - to produce an electrical current.
7. During the chemical reaction in an electric cell, electrons leave the negative terminal and
 - travel through the wire to the positive terminal.
 - travel through the electrolyte to the positive terminal.

B. Write the letter of the correct answer.

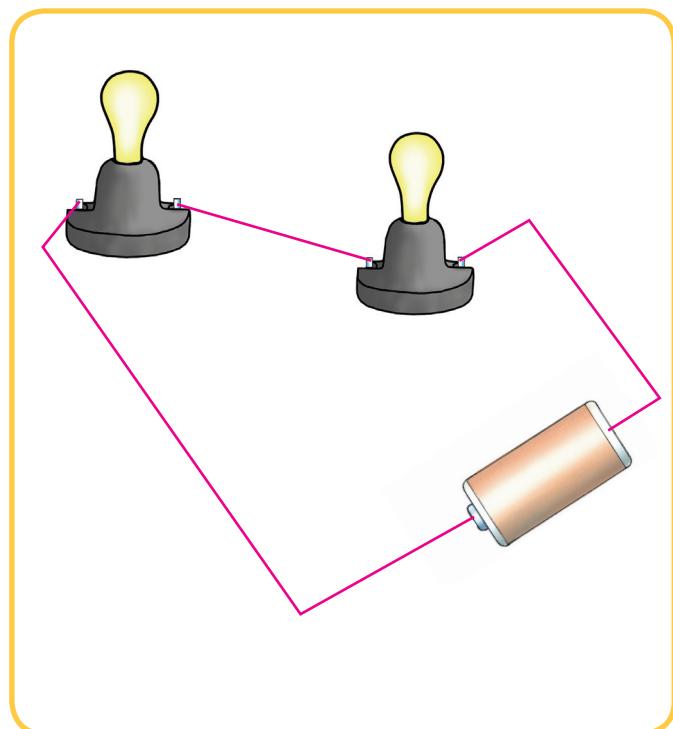
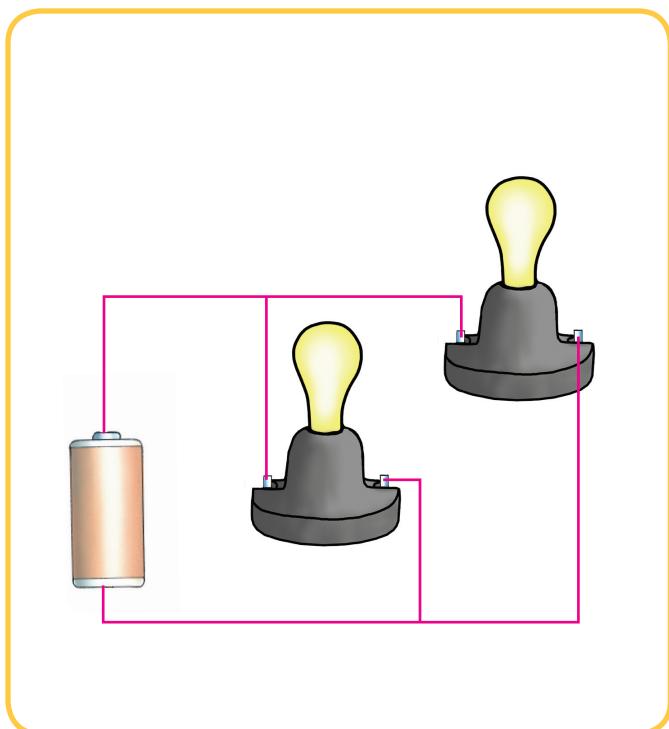
- D* 8. a material that reduces the flow of electricity
- B* 9. a continuous unbroken path through which electricity can flow
- F* 10. the measurement of power, or how fast work is done
- A* 11. contains one or more electric cells
- C* 12. a liquid or paste substance that conducts electricity
- E* 13. a conductor that can be moved to bridge the gap or not bridge the gap in a circuit

- A. battery
B. circuit
C. electrolyte
D. resistor
E. switch
F. watt

C. Draw the wires needed to form the circuits and light the bulbs.

14. parallel circuit

15. series circuit



D. Write the answers.

16. Describe the difference between static electricity and current electricity. *Static electricity happens when electrical charges build up on the surface of an object. Current electricity occurs when a circuit and a power source allow electrons to move.*
17. Name three materials that make good insulators. *plastic, wood, and glass*
18. Describe the difference between a series circuit and a parallel circuit. *A series circuit has only one path for the flow of electricity. A parallel circuit has multiple paths for the flow of electricity.*
19. Summarize how a battery works. *Answer should include the following: A chemical reaction between two metals and an electrolyte produces electrons that move from the negative terminal and along a wire to the positive terminal to complete the circuit and produce an electrical current.*

Study Guide

Student Text pages 198–200

Name _____



A. Write the letter of the correct answer.

- B 1. any material that has the ability to attract iron
C 2. the area of magnetic force around a magnet
A 3. a coil of wire with a core attached to an electrical source
- F 4. discovered that current traveling through a wire produces a weak magnetic field in the live wire
D 5. discovered that moving a magnet around or through a loop of wire produces electricity in the wire
E 6. discovered that adding a metal core to a coil of wire increases the magnetism

A. electromagnet
B. magnet
C. magnetic field

D. Joseph Henry and Michael Faraday
E. William Sturgeon
F. Hans Christian Oersted

B. Complete the sentences.

- poles 7. Magnetic force is strongest at the ___ of a magnet.
attract 8. Opposite poles of two magnets ___ each other.
repel 9. The same poles of two magnets ___ each other.

C. Complete the section.

10. How are magnets and static electricity similar? *Both can attract and repel objects.*
11. Name two things that affect the strength of an electromagnet. *Answers should include two of the following: the size of the core, the shape of the core, increasing the number of coils, the distance between the poles.*
12. Summarize the relationship between magnetism and electricity. *The flow of electricity can produce a magnet, and a magnet moving around or in wire can produce electricity.*
13. Describe how a generator works. *Electric power plant generators usually have turbines. The blades of a turbine are moved by water, wind, or steam, causing the shaft to spin a magnet inside a coil of wire. The spinning magnet produces electricity in the coil of wire.*



Famous Inventors

Student Text page 201

Name _____

Complete as you do your research.

Inventor _____

Country _____

Dates

Birth _____ Death _____

Inventions

Family background

Notable invention

Benefits of invention

Additional inventions and information

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Build an Electromagnet

Student Text pages 202–3

Name _____



Problem

How can you make an electromagnet stronger?

Materials

- 2–3 meters of insulated wire
- 1 large metal paper clip (straightened)
- electrical tape
- 2 D-cell (1.5 volt) batteries or 1 six-volt battery
- 1 bar of staples (separated into individual staples)



Hypothesis

Write a sentence that explains what features will make an electromagnet stronger. *Possible answer:*

An electromagnet made with wire coiled 10 times around a straightened paper clip will be strong enough to pick up 50 staples.

Procedure

Record your observations.

	Object used as core of electromagnet	Number of times wire wrapped around core	Number of staples lifted
Test 1			
Test 2			
Test 3			
Test 4			
Test 5			
Test 6			

Conclusions

1. Did your results support your hypothesis? Explain. _____

2. What changes did you make that made your electromagnet stronger? _____

3. How many staples did your strongest electromagnet pick up? _____

4. Write a generalization of the features that strengthen an electromagnet. *An electromagnet with the greatest number of coils, largest size of core, and highest voltage of electricity will be the strongest electromagnet.*

Magnetic Levitation

Name _____



Student Text pages 204–5

Complete the puzzle.

Across

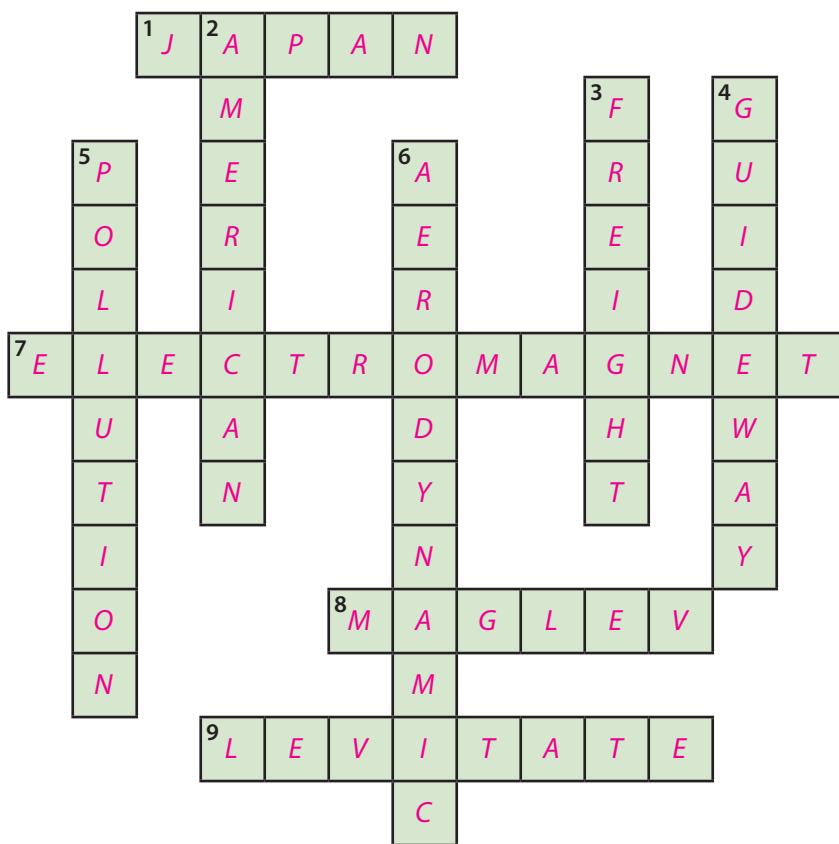
1. a country using maglev trains
7. what a maglev train uses
8. shortened way to say magnetic levitation
9. means to rise or to float

Down

2. nationality of scientists who developed first practical system of maglev trains
3. what maglev trains can carry in addition to passengers
4. maglev train track
5. what maglev trains do not cause
6. design factor that reduces wind resistance



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Study Guide

Student Text pages 206–9

Name _____

A. Complete the sentences.

electrical signal

1. A(n) ___ is an electric current that carries information.

semiconductor

2. A(n) ___ is a material that can work as a conductor or as an insulator.

communicate

3. The binary number system is a code used by electronic devices to ___ information.

integrated

4. A(n) ___ circuit is a very small circuit with all its components in a single unit.

B. Match each computer part with its function.

A

5. the brain of the computer that processes information

C

6. contains the built-in memory and programs, or long-term memory

B

7. stores facts temporarily

- A. CPU (central processing unit)
B. RAM (random access memory)
C. ROM (read only memory)

C. Answer the questions.

8. What is another name for an integrated circuit? *microchip*

9. How does an integrated circuit signal information? *It varies the amount of electricity by opening and closing circuits in sequence.*

10. What is the difference between electrical devices and electronic devices? *Electronic devices can communicate information, but electrical devices cannot.*

11. List three benefits of integrated circuits. *They are small, inexpensive, and durable.*

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Thinking It Through

Name _____

Student Text pages 188–210



Plan and write a paragraph answering each question.

1. Describe why a broken bulb affects a series circuit but not a parallel circuit.

Answer should include the following: In a series circuit, electricity can follow one path only. If a bulb breaks, then the circuit breaks. A parallel circuit has another path for the electricity to flow. If a bulb breaks, the other bulbs remain lit.

2. Describe three advantages that electromagnets have over other magnets.

Answer should include three of the following: They are inexpensive to make; the materials used to make them are common; they can be turned on and off; their strength can be increased or decreased; they are much stronger than regular magnets.

3. If someone is getting a shock from a high voltage electric fence, would it be safer to use a metal pole or a wooden stick to pull the person away from the fence? Explain.

Answer should include the following: The wooden stick would be safer. Metal is a conductor and would allow the electricity to flow to the person holding it. Wood is an insulator.

4. Why would wiring in a house be arranged in parallel rather than series circuits?

Answer should include the following: If a whole house was on a series circuit, every time a break in the circuit occurred, every electrical device would stop working. A problem in a series circuit is harder to find than one in a parallel circuit.

Looking Ahead

Name _____

A. Mark the sentence that uses the bold term correctly.

1. A bus waiting for riders to board is an example of **kinetic energy**.
 A bus moving down the street is an example of **kinetic energy**.
2. **Friction** will eventually stop a ball rolling across the floor.
 Friction from the oil allowed the egg to slide easily from the skillet.
3. The **velocity** of Andrea's bike changed when she turned left at the intersection.
 The **velocity** of the rocket changed while it waited on the launchpad.
4. Benny and Mike put a **pulley** under the treasure chest to lift it out of the hole.
 These curtains open and close by pulling on the cord that is wrapped around that **pulley**.
5. Katy did more **work** than Micah because she carried the box for a longer distance.
 Joshua thought that he did the most **work** even though he was sitting absolutely still.
6. **Acceleration** occurred when Abby made her scooter go slower.
 Jenyia applied **acceleration** to snap her boots into the snow skis.
7. **Gravity** makes a ball thrown into the air come back down to the ground.
 Gravity makes your body continue to move even though the car stopped.
8. A broom is an example of a **lever**.
 A doorknob is an example of a **lever**.
9. The block and tackle on the construction crane formed an **inclined plane**.
 The moving men carefully pushed the piano out of the truck and down an **inclined plane**.
10. The fixed point on which a lever turns is called a **joule**.
 A **joule** is the unit of measurement for work.

B. Write a question for something you would like to learn about the following:

- three laws of motion

- momentum

Motion

Name _____

Student Text pages 212–15

A. Look at each definition. Mark the characteristics that are important to the term.

	Length	Time	Direction	Mass
1. Distance is how far an object travels.	X			
2. Speed is the distance an object travels in a specific time.	X	X		
3. Velocity is speed in a given direction.	X	X	X	
4. Acceleration is a change in velocity during a period of time.	X	X	X	
5. Momentum is the velocity and mass of an object.	X	X	X	X

B. Label the examples as *distance, speed, velocity, acceleration, or momentum*. Each term will be used only once.

speed _____

6. The high-school student can run 13 km/h.

velocity _____

7. The geese are flying north at 80 km/h.

distance _____

8. A jackrabbit ran 112 kilometers.

acceleration _____

9. His car can reach 64 km/h in just a few seconds.

momentum _____

10. The huge aircraft needed a longer runway to stop than the small plane did.

C. Complete the sentences.

potential _____

11. Stored energy that an object has because of its position is its ____ energy.

kinetic _____

12. Energy that an object has because of its motion is ____ energy.

mechanical _____

13. The ability to make something move is ____ energy.

instantaneous _____

14. A speedometer measures the ____ speed of a car at one particular moment.

slows _____

15. Acceleration occurs whenever an object speeds up, ____ down, or changes direction.

friction _____

16. A force that keeps an object from moving against other objects is ____.

D. Answer the questions.

17. The car's driver followed the curve in the road, maintaining a constant speed. Did the car's velocity change? Why or why not? *Yes. Velocity refers to both speed and direction. The curve caused the direction of the car to change, so velocity changed.*

18. Two identical tractor-trailers are traveling through town. One is empty, and the other is loaded with concrete blocks. A stoplight ahead of them turns red. Which truck should start slowing down first? Why? *The one that has the concrete blocks should start slowing down first. It has more mass, so its momentum would be greater. It needs more distance to stop than the empty truck will.*

Study Guide

Student Text pages 212–19

Name _____



A. Fill in the blanks.

1. An object is in motion when its position changes.
2. To determine whether an object is in motion, you need a reference point, an object or location that is not moving.
3. Resistance to a change in motion is called inertia.
4. Newton's first law of motion says that an object at rest tends to stay at rest, and an object in motion tends to stay in motion with the same direction and speed.
5. Newton's second law of motion says that an increase or decrease in force is related to an increase or decrease in mass and/or acceleration.
6. The formula that illustrates Newton's second law of motion is
force (F) = mass (m) \times acceleration (a).
7. Newton's third law of motion says that for every force exerted there is an equal force exerted back; the law of "action" and "reaction".

B. Label the examples as 1 (first law of motion), 2 (second law of motion), or 3 (third law of motion). *Answers may vary.*

- 1 8. You are riding a skateboard. You fly forward off the board when you hit a curb.
- 3 9. The red bumper car at the fair bumps your car into the green bumper car. The red bumper car goes backward as your car goes forward.
- 1 10. A coffee cup is filled to the rim. The car accelerates forward. The coffee spills in your lap.
- 2 11. The batter swings the bat hard, sending the ball into the seats for a home run.
- 3 12. Dad lights fireworks with a match. A firecracker explodes and shoots into the air, displaying many colors.
- 2 13. You can throw a softball farther than you can throw a bowling ball.



C. Write the letter of the correct answer.

- B 14. Stored energy that an object has because of its position is called ___ energy.
A. mechanical B. potential C. kinetic
- C 15. The ability to make something move is ___.
A. potential energy B. friction C. mechanical energy
- C 16. Energy that an object has because of its motion is ___ energy.
A. inertia B. potential C. kinetic
- C 17. Speed is the ___ an object travels in a specific time.
A. momentum B. rate C. distance
- A 18. ___ is speed in a given direction.
A. Velocity B. Acceleration C. Force
- A 19. A change in velocity during a period of time is ___.
A. acceleration B. friction C. momentum
- B 20. The mass and velocity of an object determine the object's ___.
A. distance B. momentum C. speed
- B 21. ___ is a force that keeps an object from moving against other objects.
A. Gravity B. Friction C. Inertia
- A 22. The pull of one object on another is called ___.
A. gravity B. friction C. inertia

D. Answer the questions.

23. When does acceleration occur? *whenever an object speeds up, slows down, or changes direction*
24. What did Galileo discover about motion? *He discovered that a moving object does not come to rest unless an outside force acts on the object.*
25. Who continued Galileo's study and formulated three laws of motion? *Sir Isaac Newton*
26. What three principles can we derive from Newton's second law of motion? *The greater the mass of the object, the greater the force needed to move it. The greater the force exerted on the object, the greater its acceleration will be. The greater the acceleration, the greater the force exerted on the object.*
27. What are two forces that work against inertia? *gravity and friction*
28. How does gravity work against inertia? *Gravity keeps an object from moving indefinitely in a straight line.*
29. Describe three items that use friction to work properly. *Possible answers: soles of shoes, car brakes, bathtub mat, batting gloves, car tires*

Mini Cars in Motion

Name _____

Student Text pages 220–21



Problem

How can I use models to demonstrate Newton's laws of motion?

Procedure

Explain and draw your plan to demonstrate each of Newton's laws of motion. Include materials used. After testing, sketch your successful demonstration.

First Law of Motion—An object at rest tends to stay at rest, and an object in motion tends to stay in motion with the same direction and speed.

Materials	Plan	Successful Demonstration

Second Law of Motion—An increase or decrease in force is related to an increase or decrease in mass and/or acceleration.

Materials	Plan	Successful Demonstration

Third Law of Motion—For every force exerted there is an equal force exerted back; the law of "action and reaction."

Materials	Plan	Successful Demonstration

Use your demonstrations of Newton's laws of motion to answer the questions.

First Law of Motion

A mother and her two sons are riding in a car. All are wearing seat belts. The boys are in the back seat. There are two large metal toy trucks in the back window. The car stops suddenly to avoid hitting a girl retrieving a ball.

The car's windshield is smashed from the inside. One of the boys has a large gash on the side of his head. Everyone else is unharmed. One toy truck is now in the front seat, and the other is on the back seat floor.

1. What probably caused the boy's cut and the broken window? *the trucks*
2. How did the seat belts help prevent additional injury? *The seat belts stopped the passengers from continuing in a forward motion into the steering wheel, dashboard, or windshield.*
3. Why did the trucks end up where they did? *Intertia kept the trucks moving because there was nothing to stop them. One truck hit the boy, and the other truck hit the windshield.*

Second Law of Motion

Car A and Truck A are traveling side by side at the speed limit. The truck is loaded with heavy steel beams. Car B enters the intersection after running a

stop sign. Car A is just able to stop before hitting Car B. Truck A cannot stop. It hits Car B, demolishing the car and seriously injuring the driver.

4. Why could the car stop but not the truck? *Even though the velocity of the two vehicles was the same, the car had less mass to stop in the given distance.*
5. Would the damage to Car B have been as great if the truck had not been loaded? *No; the extra mass in the truck added forward momentum that required more force to stop and caused more damage.*

Third Law of Motion

A pickup truck is stopped at a red light. A small car hits the truck from behind. The truck moves forward slightly. The car bounces back several feet

from the truck. The truck has little damage, but the front end of the car is smashed.

6. How did each vehicle demonstrate the third law of motion? Describe. *The truck moved forward slightly in reaction to being hit from behind. The car bounced back several feet after hitting the heavier vehicle.*
7. What would change if there had been two cars in the accident? *Because the masses of the two cars would be similar, they would probably both bounce some.*

Roller Coaster

Student Text pages 222

Name _____



Draw and label a diagram of your planned roller coaster.

Materials

Procedure

Test your roller coaster until it works as desired. The BB should make it all the way to the end and into the plastic bag. Record your results for each test.

	Successful (yes or no)	Results
Test 1		
Test 2		
Test 3		
Test 4		
Test 5		
Test 6		

Conclusions

1. Draw a diagram of the final roller coaster.
2. Were you able to have as many loops as you wanted? Why or why not?

3. Were your loops as large as you wanted them to be? Why or why not?

4. How do the angles of the slopes affect speed and momentum? *Answers will vary. The slope is not steep enough to keep the BB moving. The slope is too steep for the BB to go up, or the BB will just fall.*

5. How do the sizes and closeness of the loops affect speed and momentum? *Answers will vary. If the loops are too large or too close together, the BB will not make it through the second loop.*

Classes of Levers

Student Text pages 223–25

Name _____

A. Complete the statements.

- | | |
|-------------------|---|
| <i>work</i> | 1. A force acting on something as it moves a certain distance is _____. |
| <i>newtons</i> | 2. Force is measured in _____. |
| <i>joule</i> | 3. The unit used to measure work is called a _____. |
| <i>force</i> | 4. $\text{work} = \text{_____} \times \text{distance}$ |
| <i>machine</i> | 5. Any object that makes work easier is called a _____. |
| <i>effort</i> | 6. The force applied to a simple machine is called the _____ force. |
| <i>resistance</i> | 7. The force that works against the effort force is called the _____ force. |
| <i>lever</i> | 8. Any bar that turns on a point is a _____. |
| <i>fulcrum</i> | 9. The spot where a lever turns or pivots is called the _____. |
| <i>fulcrum</i> | 10. Scientists classify levers into categories based on where the effort and resistance are located in relation to the _____. |

B. Solve the problems. Show your calculations.

11. The bricklayer exerted 150 newtons of force as he pushed the pushcart of bricks down an alley that is 20 meters long. When the bricklayer reached the end of the alley, how much work had he done?

$$150 \text{ newtons} \times 20 \text{ meters} = 3,000 \text{ joules}$$

12. Mr. Garland pushed the lawn cart 40 meters against 45 newtons of friction. How much work did Mr. Garland do?

$$45 \text{ newtons} \times 40 \text{ meters} = 1,800 \text{ joules}$$

13. Dr. White climbed the 6-meter ladder, carrying a package of shingles weighing 45 newtons to the roof of the house. How much work did Dr. White do?

$$45 \text{ newtons} \times 6 \text{ meters} = 270 \text{ joules}$$

Stretch Your Mind

14. The janitor exerted 80 newtons of force to push the box down the 7-meter-long hall against the force of friction. Then he lifted the box weighing 220 newtons onto the second shelf, which was 1 meter off the floor. How much work did the janitor do? Hint: The janitor did two types of work, pushing and lifting. (The contents of the box remained the same when the box was pushed and lifted. The forces of friction and gravity changed the force he exerted for each action.)

$$80 \text{ newtons} \times 7 \text{ meters} = 560 \text{ joules}; 220 \text{ newtons} \times 1 \text{ meter} = 220 \text{ joules};$$

$$560 \text{ joules} + 220 \text{ joules} = 780 \text{ joules}$$

C. Label the effort force *E*, the fulcrum *F*, and the resistance force *R*.

first-class

15. *E*

16. *F*

17. *R*

second-class

18. *E*

19. *R*

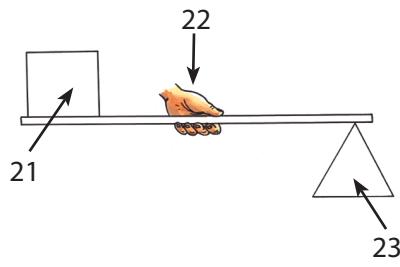
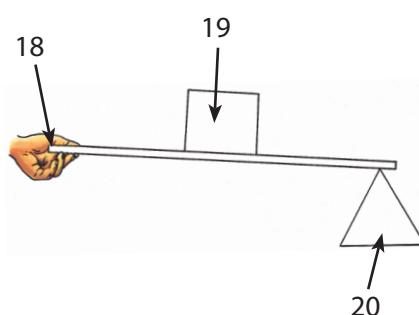
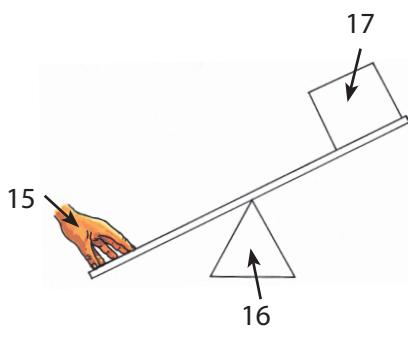
20. *F*

third-class

21. *R*

22. *E*

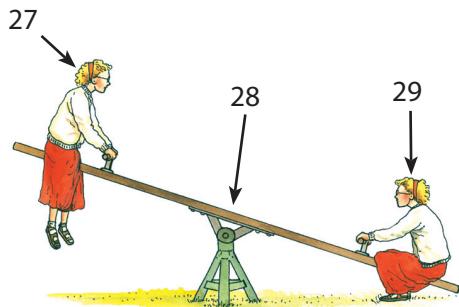
23. *F*



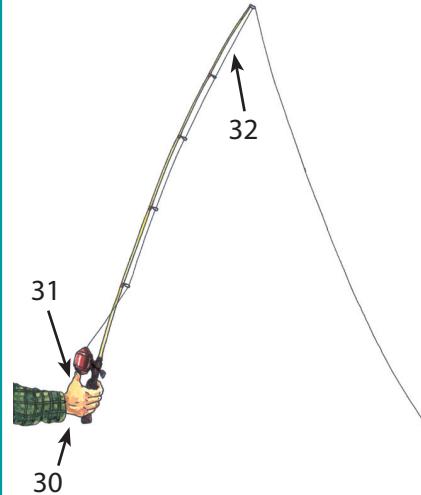
D. Label the levers as *first-class*, *second-class*, or *third-class*.

Label the effort force *E*, the fulcrum *F*, and the resistance force *R*.

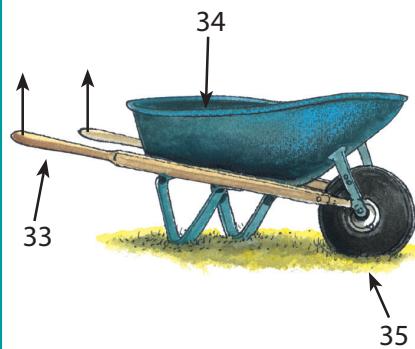
24. *first-class*



25. *third-class*



26. *second-class*



27. *R*

28. *F*

29. *E*

30. *F* (wrist)

31. *E* (thumb)

32. *R*

33. *E*

34. *R*

35. *F*

More Machines

Name _____

Student Text pages 226–29

A. Complete the sentences. Unscramble the shaded letters according to the code to find the name of a Greek philosopher who studied simple machines.

1. Pulleys make work easier by changing the direction of the force or by

r e d u c i n g the amount of force needed to move an object.

2. A fixed pulley changes the d i r e c t i o n of force but does not reduce the amount of force needed to move the object.

3. A moveable pulley does not change the direction of the force, but produces a

g a i n in force, which is a mechanical advantage.

4. Mechanical advantage is the d e c r e a s e in effort that is needed to move an object.

5. A type of wheel and axle that has toothlike projections around the wheel is called a

g e a r.

6. The mechanical advantage of an inclined plane is based on its s l o p e and the length of the inclined plane.

7. A w e d g e is used to split or lift objects.

8. Some winding mountain roads are types of s c r e w s.

9. The ridges in a screw are called t h r e a d s.

10. A c o m p o u n d machine combines two or more simple machines to make work even easier.

A r c h i m e d e s studied simple machines.

5 1 4 9 3 10 2 7 6 8

B. Identify the pictures as a **block and tackle**, **fixed pulley**, or **moveable pulley**.



11. moveable pulley

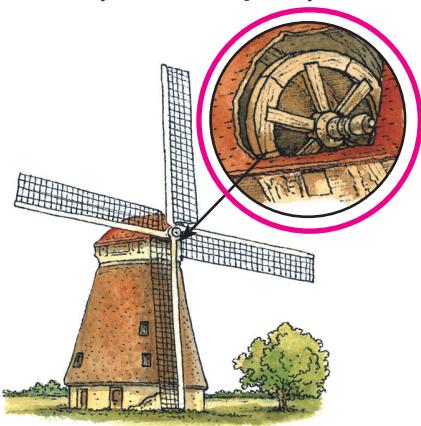


12. fixed pulley

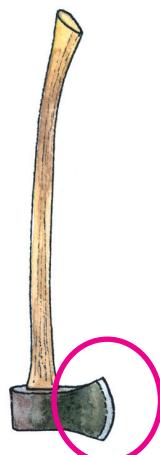


13. block and tackle

C. Circle the simple machine in each picture.
Identify each as a *pulley*, *wheel and axle*, *inclined plane*, *wedge*, or *screw*.



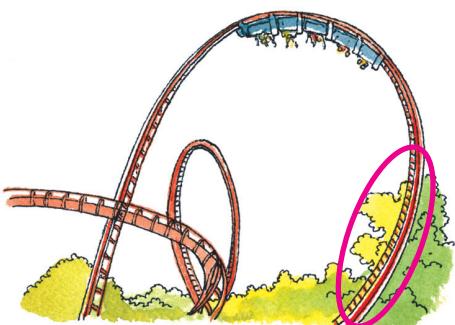
14. wheel and axle



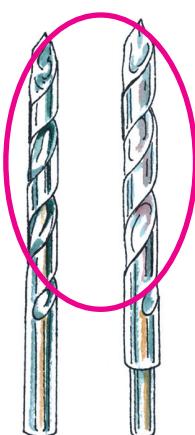
15. wedge



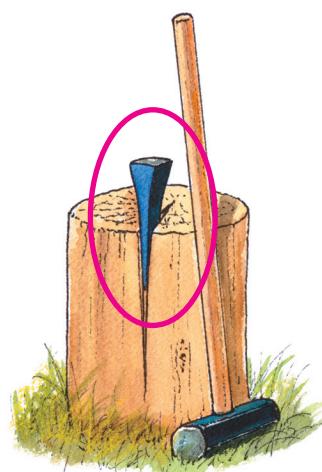
16. pulley



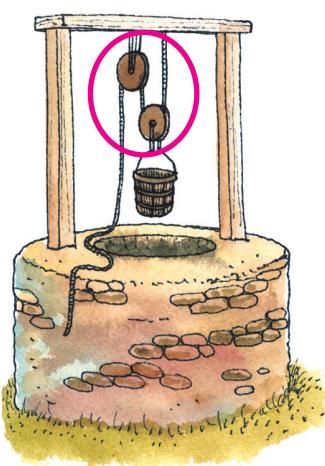
17. inclined plane



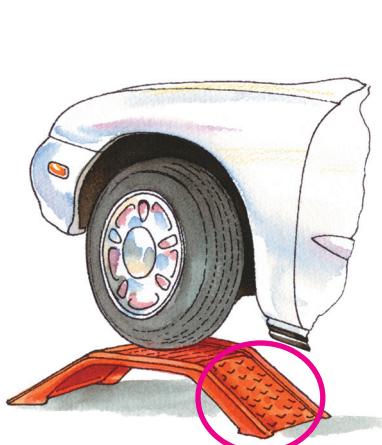
18. screw



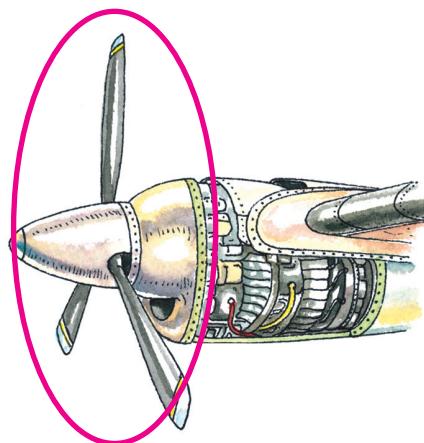
19. wedge



20. pulley



21. inclined plane



22. wheel and axle

Study Guide

Student Text pages 223–29

Name _____



A. Write the letter of the correct answer.

- B 1. a bar that turns on a point
C 2. a grooved wheel with a chain or rope wrapped in the groove
F 3. a wheel with a rod running through the wheel
A 4. a flat slanted surface that makes it easier to move an object up a distance
E 5. two inclined planes placed back-to-back and used to split or lift objects
D 6. an inclined plane wound around a cylinder or a cone

- A. inclined plane
B. lever
C. pulley
D. screw
E. wedge
F. wheel and axle

B. Fill in the blanks.

7. Work is done when a force moves an object over a distance.
8. Force is measured in newtons, and work is measured in joules.
9. The formula for work is $force \times distance = work$.
10. The decrease in effort that is needed to move an object is called mechanical advantage.
11. The spot where a lever turns, or pivots, is called the fulcrum.
12. On a first-class lever, the fulcrum is located between the effort and the resistance.
13. On a second class lever, the resistance is between the effort and the fulcrum.
14. On a third-class lever, the effort is between the resistance and the fulcrum.
15. A fixed pulley changes the direction of the force, but does not reduce the amount of force needed to move the object.
16. A moveable pulley does not change the direction of the force, but does have a mechanical advantage (decrease in effort needed to move the object).

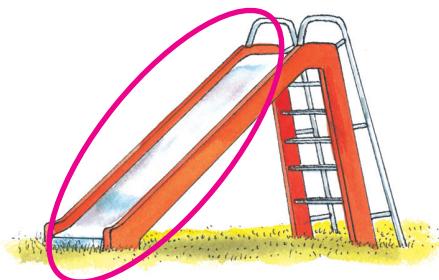
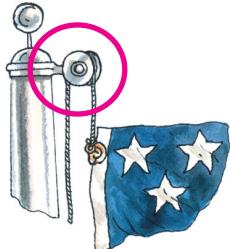
C. Write the letter of the correct answer.

- D 17. any object that makes work easier.
C 18. the force applied to a simple machine
E 19. the force that works against the effort
A 20. combines multiple fixed and moveable pulleys
B 21. combines two or more simple machines to make work easier

- A. block and tackle
B. compound machine
C. effort
D. machine
E. resistance

D. Circle the simple machine in each picture.

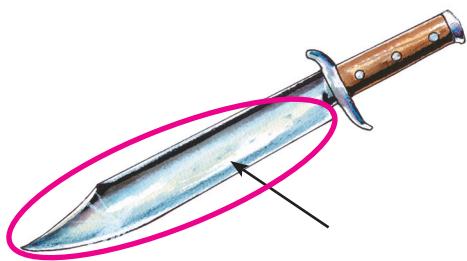
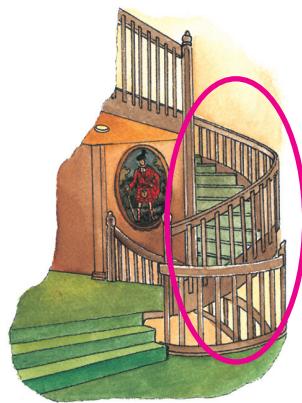
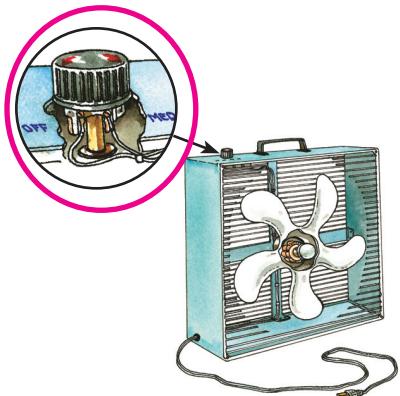
Identify each as a *pulley*, *wheel and axle*, *inclined plane*, *wedge*, or *screw*.



22. pulley

23. inclined plane

24. lever

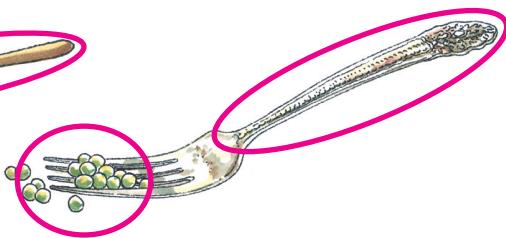
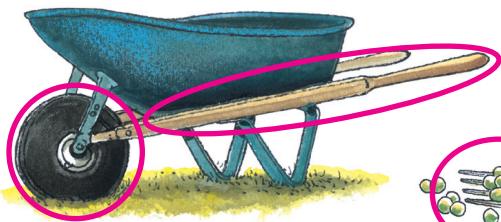


25. wheel and axle

26. screw/inclined plane

27. wedge

E. Identify the two simple machines in each of these compound machines.



28. lever

29. wedge

30. screw

wheel and axle

lever

wheel and axle

Egyptian Machines

This page is best used after all the types of simple machines have been studied.

Name _____

One Egyptian machine was the chariot. Although the Egyptians did not invent the chariot, they did make it lighter and more effective. A chariot usually had two wheels with six spokes each. The body was made of light wood and wicker. The wicker floor made the chariot soft and springy for the bumpy travel.

Chariots carried from one to four passengers. The most common chariots carried two people. One person was the driver, and the other was a warrior with access to the weapons.

Chariots were not used just for war. They were also used for hunting, processions, and ceremonial rites. When Joseph was honored by Pharaoh, he rode in the royal chariot (Gen. 41:43). Solomon built chariot cities to

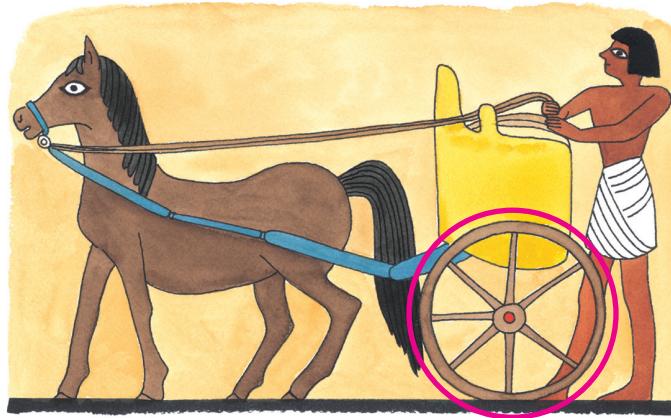
protect the northern border of Israel (1 Kings 9:15–19).

Another Egyptian machine was the shaduf (shah DOOF). It was used to draw water from the Nile River. The lever had a bucket on one end and a large weight on the other end. The skin-covered bucket was easily operated by one person.

Shadufs were used to draw water for crops and animals. The water could be poured directly onto the field. At other times, the bucket would be emptied into the upper end of a canal.

The shaduf provided drinking water for the people. The Nile River was one of the only resources that the Egyptians had. The shaduf made access to the water much easier.

A. Circle the simple machines that you find on the chariot and shaduf.



B. Answer the questions.

- What simple machines do you see in the chariot and the shaduf? *Answers should include wheel and axle and lever.*
- Cars today have shock absorbers that help make rides smooth. What did the Egyptian chariots have? *soft and springy wicker floors*
- Why do you think there was a weight attached to one end of the shaduf? *Answers should include that this helped the man operating the shaduf lift the water more easily.*
- What happened in the chariot in Acts 8:27–35? Was the chariot being used for battle or for something else? *Answers should include that the Ethiopian eunuch was using his chariot for transportation. He was reading Isaiah when Philip caught up to him and told him about Jesus.*



How Much Force?

Student Text pages 230–31

Name _____

Problem

How can an inclined plane reduce the amount of force needed to do work?

Materials

board approximately 30 cm × 80 cm
meter stick
masking tape
stack of books 15 cm high

object for weight
string 1 meter long
spring scale (newton)
calculator (optional)

Procedure

(A sample row has been done for you.)

Length of inclined plane	Force in newtons		Distance in meters		Amount of work done in joules
80 cm	3.0 N	×	.80 m	=	2.40 joules
60 cm	N	×	m	=	joules
40 cm	N	×	m	=	joules
20 cm	N	×	m	=	joules

Conclusions

1. Why was the amount of work done at each distance about the same? *Answers will vary. The shorter the distance is, the steeper the slope is; thus the amount of work done at each distance was about the same.*
2. How does the amount of force change as the length of the inclined plane decreases? *The shorter the inclined plane is, the greater the amount of force required will be.*
3. At which distance was the most force required to do the work? *20 cm*
4. Explain how this information would be helpful if you were using a ramp to load a truck or were pulling a loaded wagon up a hill. *Answers will vary. Work will be easier if the ramp is longer and the slope is smaller.*

Imaginative Inventions

Name _____

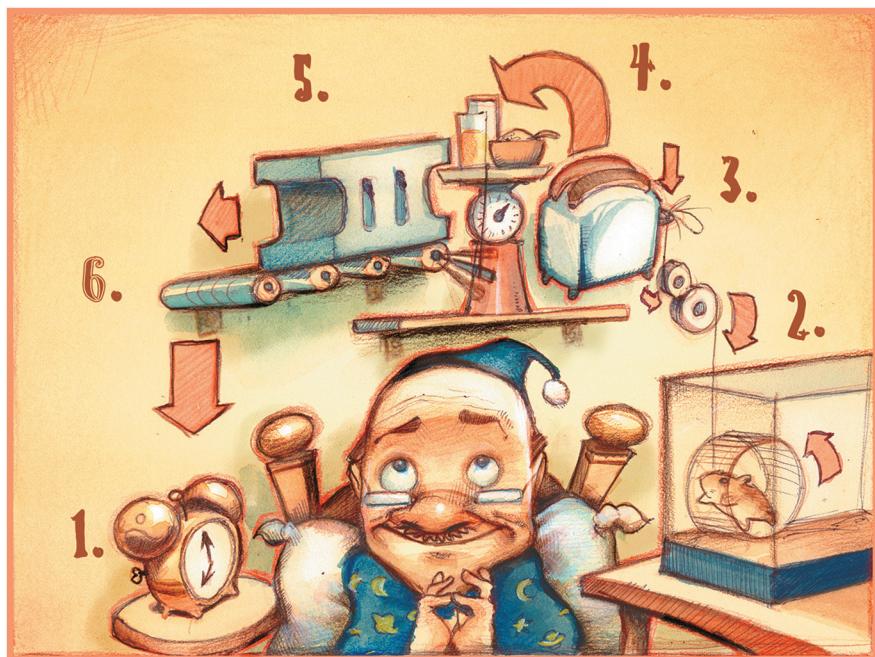
A. Read about imaginative inventions. Study and label each step of the invention on this page. The first step is already labeled.

Machines are intended to allow people to apply less effort to accomplish the same amount of work. We often call machines “labor-saving devices.” However, some jobs are simple, and complicated machines are not needed. A little human effort accomplishes the job quite well.

Some people, however, enjoy inventing complex machines to do these simple tasks. These inventions usually require very little human effort. They often combine simple

and compound machines. They are complicated and often comical.

Although these are fanciful inventions, the designers need a basic knowledge of science principles. The effects of gravity and the laws of motion are often key parts of the inventions. The inventions also require creativity, logic, and a good sense of humor. Designing and making inventions that work hard to perform simple tasks may be the hardest task of all.



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1. Alarm clock goes off.

2. *Other answers will vary.*

3. _____

4. _____

5. _____

6. _____

B. Design your own invention.
Number and label each step of your drawing.

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Thinking It Through

Student Text pages 212–32

Name _____



Plan and write a paragraph answering each question.

- How should simple machines be used in a Christian's life? How should a Christian's purpose for using simple machines be different from an unsaved person's thinking?

Answer should include the following: A Christian should use simple machines as tools to enable him to obey God in the different areas of his life. In order to be a good steward of what God entrusts to him, a Christian should apply himself to learn about these tools.

- Which requires more effort—getting a swing going or keeping it going? Which one of Newton's laws does this demonstrate?

Answer should include the following: Getting a swing going requires more effort. Newton's first law is illustrated. In order to get it going, you must overcome inertia.

3. Sophia's family stopped at a rest area during their long car trip. Behind the buildings was a tall hill. Sophia ran up and down on the hill several times to stretch her legs. She noticed that when she ran up the short, steep side, it took more effort to run than when she ran up the side that had a long, gentle slope. Why do you think there was a difference?

Answers will vary but should include the following ideas: A hill is similar to an inclined plane.

Mechanical advantage of an inclined plane is based on the slope and length of that plane. A steep, short inclined plane requires a greater amount of force to move an object (Sophia) up that inclined plane. When the distance is increased, the longer inclined plane requires less force to move the same object.

4. Several boys have been asked to move chairs from the back of a moving truck and into the auditorium. Once in the auditorium, they will need to be stacked on the stage. What simple machines might be helpful to aid in this process? Include how each would be used.

Answers could include a pulley, an inclined plane, a lever, and/or a wheel and axle.

Looking Ahead

Name _____

A. Circle the word or phrase that best completes each sentence.

1. The (magnitude / exposure) of a star depends on the star's size, temperature, and distance from Earth.
2. A light-year is the (speed / distance) that light travels in one year.
3. A cloud of dust, gases, and debris in space is called a (nebula / neutron).
4. A star that suddenly flares and becomes brighter is called a (nova / pulsar).
5. A (nebula / black hole) was once a supergiant star that collapsed and disappeared from space.
6. A (galaxy / constellation) is a group of stars that form a picture in space.
7. The scientific study of the stars is called (astrology / astronomy).
8. A (galaxy / supernova) is a huge star system that covers many light-years of space.
9. (An asteroid / a comet) is an irregularly shaped piece of rock, metal, and dust in space.
10. Scientists believe the Barringer Crater was formed when (an asteroid / a meteorite) hit the earth.

B. Write a question for something you would like to learn about the following:

- characteristics of stars
-
-
-

- the Milky Way
-
-
-

Characteristics of Stars

Student Text pages 236–39

Name _____

Complete the puzzle.

Across

1. magnitude that indicates how bright a star really is
6. color of the coolest stars
8. kind of star that is hundreds of times larger than the sun and thousands of times brighter
10. magnitude that indicates how bright a star appears to us



Down

2. star closest to the earth
3. how far light travels in one year
4. day of Creation on which God created the sun, moon, and stars
5. color of the hottest stars
7. kind of star that our sun is
9. kind of star that is hundreds of times brighter than the sun

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Psalm 8:3–4

*When I consider thy heavens, the work
of thy fingers, the moon and the stars,
which thou hast ordained; what is
man, that thou art mindful of him? and
the son of man, that thou visitest him?*

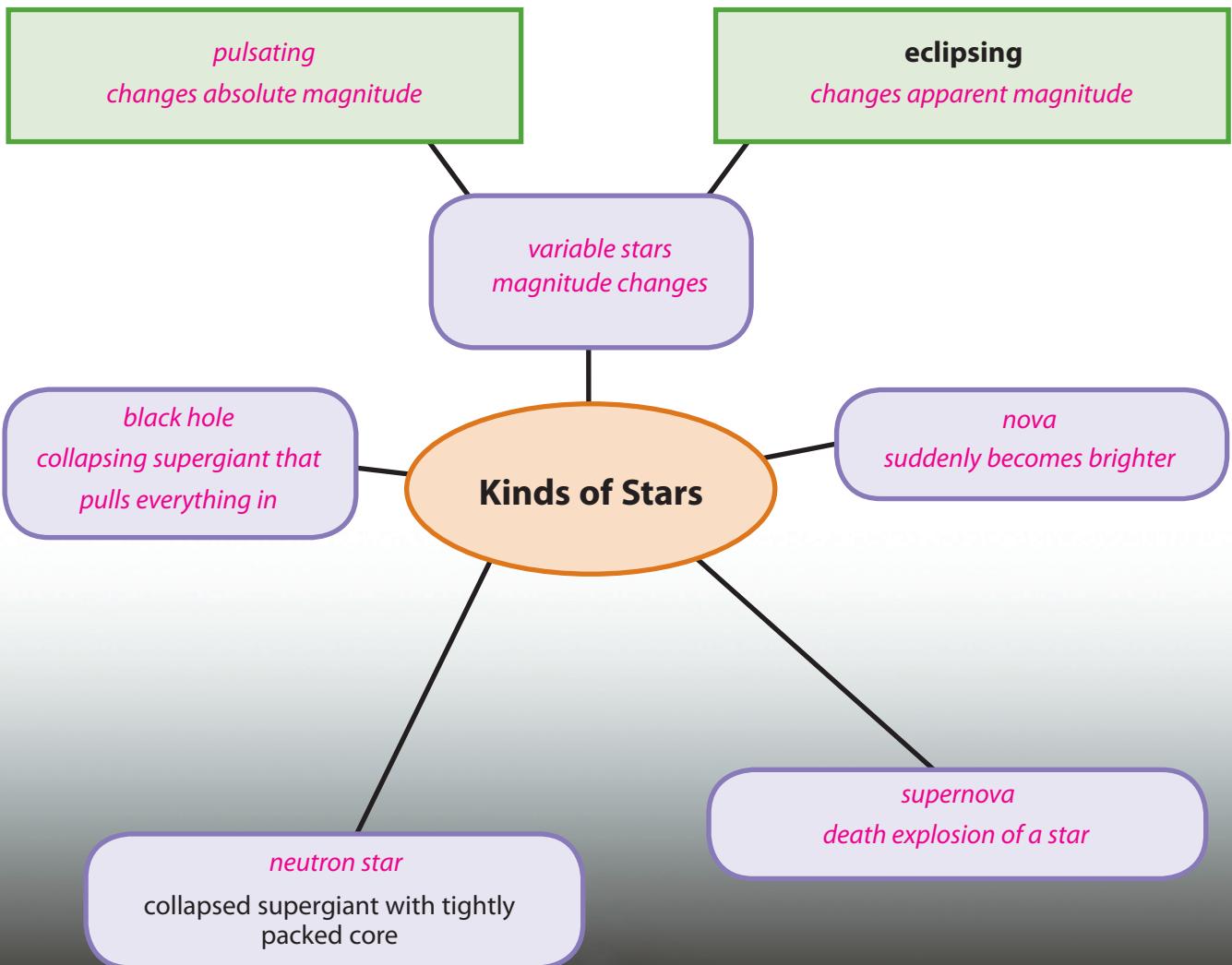
Star Web

Student Text pages 240–43

Name _____

Complete the web.

Suggested answers given.





Study Guide

Student Text pages 236–43

Name _____

A. Match the definitions with their terms.

- C 1. the brightness of stars
- B 2. how bright a star appears to us
- A 3. true brightness of a star
- G 4. neutron star that spins rapidly on its axis
- E 5. may occur when a supergiant collapses to a very dense core
- D 6. a cloud of dust, gases, and debris
- F 7. an existing star flares and becomes brighter
- H 8. the death explosion of a star

- A. absolute magnitude
- B. apparent magnitude
- C. magnitude
- D. nebula
- E. neutron star
- F. nova
- G. pulsar
- H. supernova

B. Number the sizes of stars from smallest to largest.

- 3 9. supergiants
- 1 10. dwarf stars
- 2 11. giant stars

C. Write **T** if the statement is true. If the statement is false, write a correction for the underlined words.

- T 12. A light-year is the distance that light travels in one year.
- parallax 13. The apparent movement or change in position of one star in relationship to other stars is known as pulsating.
- produce 14. Stars are glowing balls of gases that reflect light.
- T 15. A supergiant star that collapses and disappears from space is called a black hole.
- The sun 16. Proxima Centauri is the closest star to Earth.
- T 17. Variable stars regularly or repeatedly change in magnitude.

D. Write the answers.

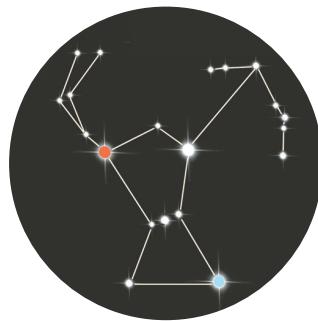
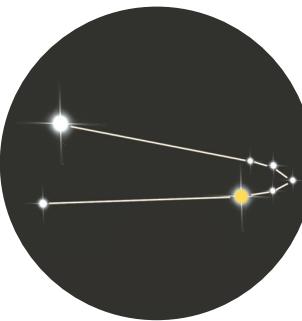
- 18. Summarize the relationship between a star's surface temperature and its color. *Answer should include the following: Colors vary depending on the star's surface temperature. The coolest stars are red and the hottest stars are blue.*
- 19. Explain the difference between pulsating variable stars and eclipsing variable stars. *Answer should include the following: Pulsating variable stars go through periods of swelling and brightening, then shrinking and dimming. The absolute magnitude changes. Eclipsing variable stars are pairs of stars that orbit each other. When one star moves in front of the other, it eclipses the other star, thus causing the apparent brightness to dim. The apparent magnitude changes.*

Observing the Heavens

Student Text pages 244–47

Name _____

A. Label the constellations.



1. Cassiopeia

2. Taurus

3. Orion

4. Pleiades

B. Write the correct letters.

B 5. Constellations that revolve around the North Star are called ____.

- A. bipolar
- B. circumpolar
- C. polaris
- D. dipper

A 6. ____ invented a reflecting telescope.

- A. Newton
- B. Hubble
- C. Galileo
- D. Bacon

A 7. A ____ breaks down the light given off by a star into all its colors.

- A. spectroscope
- B. refracting telescope
- C. reflecting telescope
- D. radio telescope

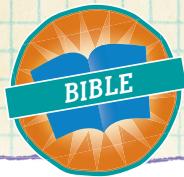
D 8. If an object is moving away from the earth, the wavelengths on a spectroscope demonstrate a ____ shift.

- A. purple
- B. blue
- C. green
- D. red

C. Write the answers.

9. Explain the difference between a refracting telescope and a reflecting telescope. *A refracting telescope uses convex and concave lenses to bend light. The reflecting telescope uses mirrors to reflect the light into an eyepiece.*

10. Explain the difference between astronomy and astrology. Why is astrology wrong? *Answer should include the following: Astronomy is the scientific study of the stars and heavenly objects. Astrology is the belief that the positions and movements of the stars and heavenly bodies influence what happens on Earth. Astrology exalts the creation of God above the Creator, and it denies the truth about God revealed in the Bible.*

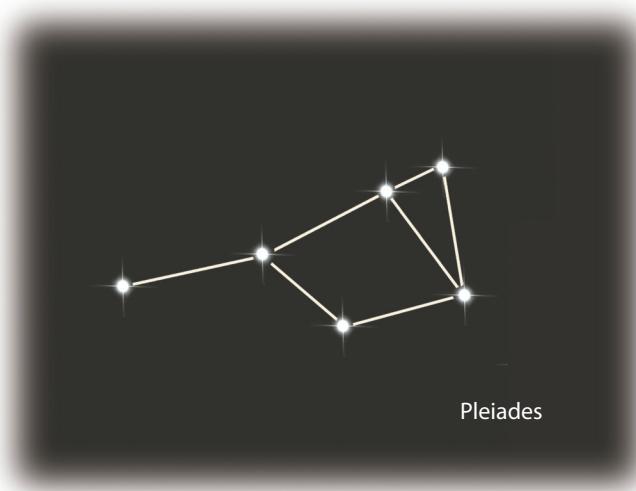


Glorious Light

Name _____

- A. Use the clues and your Bible to complete the puzzle. The circled letters complete question 9.**

1. C O U N S E L
2. G L (O) R Y
3. S U (N)
4. J E (S) U S
5. O R (I) O N
6. (D) A Y
7. J O S (E) P H
8. S T A (R) S



Pleiades

1. The Babylonians are warned against the powerless ___(s) of astrologers and stargazers that can make them weary. (Is. 47:13–14)
2. The stars and all other things were created to bring God ___. (Rom. 11:36)
3. Paul was trapped aboard a ship during a storm so fierce that neither the ___ nor the stars appeared for days. God sent an angel to encourage Paul to “fear not.” (Acts 27:20–24)
4. As a bright and brilliant shining star lights the sky and gives direction, ___ is the Light of the world, pointing the way of salvation for all. (John 1:7–9; Rev. 22:16)
5. We should seek the Lord, Who created Pleiades (the seven stars) and ___. (Amos 5:8)
6. God made the star called the sun to rule, or govern, us during the ___. (Ps. 136:8)
7. ___ dreamed a dream where the sun, moon, and stars bowed down to him. (Gen. 37:5, 9)
8. Half of the men helped guard the city, while Nehemiah and half of the Israelites labored from dawn until the ___ shone in the sky. (Neh. 4:21)
9. Psalm 8:3 and Job 37:14 tell us to _____ *consider* _____ God’s works.

- B. On your own paper, write a short explanation of how Psalm 8:3 applies to you.**

Answers will vary but may include that God wants us to show Him reverence and respect because of His greatness, might, and power.

Study Guide

Name _____

Student Text pages 244–47 and 250–55



A. Write T if the statement is true. If the statement is false, write a correction for the underlined words.

constellation

1. A group of stars that forms a pattern is called a galaxy.

Astronomy

2. Astrology is the scientific study of the stars.

T

3. When an object moves away from the earth, its color wavelengths become longer, causing a redshift.

T

4. Earth is in the Milky Way galaxy.

B. Match the instruments with their descriptions.

C

5. uses lenses to bend light to make objects appear bigger

B

6. uses mirrors to reflect light to make objects appear bigger

A

7. collects radio waves to detect objects in space that give off little light

D

8. breaks down a star's light into its colors

- A. radio telescope
B. reflecting telescope
C. refracting telescope
D. spectroscope

C. Answer the questions.

9. What is the name of the most well-known star in the Little Dipper? North Star, or Polaris

10. How do astronomers classify galaxies? according to their shape and symmetry—spiral, elliptical, or irregular

11. What is the relationship of the Milky Way to the Local Group? The Local Group is a cluster of galaxies traveling together through space. The Milky Way is one galaxy in the Local Group.

D. Write the letter of the correct answer.

A

12. two stars held together by gravity

C

13. three or four stars held together by gravity

B

14. constellations that revolve around the North Star

D

15. large groups of stars held together by gravity

- A. binary system
B. globular cluster
C. multiple star groups
D. open star cluster

E. Complete each statement.

galaxy

16. A huge star system that covers many light-years of space is called a ____.

barred spiral

17. The Milky Way is a ____ galaxy.

Asteroids

18. ____ are irregularly shaped pieces of rock, metal, and dust.

meteoroid

19. A ____ is a rocky object in space that is smaller than an asteroid.

meteor

20. When a rocky object from space enters Earth's atmosphere and lights up due to friction, it is called a ____.

meteorite

21. When a rocky object from space passes through Earth's atmosphere and hits Earth's surface, it is called a ____.

meteorite

22. Scientists believe that a ____ formed the Barringer Crater.

comet

23. A ____ is an icy chunk of frozen gases, water, and dust that orbits the sun.

Halley's Comet

24. The most famous short-term comet is ____.

F. Write the names of the constellations.

25. *Orion*

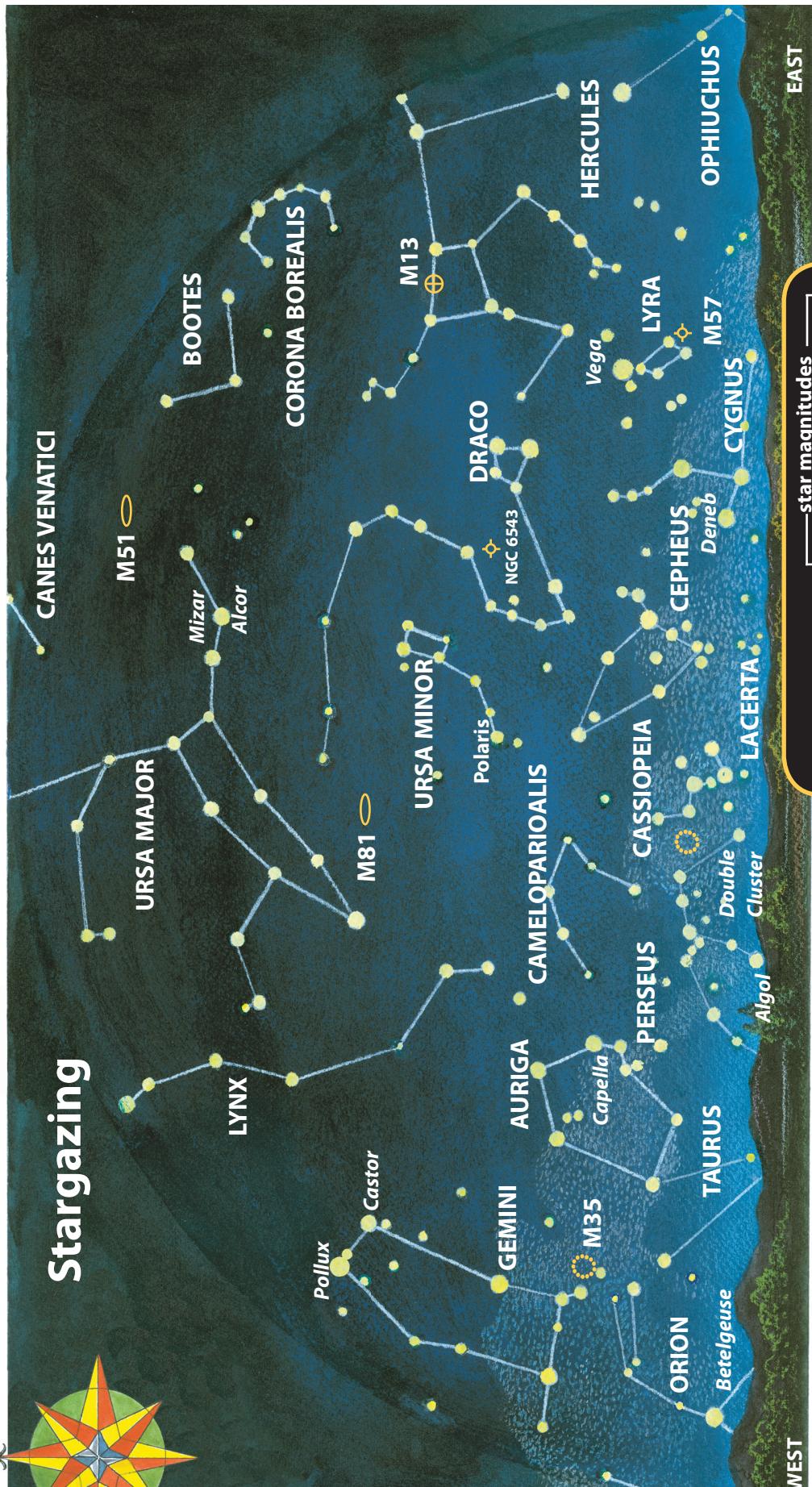


26. *Cassiopeia*





Stargazing





Stargazing

Name _____

This activity is the culmination of your study of the stars. Although looking at pictures of the stars in a textbook is useful, it cannot compare to viewing the splendor of God's creation firsthand. The best conclusion to this chapter is for you to observe the constellations in the evening sky. To get started, you may need to obtain help identifying and locating a constellation. Then try to find the constellation patterns on your own.

Enjoy stargazing!

To be completed by: _____

Suggestions for Stargazing

1. Wear layers of clothing as needed to keep warm.
2. Find a place that is away from city lights.
3. Cover the end of a flashlight with red cellophane. The red light will not disturb your night vision like a white light can.
4. Use the star chart to help you find the constellations.
5. Lie down on a blanket or sit in a chair to steady your arms as you observe the stars with binoculars.

Write the answers.

1. What constellations did you find? *Answers will vary.*

2. List anything else you observed in the sky besides the stars and the moon. *Answers will vary.*

3. What did you enjoy most about stargazing? *Answers will vary.*

4. Create your own constellation. On your own paper sketch it and name it.

Crater Creations

Student Text pages 256–57

Name _____

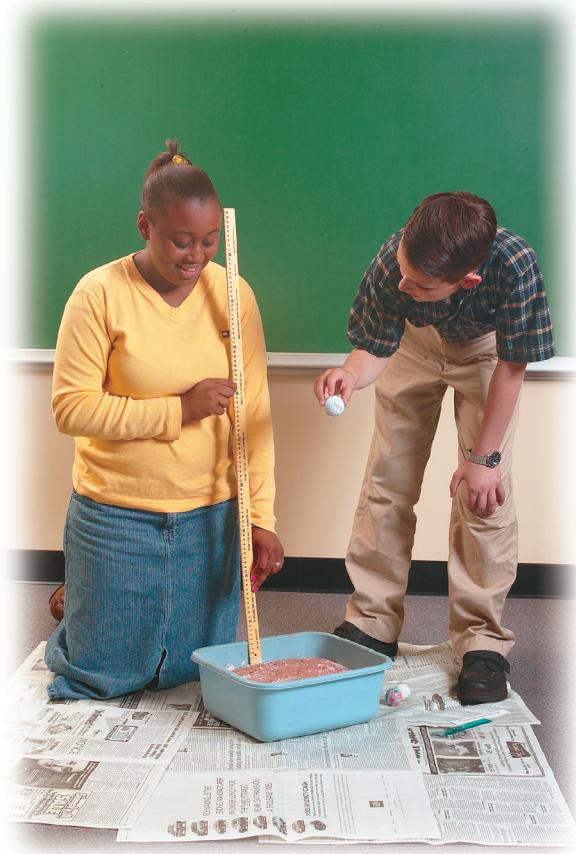


Problem

How does the mass of a dropped object affect the depth of the crater it makes?

Materials

golf ball
table tennis ball
rubber ball, similar diameter
newspaper
deep foil pan or a dishpan
2–3 bags of flour
powdered chocolate milk mix
balance
meterstick
centimeter ruler
3 colored pens or pencils



Hypothesis

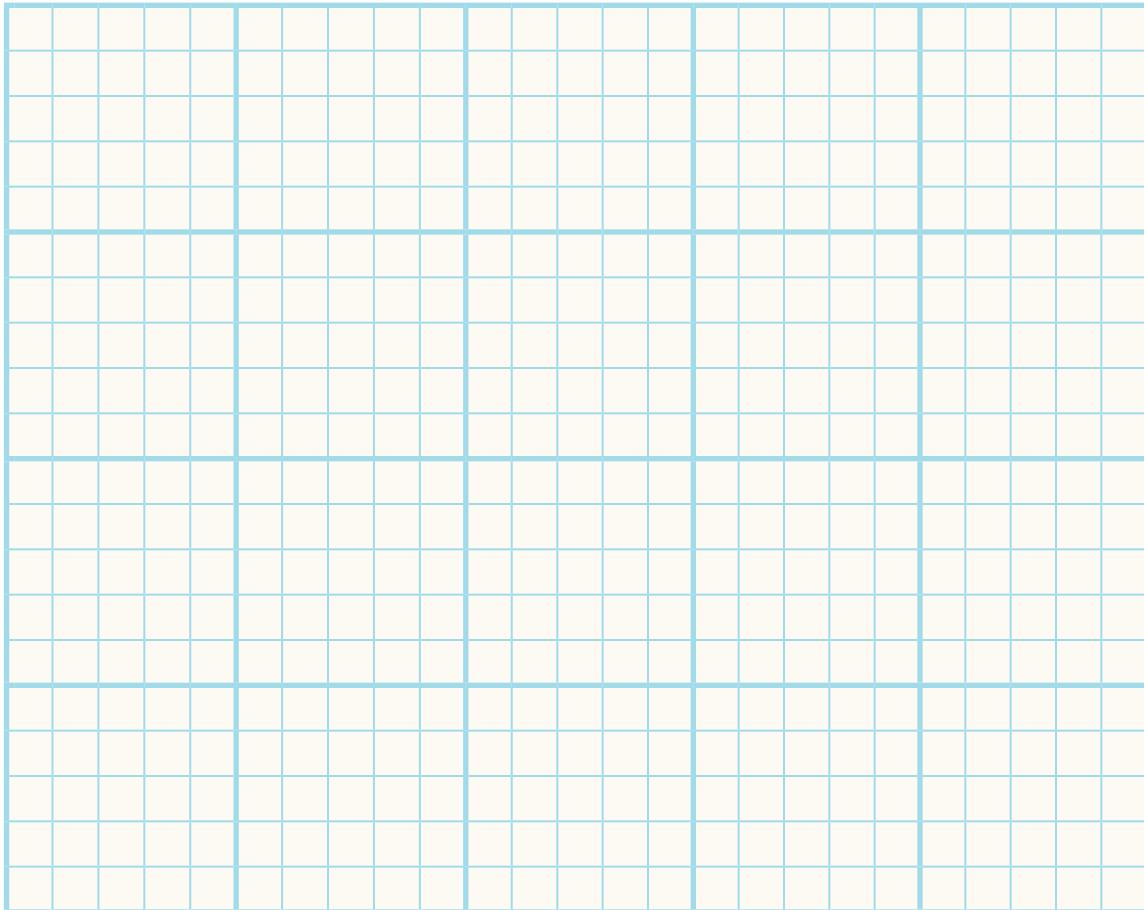
Possible hypothesis: The rubber ball will make the largest crater at the height of 20 cm and also at 60 and 100 cm.

Procedure

Color	Object	Mass	Crater depth at 20 cm	Crater depth at 60 cm	Crater depth at 1 m (100 cm)

Depth of Craters

Depth in _____



Height dropped in _____

Conclusions

- Was there any connection between the mass of the object and the depth of the crater made? Explain your answer. *Answers will vary but should include the idea that the greater the mass of the object dropped, the deeper the crater formed will be.*

- What were your results when the height variable was changed? *Answers will vary but should include the idea that the greater the height from which objects are dropped, the deeper the crater will be.*

Thinking it Through

Student Text pages 236–258

Name _____



Plan and write a paragraph answering each question.

- How do the sun and other stars produce their own light?

Answer should include the following: They produce their light through nuclear fusion. Hydrogen atoms fuse together to form helium atoms. The stars then release energy in the forms of heat and light.

- Your friend tells you that he has found a meteoroid. How can you explain to him that what he found is not a meteoroid? What is it that he has possibly found?

Answer should include the following: A meteoroid is in space, a meteor is what enters the earth's atmosphere, and a meteorite is what hits the earth's surface. He has found a meteorite.

3. What is the main advantage the Hubble Space Telescope has over other telescopes?

Answer should include the following: Most telescopes are located on Earth and must view objects through the dust and water droplets in Earth's atmosphere. The Hubble telescope is above Earth's atmosphere, so its view is clearer. It can "see" fainter stars than the telescopes on Earth can see.

4. Why should a Christian not be involved in astrology?

Answer should include the following: People who study and practice astrology trust the stars and other heavenly bodies for guidance. Christians should depend on God's Word to lead them and help them make decisions.

Looking Ahead

Name _____

A. Mark the answer.

1. Each orbit that a planet makes around the sun is called a ____.
A. rotation B. revolution C. totality
2. Earth's moon is a natural ____.
A. planet B. probe C. satellite
3. Terrestrial planets include Earth, Venus, and ____.
A. Jupiter B. Mercury C. Saturn
4. The outermost part of the sun is called the ____.
A. corona B. chromosphere C. photosphere
5. The Great Red Spot can be found on ____.
A. Saturn B. Neptune C. Jupiter
6. When the moon passes between Earth and the sun, it is called a ____.
A. solar eclipse B. lunar eclipse C. totality
7. The ____ of the earth during its revolution around the sun causes the seasons.
A. distance B. tilt C. rotation
8. The planet ____ is the most like Earth.
A. Mercury B. Jupiter C. Mars
9. Electrically charged particles from the sun that are pulled to the earth's poles cause ____.
A. a solar storm B. an aurora C. a solar flare
10. An unmanned research spacecraft that travels beyond Earth's orbit is called a ____.
A. probe B. satellite C. space shuttle

- | |
|--|
| 1. (A) <input checked="" type="radio"/> (B) <input type="radio"/> (C) <input type="radio"/> |
| 2. (A) <input type="radio"/> (B) <input checked="" type="radio"/> (C) <input type="radio"/> |
| 3. (A) <input type="radio"/> (B) <input checked="" type="radio"/> (C) <input type="radio"/> |
| 4. (A) <input checked="" type="radio"/> (B) <input type="radio"/> (C) <input type="radio"/> |
| 5. (A) <input type="radio"/> (B) <input type="radio"/> (C) <input checked="" type="radio"/> |
| 6. (A) <input checked="" type="radio"/> (B) <input type="radio"/> (C) <input type="radio"/> |
| 7. (A) <input type="radio"/> (B) <input checked="" type="radio"/> (C) <input type="radio"/> |
| 8. (A) <input type="radio"/> (B) <input type="radio"/> (C) <input checked="" type="radio"/> |
| 9. (A) <input type="radio"/> (B) <input checked="" type="radio"/> (C) <input type="radio"/> |
| 10. (A) <input checked="" type="radio"/> (B) <input type="radio"/> (C) <input type="radio"/> |

B. Write a question for something you would like to learn about the following:

- Pluto

- International Space Station

Space Exploration

Name _____

Student Text pages 260–63

A. Complete the chart.

Rockets	Space Shuttle	Satellites	Probes	International Space Station
<ul style="list-style-type: none"> Probably invented by <u>Chinese</u> First rockets used gunpowder and were weapons <u>Robert Goddard</u> launched the first liquid-fueled rocket in 1926 Wernher von Braun led a team to develop rockets for <u>space travel</u> Can be used only <u>once</u> 	<ul style="list-style-type: none"> First <u>reusable</u> space vehicle Transported <u>equipment</u> and <u>people</u> to and from the International Space Station Used from 1981–2011 	<ul style="list-style-type: none"> An object that <u>orbits another object</u> in space First artificial satellite, <u>Sputnik I</u>, launched by the <u>Soviet Union</u> in 1957; starts the space race Used for <u>exploration</u>, <u>communication</u>, <u>tracking</u>, <u>weather</u>, international spying, and distance education 	<ul style="list-style-type: none"> Unmanned <u>research</u> spacecraft sent beyond Earth's orbit Can explore by taking pictures, <u>landing</u>, or <u>collecting samples</u> Called a <u>lander</u> if meant to land and called a <u>rover</u> if meant to move about on the surface 	<ul style="list-style-type: none"> Facility that orbits the <u>earth</u> Maintained and used by different <u>countries</u> Place where astronauts conduct <u>experiments</u> and learn how living in space affects humans

B. Answer the question.

How is living in space different from living on Earth? Answers will vary but should include the ideas that weightlessness affects eating, sleeping, working, and exercise.



Wernher von Braun

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Inflatable Spacecraft

Name _____

Student Text pages 264–65



A. Fill in the blanks.

1. The United States government space agency, the National Aeronautics and Space Administration, is also called NASA.
2. Inflatable spacecraft are smaller and lighter than other types of spacecraft.
3. The first communications satellite, *Echo I*, was an inflatable satellite.
4. In 1996, the crew of the *Endeavor* released a tiny antenna which unfolded and inflated to become the size of a tennis court.
5. Inflatable habitats are made of material that can withstand being hit by meteors.
6. Inflatable habitats and other spacecraft are also called expandable spacecraft.
7. Scientists are studying ways to make inflatable rovers that can study Mars and other planets.
8. Solar sails are expandable spacecraft that are powered by the sun.
9. Solar sails move slowly at first but gain momentum quickly because there is no air resistance.
10. Inflatable spacecraft increase the possibilities for studying God's universe.

B. Find the answers from part A in the word search below.

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





Johannes Kepler: Scientist of the Faith

Name _____

"Great is our Lord, and great is His excellence and there is not count of His wisdom. Praise Him, Sun, Moon, and Planets . . . and you also, my soul, praise the Lord your Creator as long as I shall live."

This was Kepler's conclusion to *The Harmony of the World*, his most famous book.

Johannes Kepler (1571–1630) was born into a very poor German family. He studied theology, philosophy, mathematics, and astronomy, doing extremely well in mathematics. Although he planned to become a minister, Kepler yielded to God's calling to become a mathematician and astronomer instead.

Kepler became a Christian at a young age. His goal in life was to glorify God. One way that he wanted to do this was by showing the intricacies of the universe.

Kepler is known as a founder of modern astronomy. He studied Mars's movements and discovered the three laws of planetary

motion in our solar system. Astronomers thought that everything revolved around the earth in circular paths. He proved the planets moved in elliptical orbits, or paths, around the sun. This discovery established predictability and order in the solar system. Kepler rejoiced that his discoveries made people marvel at God's power.

Throughout his life Kepler faced hardships, trials, sickness, persecution, and death in his family, but he remained faithful to God. He did not desire any honor for himself but sought to elevate the name of God the Father.



Answer the questions.

- What Christlike qualities are revealed through Kepler's life? *Answers will vary but may include the following: Kepler was determined to seek God and glorify Him. He was thankful that his discoveries made people marvel at God's power. As a mathematician and astronomer, Kepler desired to give God all honor and glory rather than seeking his own fame. He was a humble man.*
- Read 1 Corinthians 10:31. How should a Christian do everything in his life? *to the glory of God*
- How can a scientist bring glory to God in the things he does each day? *Answers will vary but could include showing others the amazing ways God's creation works or using scientific knowledge to do good works that glorify God (Matt. 5:16).*

Rocket Race

Student Text pages 266–67

Name _____



Problem

How can I make a balloon rocket propel a long distance?

Materials

balloon
clothespin, spring style
drinking straw
tape
glue
10-meter fishing line
meter stick or tape measure

Other materials you used:

Hypothesis

Draw and label your balloon rocket design.



Procedure

1. Explain why you chose the design features in your rocket.

2. How do you think these features will help your rocket go farther?

3. Test your rocket. Measure and record the distance it traveled.

Distance traveled	
Test 1	
Test 2	
Test 3	

Conclusions

1. Was your hypothesis (design) effective? Explain. _____

2. What features of your rocket helped it go farther? _____

3. What features of your rocket kept it from traveling farther? _____

4. How would you change the design of your rocket? _____

Study Guide

Name _____

Student Text pages 260–65 and 268–71



A. Write the letter of the correct answer.

- D 1. the surface of the sun
A 2. the sun's atmosphere
B 3. the outermost part of the sun, "the crown"
H 4. dark spots on the photosphere that may be related to solar storms
C 5. bright clouds of gas on the photosphere
E 6. created by solar storms exploding from the photosphere
F 7. a huge stream of gas that extends out past the sun's chromosphere and into the corona
G 8. made of electrically charged particles from the sun

- A. chromosphere
B. corona
C. faculae
D. photosphere
E. solar flares
F. solar prominence
G. solar wind
H. sunspots

B. Fill in the blanks.

9. The International Space Station orbits _____ *Earth* _____ and is maintained and used by sixteen different _____ *countries* _____.
10. The space _____ *shuttle* _____ was a reusable vehicle that transported equipment and people to and from the International Space Station.
11. An _____ *aurora* _____ is energy emitted in the form of beautiful colors of light.
12. The seasons are caused by the _____ *tilt* _____ of the earth as it revolves around the sun.
13. The _____ *axis* _____ of a planet is an imaginary line around which a planet rotates.

C. Write the letter of the correct answer.

- A 14. Each orbit that a planet makes around the sun is called a _____.
A. revolution B. satellite C. rotation
- C 15. The complete turn of a planet on its axis is called a _____.
A. revolution B. satellite C. rotation
- C 16. Any object that orbits another object in space is a _____.
A. probe B. rover C. satellite
- B 17. Unmanned research spacecraft sent beyond Earth's orbit are called _____.
A. rockets B. probes C. space shuttles
- B 18. _____ launched the first liquid-fueled rocket.
A. Wernher von Braun B. Robert Goddard C. Johannes Kepler
- A 19. _____ helped develop rockets for space travel.
A. Wernher von Braun B. Robert Goddard C. Johannes Kepler

D. Answer the questions.

20. What began the space race between Russia and the United States? *the Russian launch of the first artificial satellite, Sputnik I*

21. What are three ways satellites can be used? *Possible answers: to take pictures, to explore space, for communication, for tracking weather, for international spying, for distance education*

22. How are probes used to explore space? *Possible answers: to explore planets and other solar system objects by taking images of them or landing on them; taking samples from nearby planets*

23. What are some advantages of inflatable spacecraft? *Possible answers: smaller in size and lighter than other types of spacecraft, less expensive, take up less space on the rocket used to launch it*

24. What are two uses for inflatable spacecraft that have been or are being developed? *Possible answers: satellites, antennae, habitats, rovers, solar sails*

25. What kind of storms does the sun have? How do these storms affect life on earth? *magnetic storms; can disrupt communications satellites and GPS navigation signals*

26. What keeps the planets in orbit around the sun? *the sun's huge mass exerts a strong gravitational pull on the planets*

Planet Profile

Name _____

Student Text pages 272–77 and 282–84

Complete the *Planet Profile* chart.

(Possible answers given)

Planet	Known as	Period of rotation (Earth time)	Period of revolution (Earth time)	Unique facts
Mercury	the planet closest to the sun	59 days	88 days	<ul style="list-style-type: none"> closest planet to the sun smallest planet in size weak gravitational field that cannot hold on to an atmosphere has the shortest year in the solar system
Venus	<i>the Morning Star</i> <i>the Evening Star</i>	243 days	224.7 days	<ul style="list-style-type: none"> second planet from the sun brightest object in the morning and evening skies closest planet to Earth covered with thick cloud cover retrograde rotation
Earth	home sweet home	1 day	365 $\frac{1}{4}$ days	<ul style="list-style-type: none"> third planet from the sun only planet on which man survives in his natural state water exists in a liquid state gravity holds atmosphere in place one natural satellite
Mars	<i>the red planet</i>	24 $\frac{1}{2}$ hours	687 days	<ul style="list-style-type: none"> fourth planet from the sun iron oxide in its soil planet most like Earth dry like a desert experiences seasons because of its tilt

(Possible answers given)

Planet	Known as	Period of rotation (Earth time)	Period of revolution (Earth time)	Unique facts
Jupiter	<i>the largest planet</i>	<i>10</i> hours	<i>12</i> years	<ul style="list-style-type: none"> <i>fifth planet from the sun</i> <i>largest planet</i> <i>most notable feature is its Great Red Spot</i> <i>surface is an ocean of liquefied gases</i>
Saturn	<i>the ringed planet</i>	<i>11</i> hours	<i>30</i> years	<ul style="list-style-type: none"> <i>sixth planet from the sun</i> <i>second largest planet</i> <i>highly visible rings</i> <i>has more known moons than any other planet</i>
Uranus	<i>the planet that rotates sideways</i>	<i>17</i> hours	<i>84</i> years	<ul style="list-style-type: none"> <i>seventh planet from the sun</i> <i>rotates on its side</i> <i>has atmosphere of poisonous methane gas</i> <i>blue-green color</i> <i>long periods of darkness and light</i>
Neptune	<i>the blue planet</i>	<i>16</i> hours	<i>165</i> years	<ul style="list-style-type: none"> <i>eighth planet from the sun</i> <i>most violent weather</i> <i>Great Dark Spot</i> <i>thick cloud cover of methane gas</i>

Study Guide

Student Text pages 272–79

Name _____



A. Fill in the blanks.

1. Mercury, Venus,
Earth, and Mars are called the inner planets.
2. Jupiter, Saturn,
Uranus, and Neptune are called the outer planets.
3. Between Mars and Jupiter is an area called the asteroid belt.
4. Beyond Neptune is the Kuiper Belt, an area of small icy objects which includes Pluto.
5. A solar eclipse happens when the moon passes between the earth and the sun.
6. A lunar eclipse occurs when the moon passes through the shadow of the earth.
7. The phase of an eclipse when the moon appears to cover the sun completely is called a totality.
8. American Neil Armstrong became the first man on the moon in July 1969.
9. The phases of the moon are caused as different areas of its surface are lighted by the sun.
10. Instead of giving off its own light, the moon reflects the light from the sun.

B. Write the letter of the correct answer. Answers will be used more than once.

- D 11. the red planet
- B 12. brightest object in the morning and evening skies
- A 13. planet closest to the sun
- C 14. has one natural satellite, the moon
- A 15. the smallest planet
- D 16. the planet most like Earth
- C 17. able to sustain life
- A 18. has the shortest year in the solar system
- D 19. experiences seasonal changes because it has a tilt like Earth
- B 20. planet closest to Earth
- B 21. sometimes called Earth's twin because it is a similar size and distance from the sun
- C 22. has liquid water

- A. Mercury
B. Venus
C. Earth
D. Mars

C. Complete the section.

23. What criteria must be met in order for a solar system object to be considered a planet? *It must orbit the sun and be big enough for its own gravity to keep it in the shape of a sphere. It also cannot share the space of its orbit with any other object of significant size, other than moons.*

24. Which planets are called terrestrial planets? Why? *Mercury, Venus, Earth, and Mars are considered terrestrial planets because they are rocky, dense, and Earthlike in composition.*

25. Which planets are called gas giants? Why? *Jupiter, Saturn, Uranus, and Neptune are called gas giants because their surfaces are made of gases.*

26. Why do we always see the same side of the moon? *The moon rotates once on its axis as it makes one revolution around the earth.*

27. What are three ways that Earth's atmosphere is helpful? *It maintains warmth from the sun, filters out the sun's harmful rays, and protects us from meteors.*

28. Why is Venus hotter than Mercury even though Mercury is closer to the sun? *A thick cloud of carbon dioxide around Venus traps heat.*

Spare Parts Solar Oven

Student Text pages 280–81

Name _____



Problem

How can I create a solar oven that will melt a marshmallow?

Materials

cardboard box
marshmallow
watch or clock

Other materials you used:



Hypothesis

Sketch your solar oven design.

Procedure

1. Describe how your solar oven will work. _____

2. What features of your solar oven will help it collect heat? _____

3. How long did it take for your marshmallow to melt? _____
4. Did your marshmallow melt completely? Describe what it looks like. _____

Conclusions

1. Did your solar oven perform as well as you expected? Why or why not? _____

2. What feature(s) of your design seemed to cause the solar oven to heat well? _____

3. What feature(s) kept the oven from working the way you planned? _____

4. What improvements could you make to your solar oven to cause it to work better? _____

Study Guide

Student Text pages 282–85

Name _____



A. Write the letter of the correct answer. Answers will be used more than once.

- A 1. planet that has the Great Red Spot
- C 2. rotates on its side
- B 3. is known as the “ringed planet”
- D 4. planet that has the Great Dark Spot
- A 5. largest planet
- B 6. has more known moons than other planets
- D 7. planet that has the most violent weather
- C 8. has long periods of darkness and light due to its tilt

- A. Jupiter
- B. Saturn
- C. Uranus
- D. Neptune

B. Complete the section.

- 9. Why can spacecraft not land on the gas giants? *The surfaces of the gas giants are liquefied gases with no solid surface to land on.*
- 10. What do scientists think the Great Red Spot is? *a huge hurricane that blows nonstop*
- 11. What are Saturn's rings made of? *many small, frozen particles that reflect the sun's light*
- 12. What gives Uranus its bluish color? *Its atmosphere is poisonous methane gas.*
- 13. Where does much of the information about the outer planets come from? *the Voyager probes*
- 14. Why is Pluto no longer classified as a planet? *It does orbit the sun and is spherical, but it shares the path of its orbit with other objects in the Kuiper Belt.*
- 15. How is a dwarf planet similar to a planet? How is it different? *Like planets, a dwarf planet orbits the sun and is spherical. But unlike planets, a dwarf planet can share its orbit with other objects of a similar size.*
- 16. Name the dwarf planets. *Pluto, Ceres, Eris, Haumea, Makemake*



Solar Walk

Name _____

- A. The chart lists the relative size of each planet and its distance from the sun.

To calculate the distance between each planet, subtract the previous planet's distance from the sun (Column 3) from the current planet's distance from the sun (Column 3). Use the information in the last column to take a solar walk that shows a scale model of the solar system.

Example: Venus's distance from the sun – Mercury's distance from the sun

$$6.7 - 3.6 = 3.1$$

Planet	Relative size of planet	Relative distance from the sun in meters	Relative distance from the previous planet in meters
the sun	softball	—	—
Mercury	grain of sand	3.6	—
Venus	poppy seed	6.7	$6.7 - 3.6 =$ <u>3.1</u>
Earth	poppy seed	9.3	$9.3 - 6.7 =$ <u>2.6</u>
Mars	mustard seed	14.0	$14.0 - 9.3 =$ <u>4.7</u>
Jupiter	pea	48.0	<u>34</u>
Saturn	smaller pea	89.0	<u>41</u>
Uranus	BB	180.0	<u>91</u>
Neptune	BB	230.0	<u>50</u>

- B. After returning from your solar walk, answer the questions.

1. Did the size of the solar system surprise you? Why or why not? *Answers will vary.*

2. Why would it be impossible to fit a scale model using the same relative size and distance in a classroom? *Answers will vary but should include that either the planets would be too small to see or the distance between them would be too large to fit in the classroom.*

Travel Brochure

Name _____



- A. The year is 2050. You are a graphic designer for a travel agency on Earth. You have received this memo from your boss.



1500 Moonbeam Way
Space Station, FL 34000
(987) 555-1654

Jack McAllister, Head of Marketing
Final Frontier Travel Agency
February 6, 2050

To: All brochure designers

Thank you for your fine work in designing brochures for the Lunar Vacation. We have been selling many vacations to the moon. I'm sure that our talented designers deserve much of the credit for the attractive brochures. I am confident that you are ready for this next project.

We are planning seven new and exciting vacations. There will be a vacation to each of the planets in our solar system. Choose one of the planets other than Earth and design a travel brochure for that planet. Please make your brochure attractive and informative. For the benefit of our clients, please include the following information:

1. the weather on the planet
2. landforms to visit
3. the history of the planet's exploration
4. survival items for travelers
5. length of the trip
6. any additional information that you find helpful

Thank you for your fine work for Final Frontier Travel Agency.

Sincerely,

Jack McAllister
Jack McAllister

What to do

B. Follow the directions given by your boss, Jack McAllister, in the memo. Use this space to take notes as you research your planet. Develop your notes into a travel brochure. Be prepared to explain the information you include in your brochure.

1. the weather on the planet _____

2. landforms to visit _____

3. the history of the planet's exploration _____

4. survival items for travelers _____

5. length of the trip _____

6. any additional information that you find helpful _____

Thinking It Through

Student Text pages 260–86

Name _____



Plan and write a paragraph answering each question.

1. Why did astronauts need to wear protective suits on the moon?

Answer should include the following: The moon does not have an atmosphere like Earth's and does not have the gases we need to breathe. The suits provide oxygen for the astronauts and protect them from the sun's harmful rays and extreme temperatures.

2. How do Earth's location and characteristics evidence God's care for man?

It is the only place where man can live in his natural state. It is the perfect distance from the sun, which gives it a moderate temperature, allowing water to exist in a liquid form. The rotation of Earth allows the atmosphere and surface to receive adequate heating and cooling each day to maintain Earth's overall climate. The atmosphere helps maintain the warmth from the sun and filters out the sun's harmful rays. It also keeps meteors from crashing onto Earth's surface.

3. Why do auroras occur only at the North and South Poles of the earth?

Answer should include that the electrically charged particles from the sun are trapped in the earth's magnetic field. Magnetic attraction is strongest at the poles, so these trapped particles are pulled towards the earth's magnetic poles.

4. Explain two challenges of living in space.

Answers will vary but should include some of the following: Weightlessness affects how astronauts eat, sleep, work, and exercise. Food is often dehydrated, and drinks need to be in sealed containers. Astronauts need to exercise every day to keep their muscles from deteriorating.

Looking Ahead

Name _____

A. Mark the sentence that uses the bold term correctly.

1. A squirrel must have gotten this pine cone from a **gymnosperm**.
 A **gymnosperm** has its seeds protected in fruit.
2. Corn and pecans are two examples of **fruit**.
 The **fruit** of a plant produces pollen.
3. A **pistil** is the female part of a flower.
 The **pistil** provides protection for the flower.
4. An apple tree grows from **spores**.
 Wind blew the **spores** from the fern far away.
5. When Tim kicked the mushrooms, their **fruiting bodies** broke apart.
 Mrs. Kramer's squash plants produced many long, green **fruiting bodies**.
6. Rachel's pet frog likes to **germinate** during the winter.
 Sam noticed that his radish seeds had just begun to **germinate**.
7. Caleb noticed a honeybee that was covered in yellow pollen from the **stamen** of a flower.
 Seeds form at the bottom of the **stamen**.
8. The green **embryo** protects the flower bud before it opens.
 Kylie broke open a bean seed and looked at the **embryo**, a tiny new plant.
9. The little plants on the spider plant stems result from **vegetative reproduction**.
 Mrs. Reed's flowers went through **vegetative reproduction** when they bloomed and produced seeds.
10. A baby **marsupial** continues to develop in its mother's pouch after birth.
 A baby **marsupial** can function independently as soon as it is born.

B. Write a question for something you would like to learn about the following:

- cotyledons

- different kinds of animal eggs

Plant Reproduction

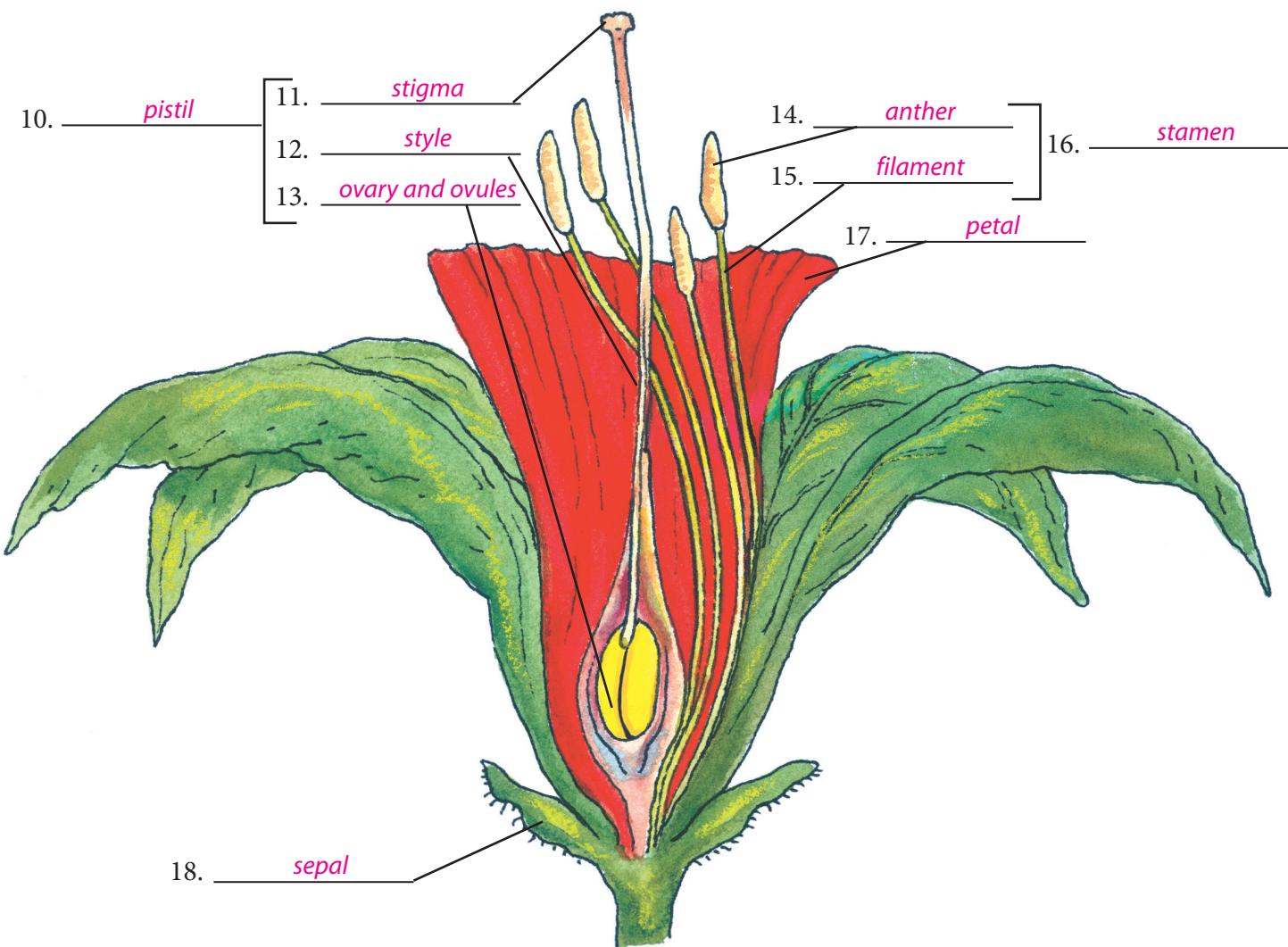
Name _____

Student Text pages 290–93

A. Define the following terms.

1. angiosperms *plants that produce seeds in a fruit*
2. stamen *the male part of the flower*
3. anther *the top of the stamen where pollen is produced*
4. pistil *the female part of the flower*
5. ovary *the bottom part of the pistil that contains one or more ovules*
6. stigma *the sticky tip of the pistil*
7. zygote *the fertilized egg*
8. fruit *the part of a flowering plant that contains the seeds*
9. cotyledons *special seed leaves that contain the stored food*

B. Label the parts of the flower.



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Flower Dissection

Student Text pages 294–95

Name _____



Purpose

Dissect a flower and identify its parts.

This is an open-ended activity, so the answers will vary greatly.

Materials

large flower
magnifying glass
small knife or other cutting tool
sheet of black paper
centimeter ruler
toothpick

Write the type of flower you are observing.

Answers will vary.



Procedure

1. Record your observations.

	Observations
Number of petals	
Markings on petals	
Length of flower in centimeters (from the base of the sepals to the tip of the longest petal)	
Stamens (what they look like, where they are placed in the flower, etc.)	

2. Draw a picture of a stamen and label its parts.

3. Measure and record the length of each stamen. (Note: Not all flowers have six stamens.)

	Length of Stamen
Stamen 1	_____ cm
Stamen 2	_____ cm
Stamen 3	_____ cm
Stamen 4	_____ cm
Stamen 5	_____ cm
Stamen 6	_____ cm
Average length of stamens	_____ cm

4. Describe the pollen grains. _____

5. Record the length of the pistil. _____

6. Draw a picture of the pistil and label the parts.

7. After cutting the pistil, examine the ovary. How many ovules are inside? What is the purpose of these ovules? *There are one or more ovules. The ovules are where the eggs are produced.* _____

Conclusions

1. List all parts of the flower you have dissected. _____

2. Compare the measurements of different flowers. _____

Study Guide

Name _____

Student Text pages 290–93 and 296–99



A. Write the letter of the correct answer.

- F 1. the male part of a flower
E 2. protect the flower bud
A 3. the part of the stamen that produces pollen
D 4. the female part of a flower
G 5. the sticky tip of the pistil that traps the pollen
B 6. the part of the pistil that develops into a fruit
C 7. the place in the pistil where the eggs are produced; develops into the seed coat
H 8. connects the ovary to the stigma

- A. anther
B. ovary
C. ovule
D. pistil
E. sepals
F. stamen
G. stigma
H. style

B. Starting with pollination, number the steps to show how the seeds of a flowering plant develop.

- 1 9. Pollen is transferred from the anther to the stigma.
4 10. The petals fall off, and the zygote develops into an embryo.
2 11. A pollen tube grows down into the pistil.
3 12. Fertilization occurs and a zygote forms.
5 13. The ovule develops into the seed coat, and the ovary develops into the fruit which contains the seed(s).

C. Fill in the blanks.

14. Plants can be pollinated by animals, wind, or water.
15. Cross-pollination happens when the pollen is from a flower on a different plant.
16. Self-pollination occurs when the pollen comes from a flower on the same plant.
17. Angiosperms reproduce from seeds that develop from pollinated flowers.
18. Conifers, a type of gymnosperm, reproduce from seeds that often develop in cones.
19. Ferns and mosses reproduce from spores.
20. Fungi produce fruiting bodies, structures that contain their spores.

D. Number the steps in the order of a conifer's life cycle, starting with the mature plant. The first one is numbered for you.

- | | |
|---|---|
| 1 | 21. Mature conifers produce male and female cones. |
| 4 | 22. Fertilization occurs. |
| 7 | 23. A seed lands in soil and develops into a seedling. |
| 2 | 24. Male cones produce pollen. |
| 5 | 25. Seeds develop inside the female cone. |
| 3 | 26. Wind blows the pollen into the scales of the female cones. |
| 8 | 27. The seedling becomes a mature plant. |
| 6 | 28. When the seeds are developed, the cone opens and the wind carries the seeds away. |

E. Complete the section.

29. What are the three parts of a seed? *embryo, cotyledons (stored food), seed coat*

30. What conditions do seeds need to germinate? *water, oxygen, and the proper temperature*

31. Name three ways that spores are different from seeds. *Spores are smaller than seeds. Spores consist of only one cell. Spores do not have stored food.*



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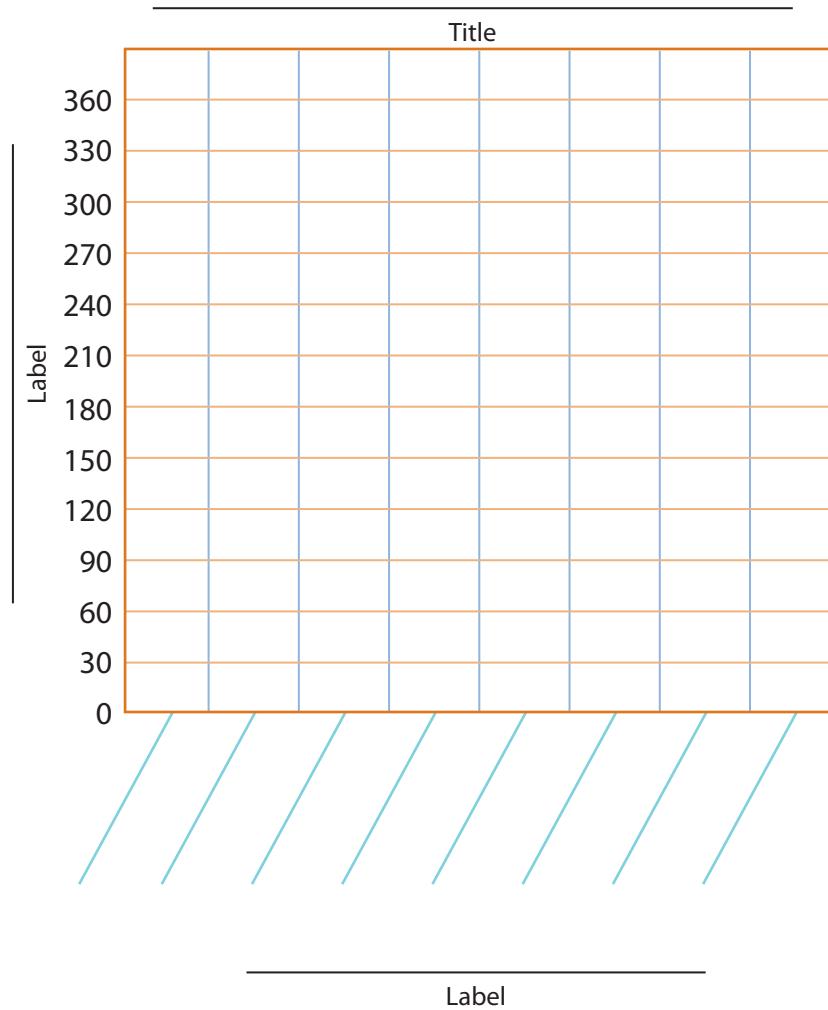
Animal Reproduction

Student Text pages 300–303

Name _____

A. Use the information from the chart to create a bar graph.

Animal	Length of Gestation
Cottontail rabbit	30 days
Bobcat	60 days
Mountain lion	90 days
Mountain goat	180 days
White-tailed deer	210 days
Black bear	210 days
American bison	270 days
Blue whale	360 days



B. Write **T** if the statement is true. If the statement is false, draw a line through the incorrect part and write the correct term on the blank.

T

- After a zygote cell divides for the first time, it is called an embryo.

placenta

- Placental mammals receive food and oxygen through the mother's pouch.

pouch

- Marsupial mammals finish developing in their mother's placenta.

oval

- Reptile eggs are usually round or pointed.

T

- An egg provides protection, nutrients, food, and waste removal for the developing animal.

T

- Species that do not provide parental care often lay large numbers of eggs at a time.



What Value Does God Place on Life?

Name _____

A. Read the verses and complete the statements about God's value on life.

Genesis 1:27 1. Man is a special creation made in God's own *image*.

Genesis 4:8–12 2. After Cain killed his brother Abel, God *cursed* him.

Exodus 20:13 3. One of the Ten Commandments says, "Thou shalt not *kill or murder*."

Isaiah 44:2 4. God made me and formed me in the *womb*.

Jeremiah 1:5 5. God knew who Jeremiah would be and what he would do *before* Jeremiah was even born.

Exodus 4:10–12 6. Regardless of man's imperfections, or disabilities, God made each person for a specific purpose. He made the dumb (mute), the *deaf*, the seeing, and the *blind*.

Job 12:9–10 7. God controls the soul of every living thing and the *breath* of all mankind.

Matthew 10:30–31 8. God knows all about me. He knows the *number* of hairs on my head, and my life is valuable to Him.

Job 33:4 9. God made me, and His *breath* gave me life.

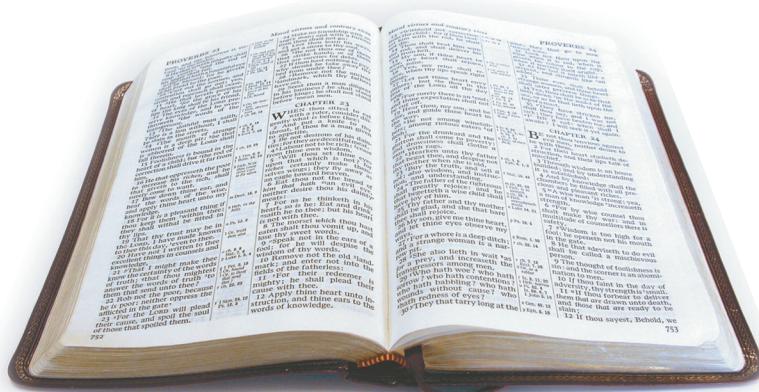
Psalm 139:13–14 10. The Bible tells us to praise God, for we are fearfully and wonderfully made. Marvelous are His *works*.

B. Match the description and the verse.

- E** 11. Life and death are controlled by the Lord.
- A** 12. Physical life is a gift from God.
- C** 13. Death is a result of sin.
- B** 14. Every man has an appointed time to die.
- D** 15. God provides eternal life through Jesus Christ.

- A. Acts 17:25
- B. Hebrews 9:27
- C. Romans 5:12
- D. Romans 6:23
- E. 1 Samuel 2:6

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Asexual Reproduction

Student Text pages 304–7

Name _____

Complete the chart.

Binary Fission	Budding	Fragmentation	Regeneration	Vegetative Reproduction
<p>Description</p> <p>An organism duplicates its nucleus and then splits in half to become two separate organisms.</p>	<p>Description</p> <p>A new individual develops on the parent organism and grows until it is able to survive on its own. It then breaks off from the parent and lives independently.</p>	<p>Description</p> <p>The parent organism breaks into tiny fragments. Each fragment can grow into a new organism.</p>	<p>Description</p> <p>If a part of the organism is broken off and contains part of its center, then the whole organism can regrow.</p>	<p>Description</p> <p>Occurs when a part of a plant that is usually not involved in reproduction is able to develop into a new plant</p>



Study Guide

Student Text pages 300–305

Name _____

A. Write the letter of the correct answer.

- A** 1. What is a zygote cell called after it divides for the first time?
A. embryo B. marsupial C. egg
- B** 2. Which term refers to a type of mammal that develops fully inside the mother's body?
A. gestation B. placental mammal C. marsupial
- C** 3. Which term refers to a type of mammal whose young finishes developing in a pouch outside the mother's body?
A. gestation B. placental mammal C. marsupial
- A** 4. What is the period of time during which a mammal develops inside its mother's body called?
A. gestation B. zygote C. reproduction
- B** 5. What is the process of reproducing from only one parent called?
A. sexual reproduction B. asexual reproduction C. gestation
- A** 6. What is the process of reproducing from two parents called?
A. sexual reproduction B. asexual reproduction C. gestation

B. Fill in the blanks.

7. Eggs provide protection, nutrients, food, and waste removal for the developing animal.
8. Fish and amphibians usually lay eggs in water.
9. Reptiles and birds usually lay eggs on land.

C. Identify the method of asexual reproduction.

- D** 10. occurs when part of an organism containing a piece of its center is broken off and can regrow a whole organism
- A** 11. occurs when an organism duplicates its nucleus and splits in half to become two separate organisms
- E** 12. occurs when part of a plant that is usually not involved in reproduction can develop into a new plant
- B** 13. occurs when a new individual develops on a parent organism and grows there until it can survive on its own
- C** 14. occurs when an organism breaks into tiny pieces that can grow into new organisms

- A. binary fission
B. budding
C. fragmentation
D. regeneration
E. vegetative reproduction

It's a Race!

Student Text pages 306–7

Name _____



Problem

Which will grow greenery 6 centimeters high first—the carrot top or the carrot seed?

Materials

2 cups or containers
potting soil
carrot top, greenery removed
2 carrot seeds
water
centimeter ruler

Hypothesis

Possible hypothesis: The carrot seed will grow 6 cm of greenery before the carrot top does.

Procedure

	Number of stems visible		Number of leaves visible		Height of longest stem (Indicate carrot top or carrot seed.)
	carrot top	carrot seed	carrot top	carrot seed	
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					
Day 6					
Day 7					
Day 8					
Day 9					
Day 10					
Day 11					



	Number of stems visible		Number of leaves visible		Height of longest stem (Indicate carrot top or carrot seed.)
	carrot top	carrot seed	carrot top	carrot seed	
Day 12					
Day 13					
Day 14					
Day 15					
Day 16					
Day 17					
Day 18					
Day 19					
Day 20					
Day 21					

Conclusions

1. Which plant reached 6 centimeters first? Did your results support your hypothesis? _____

2. How did the leaves of the carrot top differ from the leaves of the carrot seeds? _____

Thinking It Through

Student Text pages 290–308

Name _____



Plan and write a paragraph answering each question.

- Julia Sibiya is an agricultural scientist. In this photo she is inspecting diseased crops at a research farm in South Africa. She is concerned about the number of elderly women farmers who have to take on more family responsibilities. How will her study of the fungus on the corn help the women farmers?

Answers will vary but should include the idea that studying the fungus will help her know how to raise corn that is better able to resist disease.

Thus the farmers would get a better yield from their crops. The increased yield would not only provide food for their families but also provide a surplus that could be sold to increase the family's income.



- Your cousin insists that a fruit is only foods such as pears and apples. Your sister says that acorns and corn are also fruits. Which person would you agree with? Explain your answer.

Answers will vary but should include the idea that the scientific definition of a fruit is the part of the plant that contains the seeds. It is the ripened, seed-containing ovary of a flowering plant. Your cousin is referring to the common usage for the word fruit. Your sister is using the scientific definition of fruit.

3. How do the different types of eggs show God's careful design in creation?

Answer should include the following: God designed each animal's eggs to suit their environment.

Some birds' eggs are specially shaped so they will not roll off high ledges or will fit closer together in the nest. Birds' eggs are also often camouflaged to match the nesting environments. Some reptile eggs are soft and flexible so they will not be crushed by the weight of the dirt piled on top of them. Eggs laid in water are often covered in a clear, jellylike fluid for protection.

4. Crabgrass is a kind of grass that produces stolons. Why is it so difficult to get rid of crabgrass that has taken over a yard?

Answer should include the following: The crabgrass stolons take hold of the soil in many places and produce roots. Therefore, the crabgrass has many roots in many places and is hard to pull up.

Looking Ahead

Name _____

A. Circle the word or phrase that best completes each sentence.

1. A characteristic that you inherit from your parents is called a (trait) / gene).
2. The chemical code, or (gene / DNA), tells your cells what to do.
3. Plants that show the same trait for several generations are considered (purebred) / hybrid).
4. A plant that is produced by crossing parent plants with different forms of the same trait are considered to be (hybrid) / purebred).
5. A characteristic that is always evident whenever the gene for it is present in the chromosomes is called the (recessive / dominant) trait.
6. (Reginald Punnett / Gregor Mendel) is called the Father of Genetics.
7. A cat's green eyes is one characteristic of its (genotype / phenotype).
8. The study of how physical characteristics are inherited is called (genetics) / heredity).
9. Most genetic diseases are (incurable) / curable).
10. A chart that traces a particular trait through a family is called a (Punnett square / pedigree).

B. Write a question for something you would like to learn about the following:

- Punnett squares

- genetic engineering



Reflecting Traits

Name _____

Children exhibit traits that are similar to their parents. It is often said that a baby has his mother's nose or her father's eyes. These traits are inherited. Besides physical characteristics, we also learn traits from our parents. A son may try to walk like his dad. A daughter may laugh like her mother. God tells us that He created Adam after His own image. Christians should, as His children, reflect the image of God. This requires that those who are His children demonstrate in their lives the characteristics that they know to be true about Him. He has given us His Word that we might understand His characteristics, or attributes.

Justice Wisdom Mercy Patience



Complete the section to learn about an attribute of God.

1. Choose an attribute of God from the list above. Write other forms of the word that you think might appear in the Bible. (Example: love, loving, charity)

2. Look up the word in an English dictionary. Write the definition that you think applies.

3. Look up the word in a Bible dictionary. Write the definition of the word and revise your previous list of words if necessary.

4. Use a concordance or topical index to find Bible passages where the attribute can be found. Be sure to look for verses that specifically describe God with that attribute. Write the references for at least five passages.

5. After reading the passages thoroughly, write a paragraph on your own paper to explain what you believe this attribute of God means and how you can reflect it in your life.

It's All in the Genes

Name _____

Student Text page 312

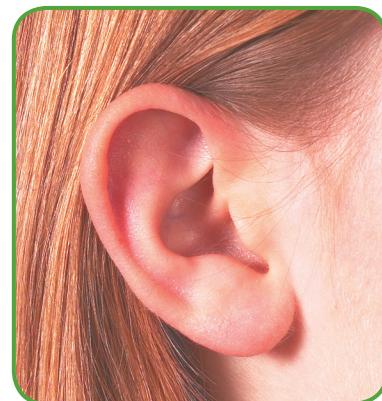
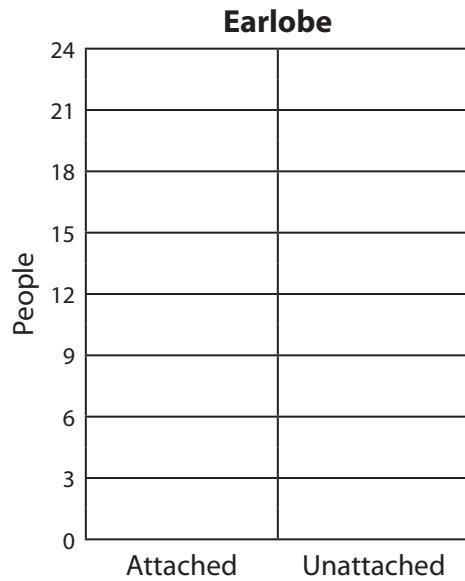


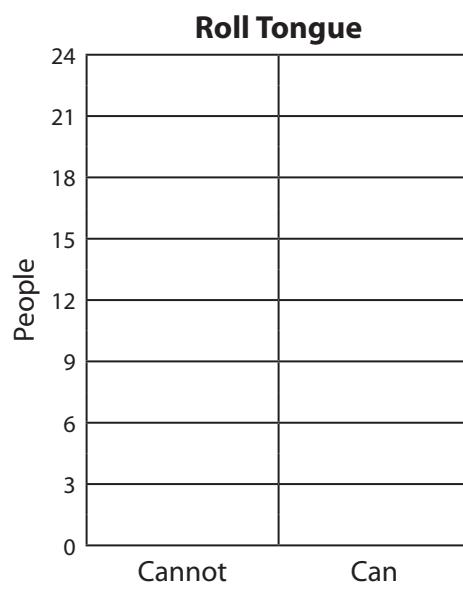
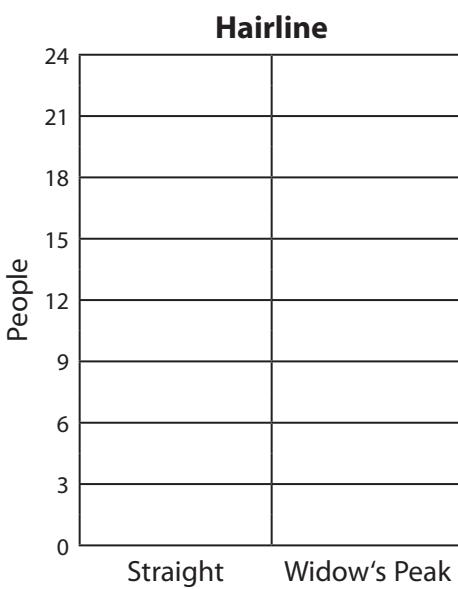
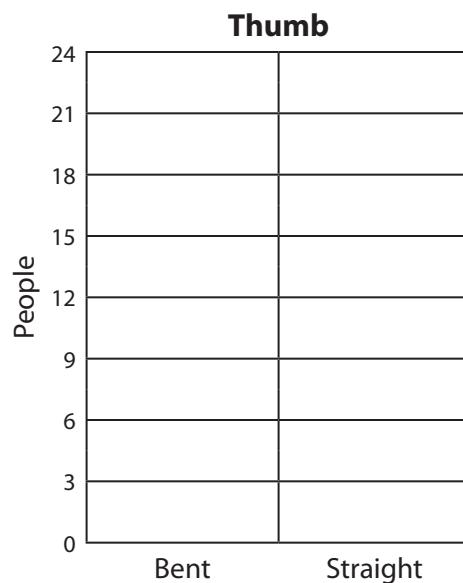
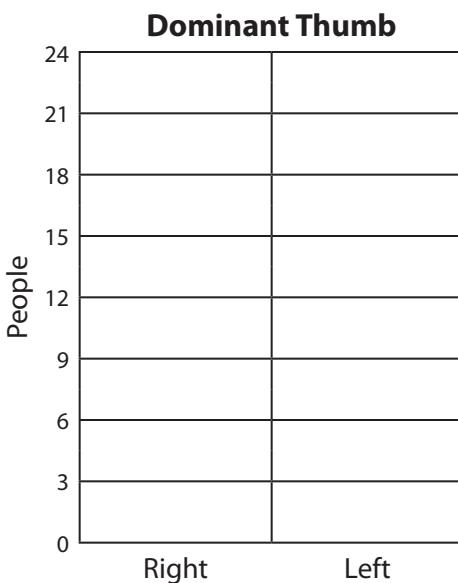
- A. Survey at least fifteen people to determine which traits they have. Record a tally mark for each trait.

Traits	Number of people
Attached earlobe	
Unattached earlobe	
Right thumb dominant	
Left thumb dominant	
Bent thumb	
Straight thumb	
Straight hairline	
Widow's peak hairline	
Cannot roll tongue	
Can roll tongue	

- B. Make bar graphs to represent the data you collected.

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Conclusions

Circle the trait in each pair that showed up more frequently.

Attached earlobe — Unattached earlobe

Right thumb dominance — Left thumb dominance

Bent thumb — Straight thumb

Straight hairline — Widow's peak hairline

Cannot roll tongue — Can roll tongue



Making a DNA Molecule Model

Student Text pages 313–14

Name _____

A. Complete the section.

1. What are bases? *the four basic molecules of DNA*
2. In a DNA molecule only certain bases fit together. Which bases fit together?
Base A fits with base T.
Base G fits with base C.
3. The order in which the bases are arranged creates the code, or pattern, for each gene.

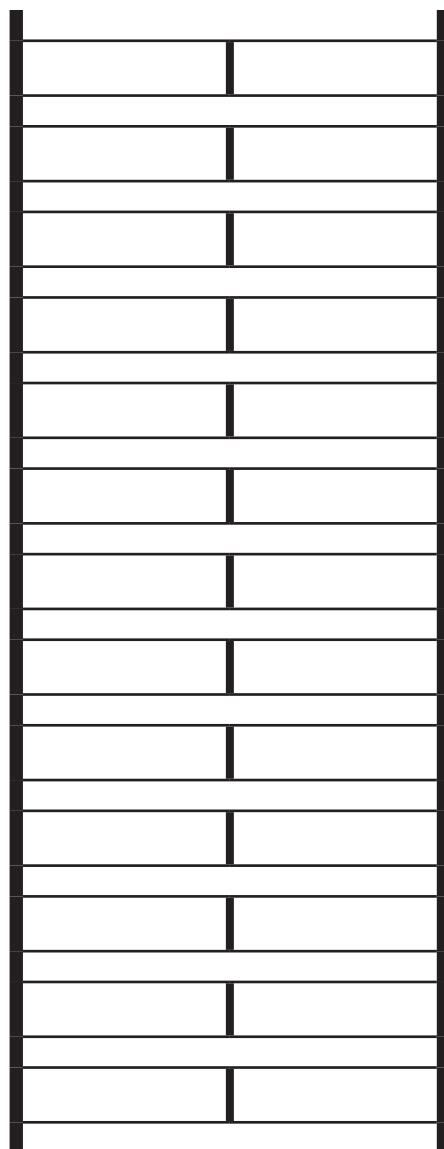
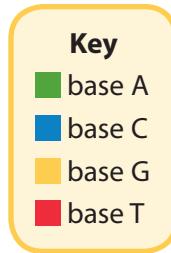
B. Construct a DNA molecule from chenille wires.

Materials

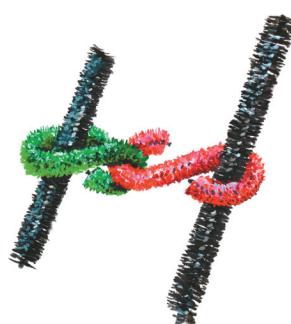
green, red, yellow, and blue colored pencils
two 12-inch black chenille wires
six 2-inch green chenille wires
six 2-inch red chenille wires
six 2-inch yellow chenille wires
six 2-inch blue chenille wires

Procedure

1. Use colored pencils to plan your DNA molecule model on the diagram. Remember to combine the bases correctly.



2. Prepare 10 rungs for your DNA molecule by combining the 2-inch chenille wires according to your plan.



3. Attach each end of the rungs to a 12-inch chenille wire at 1-inch intervals.
4. Check your connections to make sure they are secure.
5. Twist your “ladder” to form a model of the double helix.



Conclusions

1. Compare your DNA molecule model with that of another student. Did he have the same model as yours? *Answers will vary.*
2. A real DNA molecule has more than 10 rungs. Do you think it is possible for DNA molecules to have the same patterns? *Answers will vary.*
3. What are some ways people use DNA testing? *Possible answers: to identify soldiers killed in action and to aid police in identifying criminals*

Study Guide

Name _____

Student Text pages 310–11 and 313–14



A. Write the letter of the correct answer.

- C** 1. Inherited physical characteristics are called ____.
A. genes
B. DNA
C. traits
D. heredity
- A** 2. Small sections of DNA that control the traits of an organism are called ____.
A. genes
B. DNA
C. traits
D. heredity
- B** 3. The molecule carrying the chemical code that tells cells what to do is called ____.
A. genes
B. DNA
C. traits
D. heredity
- D** 4. The passing of traits from parent to offspring is called ____.
A. genes
B. DNA
C. traits
D. heredity
- B** 5. The shape of the DNA molecule was discovered by ____.
A. Robert Goddard
B. James Watson and Francis Crick
C. Sir Isaac Newton and Galileo
D. Gregor Mendel and Reginald Punnett



B. Fill in the blanks.

6. The DNA molecule is sometimes called a double helix because it is shaped like a twisted spiral ladder.
7. DNA rungs are formed from four basic molecules called bases.
8. The order in which the DNA bases are arranged creates the code, or pattern, for each gene.
9. Every organism has a different DNA pattern from other organisms.
10. Within an organism every cell has the same DNA pattern.

C. Answer the questions.

11. How are genes, DNA, and chromosomes related? Genes are small sections of DNA. DNA is the molecule carrying the chemical code that tells cells what to do. Chromosomes contain DNA.

12. What are four examples of inherited traits? Possible answers: eye color, freckles, shape of red blood cells, hair color, length of eyelashes, gender, blood type, colorblindness, hairline, attached or unattached earlobes

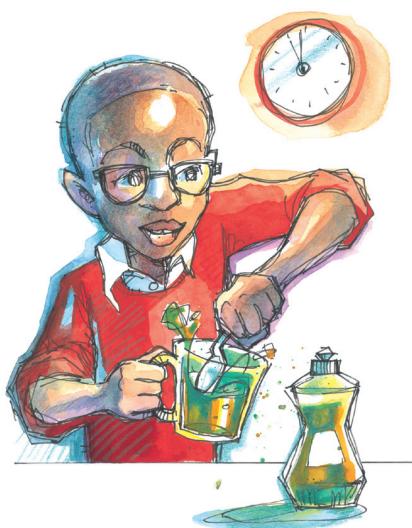
13. In addition to genetic inheritance, what are three things that work together to determine your traits? your environment, habits, and the things that you learn

14. What are two uses for DNA testing? to identify soldiers killed in action, to solve crimes

DNA Extraction

Student Text page 315

Name _____



Materials

15 mL raw wheat germ
45 mL water
8 mL liquid detergent
4 mL meat tenderizer
45 mL rubbing alcohol
toothpicks, wooden skewers, or craft sticks
metric measuring spoons
clear plastic containers

Use the following FAQ (Frequently Asked Questions) to learn more about DNA extraction.

FAQ	Answer
1. Is raw wheat germ the only substance that can be used for the extraction?	No, any organic substance that contains cells will work. Some substances, like raw wheat germ, will work better than others. You can prepare organic substances, such as liver, split peas, onions, etc., with water to form the organic solution.
2. How do I prepare the organic solution?	Mix the organic substance with water. You should have approximately three times as much water as organic substance. Mix the organic substance and the water in a blender. Strain the mixture to get the organic solution.
3. Do I need to use a blender?	A blender helps break open the cells of many substances to release the DNA molecules.
4. Why do I add the detergent?	The detergent grabs any fat molecules. This also helps isolate the DNA molecules.
5. How do I stir the organic solution after adding the detergent?	Stir gently. You do not want to break apart the long DNA molecules by stirring forcefully.
6. Do I need to use a certain kind of detergent?	No. Any liquid dish or laundry detergent will work. The amount of liquid detergent should equal one-sixth of the organic solution.
7. Why do I add meat tenderizer?	Meat tenderizer contains enzymes that help further separate the DNA from other cellular substances.



FAQ	Answer
8. Why do I add alcohol?	Alcohol is less dense than water. DNA is soluble in water but not in alcohol. The released DNA rises from the organic solution into the alcohol layer, separating from the other parts of the cell. The fats and the proteins remain in the organic solution.
9. Why do I tip the container to pour the alcohol?	By tipping the container and pouring the alcohol gently down the side, the alcohol is less likely to mix with the organic solution. The amount of alcohol should equal the amount of organic solution.
10. What if nothing happens in 10 minutes?	Sometimes the DNA strands take longer to form. You may need to let it sit overnight.
11. I have tried the extraction and nothing happened. What should I do?	You may need to go back to step 1 and repeat the procedure using less water in step 2. Some food sources of DNA contain more water than others. If the solution has too much water, it may not work as desired. Also, be sure you give each step adequate time.



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Follow-up

Now plan your own extraction. What organic substance will you use, and what variables will you change?

Genetics and Genes

Name _____

Student Text pages 316–19

A. Pea plants were tested for green or yellow seed color. Number the four steps of the experiment in order, then answer the question.

3

1. Allow the hybrid generation to self-pollinate.

1

2. Cross a purebred plant that has yellow seeds with a purebred plant that has green seeds.

2

3. The resulting plants all have yellow seeds.

4

4. The new plants have some yellow seeds and some green seeds.

5. Which color seed seems to be dominant? yellow

Why? only yellow seeds were present in the hybrid generation



B. Fill in the blanks

6. Mendel began his experiments with purebred plants.

7. Mendel had to cross-pollinate his plants because pea plants are usually self-pollinated.

8. Mendel found that tallness was a dominant trait for pea plants.

9. Hybrid plants are produced by crossing pollinated plants that have different forms of the same trait.

10. When no dominant factor is inherited, a recessive trait appears.

11. If it is present in a person's chromosomes, a dominant gene will always be expressed.

12. The physical appearance of a pea plant is called the phenotype.

13. The phenotype for two plants can be the same even when the plants have different genotypes.

14. When an organism has codominant genes, both genes are expressed.

15. When genes blend together to form a different outcome, this is called incomplete dominance.

Punnett Squares

Student Text pages 320–23

Name _____

A. Complete a Punnett square to explain each situation.

1. Both parents have one dominant gene for curly hair and one recessive gene for straight hair. Let H represent curly hair and h represent straight hair. What is the probability, or possibility, that one of their children will have curly hair?

	H	h
H	HH	Hh
h	Hh	hh

The probability of a curly-haired child is 3 out of 4, or 75 %.

2. One parent has two dominant genes for an unattached earlobe. The other parent has two recessive genes for an attached earlobe. Let E represent unattached earlobes and e represent attached earlobes. What is the probability, or possibility, that one of their children will have attached earlobes?

	E	E
e	Ee	Ee
e	Ee	Ee

The probability of a child with attached earlobes is 0 out of 4, or 0 %.

3. One parent has a dominant gene for a straight thumb and a recessive gene for a bent thumb. The other parent has two recessive genes for a bent thumb. Let T represent straight thumbs and t represent bent thumbs. What is the probability, or possibility, that one of their children will have a bent thumb?

	T	t
t	Tt	tt
t	Tt	tt

The probability of a child with a bent thumb is 2 out of 4, or 50 %.

4. Both parents have a dominant gene for rolling the tongue and a recessive gene for not being able to roll the tongue. Let R represent rolling the tongue and r represent not being able to roll the tongue. What is the probability, or possibility, that one of their children will be able to roll his tongue?

	R	r
R	RR	Rr
r	Rr	rr

The probability of a child being able to roll his tongue is 3 out of 4, or 75 %.

Study Guide

Student Text pages 316–23

Name _____



A. Write the letter of the correct answer.

- C 1. the arrangement of genes within the organism
- E 2. the physical appearance of an organism
- B 3. the characteristic that is shown in the hybrid generation
- F 4. the characteristic hidden in the hybrid generation but appears in later generations when no dominant factor is inherited
- A 5. happens when both genes for a trait are expressed
- D 6. happens when the genes for a trait blend together

- A. codominant
- B. dominant trait
- C. genotype
- D. incomplete dominance
- E. phenotype
- F. recessive trait

B. Fill in the blanks.

- 7. The study of how traits are inherited is called genetics.
- 8. Plants that show the same trait for many generations when pollinated naturally are purebred plants.
- 9. Plants produced by crossing purebred parent plants that each have a different form of the same trait are called hybrids.
- 10. Traits that may be inherited by daughters but are usually only visible in sons are called sex-linked traits.
- 11. Punnett squares show the genetic possibilities of a particular trait that can result for offspring of a specific set of parents.
- 12. A pedigree traces a particular trait from one generation to another.

C. Complete the section.

- 13. Summarize Mendel's experiments with peas for tallness. He cross-pollinated tall purebred plants with short purebred plants. All the resulting plants were tall. He allowed the hybrids to self-pollinate and found that the next generation had both tall and short plants.
- 14. What were three benefits of Mendel choosing to use pea plants for his experiments? They grow quickly, produce many seeds, and have traits that are easy to trace because they appear in only one of two forms.

15. What is the difference between plants referred to as the P generation and the ones called the F1 generation in Mendel's experiments?

The P generation refers to the purebred parent plants. The F1 generation are the hybrids, or offspring of the parent plants.

16. State the conclusions that Mendel drew from his experiments.

Offspring inherit traits in pairs of factors. Some traits are hidden in some generations but reappear in following generations.

D. Answer the questions.

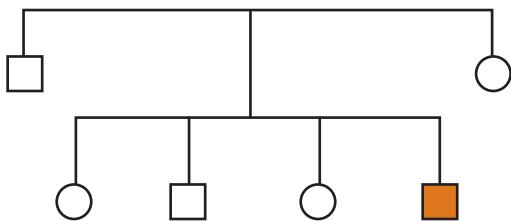
17. Both parents have a dominant and a recessive gene. Let H represent the dominant gene for hair on fingers and h represent the recessive gene for no hair on fingers. What is the probability, or possibility, of having a child with no hair on his fingers?

H	h	
H	HH	Hh
h	Hh	hh

The probability of a child with no hair on his fingers is 1 out of 4, or 25 %.

Pedigree for hair on fingers

No hair on fingers (recessive) = shaded
Hair on fingers (dominant) = unshaded



18. What does the circle represent?

a female

19. What do the vertical lines connect?

parents to their children

20. What trait is being traced in this pedigree?

hair on fingers

21. Does the father have hair on his fingers?

yes

22. How many children have hair on their fingers?

three

23. Do both parents have only dominant genes for this trait? Explain.

No, since one child displays the recessive trait of no hair on fingers, both parents must carry a recessive gene for that trait.

Paper Pet Genetics

Student Text pages 324–25

Name _____



Materials

blue, green, yellow, and orange construction paper
compass or large circle pattern
centimeter ruler

scissors
glue
crayons or markers
parental genotypes cards



Procedure

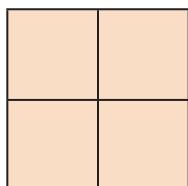
Genetic information	
Dominant Genes	Recessive Genes
Blue color (B)	Green color (b)
Square face (F)	Round face (f)
Round eyes (R)	Oval eyes (r)
Triangular ears (E)	Semicircular ears (e)

1. Record the genotype of each parent for your paper pets.

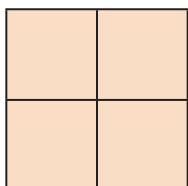
Father genotype	Mother genotype
Face color:	Face color:
Face shape:	Face shape:
Eye shape:	Eye shape:
Eye shape:	Eye shape:

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2. Complete a Punnett square to show what color (green or blue) your pet can be.

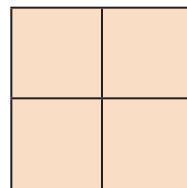
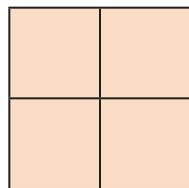


3. Complete a Punnett square to show what face shape (square or round) your pet can have.



Genetic information	
Dominant Genes	Recessive Genes
Blue color (B)	Green color (b)
Square face (F)	Round face (f)
Round eyes (R)	Oval eyes (r)
Triangular ears (E)	Semicircular ears (e)

4. Complete a Punnett square to show what eye shape (round or oval) your pet can have.
5. Complete a Punnett square to show what ear shape (triangle or semicircle) your pet can have.



6. Use the chart to record your choices and construct your pets.

	Pet 1	Pet 2	Pet 3
Face color			
Face shape			
Eye shape			
Ear shape			

Study Guide

Student Text pages 326–29

Name _____



A. Write the letter of the correct answer.

- C 1. occurs when red blood cells are hard and curved instead of round and flexible
- A 2. causes mucus to clog the lungs and air passages and prevents food from being fully digested
- B 3. occurs when a chromosome makes an extra copy of itself, which may cause some disabilities

- A. cystic fibrosis
B. Down syndrome
C. sickle cell anemia

B. Complete the section.

4. Explain why genetic diseases are not contagious. *Possible answers: Genetic diseases are inherited, meaning they are genetically passed from parent to child.*

5. Are genetic diseases tragic mistakes? Explain your answer. *No. They are part of God's plan. He can use the unique abilities and characteristics of every life to fulfill His purposes.*

6. What does genetic engineering involve? *changing a gene or moving some of one organism's genes into another organism*

7. List examples for each way genetic engineering can be used.

Medicine	<i>Gene therapy (switching a healthy gene for one that is not working properly) Making bacteria produce insulin for diabetics New treatments for people suffering from hemophilia or burns</i>
Animals	<i>Making the animals grow larger faster to provide more food for people Producing livestock that is more resistant to disease or better able to tolerate heat and drought</i>
Plants	<i>Causing plants to require less water Enabling plants to produce their own insecticide so farmers can use fewer chemicals on crops Causing plants to taste bad to insects that would normally eat them</i>



A Useful Weed

Student Text pages 330–31

Name _____

A. Complete the puzzle.

1. G E N E T I C

2. U N H E A L T H Y

3. D N A

4. P L A N T

5. M A P P E D

6. C O L D

7. F I R E F L Y

8. M A T U R E S

9. S P A T U L A

10. S A L T



1. Scientists use ____ engineering to produce plants that can resist diseases.
2. Some thale cress glows when it is ____.
3. Thale cress has a simple ____ structure that makes it good for experimentation.
4. Thale cress is considered a “model ____.”
5. The genetic structure of thale cress has been ____.
6. Some thale cress glows when it is ____.
7. Scientists took the glowing gene from a ____.
8. Thale cress is good for experimentation since it ____ quickly and produces many seeds.
9. The ____ gene from thale cress can help plants adjust to cooler conditions.
10. Thale cress has genes that allow plants to tolerate higher ____ levels.

B. Answer the questions.

11. How is the choice of thale cress similar to Mendel’s choice of the pea plant? Both plants mature quickly and produce many seeds.
12. How do scientists produce cold or disease-resistant plants similar to Mendel’s experiments with pea plants? Mendel cross-pollinated plants that had certain traits to produce plants with the traits that he wanted. Today’s scientists also cross-pollinate plants to produce other plants with traits that they want.

Thinking It Through

Student Text pages 310–32

Name _____



Answer the questions.

- Your friend Tracy has a widow's peak hairline, but her older brother, Joe, does not. How can this be true, since Joe and Tracy's parents both have widow's peaks? Draw Punnett squares to help you explain the possible dominant and recessive traits of Joe and Tracy's parents.

Answer should include Punnett squares. Joe and Tracy's parents must both have the genotype of Ww (one dominant and one recessive gene), which causes them to have widow's peaks but also allows them to have a child without a widow's peak (ww).

- A series of crimes has been committed. A hair was found at one crime scene and some blood was found at a different crime scene. Investigators determined that the same person was at both locations. Explain how investigators could use those clues to reach that conclusion.

Answer should include the following: They can test the DNA of both the hair and the blood. All cells in a person's body have the same DNA. If the hair and blood have the same DNA, then they belong to the same person.

3. Why is Mendel called the Father of Genetics?

Answers will vary but should include the following ideas: Through his experiments, Mendel realized that genes determine many physical traits and that the traits are passed from generation to generation. He realized that some traits could be hidden in one generation but expressed in the next generation.

4. Explain why genetic engineering can be both helpful and harmful.

Answers will vary but should include some of the following: It can be used to treat some genetic diseases, but it is not a cure. It can be used to provide treatments for diabetics, hemophiliacs, and burn patients. It can provide food for more people through making plants and animals better able to tolerate heat and drought or more resistant to disease. However, it can also cause unexpected problems such as allergic reactions and other health risks. Plants that produce their own insecticides might also kill some beneficial insects. Research is expensive.

Looking Ahead

Name _____

A. Mark the answer.

1. The command center for the body is the ____.
A. spinal cord B. brain C. neuron
2. Recalling what you had for lunch today is a use of your ____.
A. long-term memory B. short-term memory C. extensive memory
3. The backbone protects the ____.
A. lobes B. spinal cord C. cerebellum
4. A ____ in the nervous system is made up of a cell body, dendrites, and an axon.
A. hormone B. synapse C. neuron
5. Blinking at a sudden movement is a ____ because your body responded before your brain had time to think.
A. reflex B. synapse C. receptors
6. The endocrine system uses ____ to send messages in the body.
A. hormones B. neurons C. vibrations
7. The group of cells that help regulate the endocrine glands is the ____.
A. pancreas B. hypothalamus C. lobe
8. The endocrine gland that controls the growth of bones is the ____.
A. pituitary gland B. thyroid gland C. adrenal gland
9. The ____ passes from the axon to the dendrites of nerve cells as it travels quickly to the brain.
A. neuron B. sheath C. impulse
10. The electrical message jumps over the ____ between each nerve cell.
A. myelin B. synapse C. somatic

- | |
|-----------------|
| 1. (A) (B) (C) |
| 2. (A) (B) (C) |
| 3. (A) (B) (C) |
| 4. (A) (B) (C) |
| 5. (A) (B) (C) |
| 6. (A) (B) (C) |
| 7. (A) (B) (C) |
| 8. (A) (B) (C) |
| 9. (A) (B) (C) |
| 10. (A) (B) (C) |

B. Write a question for something you would like to learn about the following:

- the nervous system

- the endocrine system

Central Nervous System

Student Text pages 336–39

Name _____

A. Fill in the blanks.

1. The central nervous system consists of the brain and the spinal cord.
2. The peripheral nervous system communicates with the central nervous system about what is happening in and around the body.
3. The column of nerve fibers protected by your backbone is the spinal cord.

B. Identify the functions of the parts of the brain.

- C 4. controls conscious movement and directs muscles when learning a new activity
- A 5. controls involuntary activities, the functions necessary for life
- C 6. center of reasoning and decision making; influences your personality
- C 7. receives and interprets messages from your senses
- B 8. helps to control your balance and muscle coordination; remembers how to do an activity
- C 9. classifies sounds as speech, music, or noise
- B 10. controls the speed and force with which you move
- A 11. connects the brain to the spinal cord

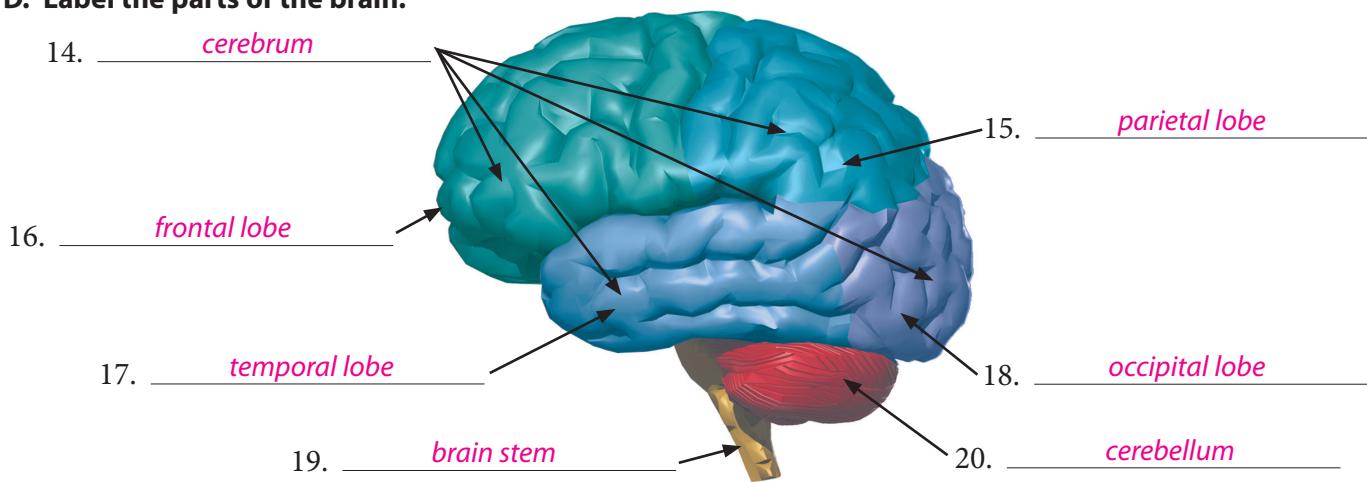
A. brain stem
B. cerebellum
C. cerebrum

C. Answer the questions.

12. Why is it important to wear protective equipment when playing certain sports or riding a bike?
to protect the body from injuries to the brain or spinal column, which can result in blindness, paralysis, loss of speech or movement, or death
13. What parts of the human body protect the brain? *the skull and cerebrospinal fluid*

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D. Label the parts of the brain.



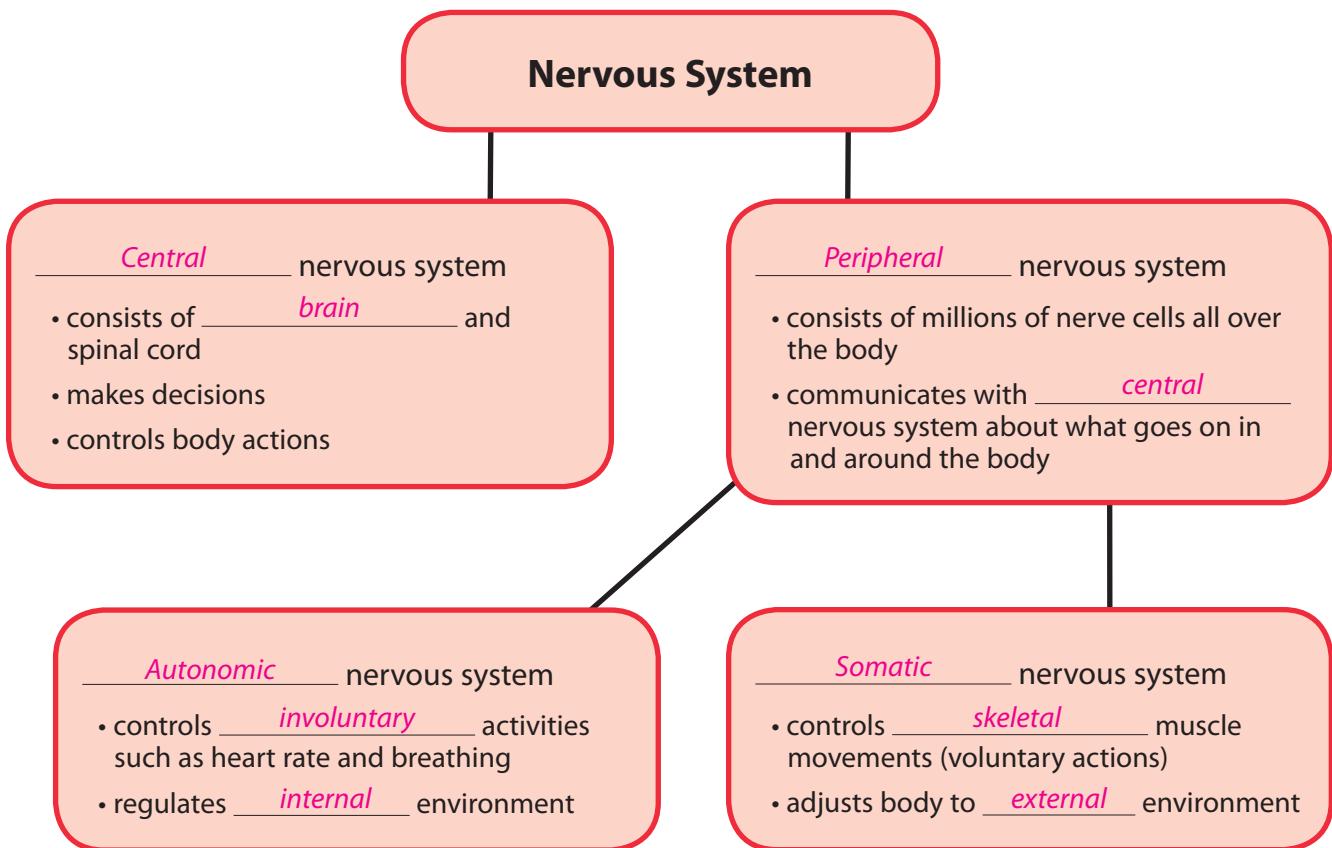
Study Guide

Student Text pages 336–43

Name _____



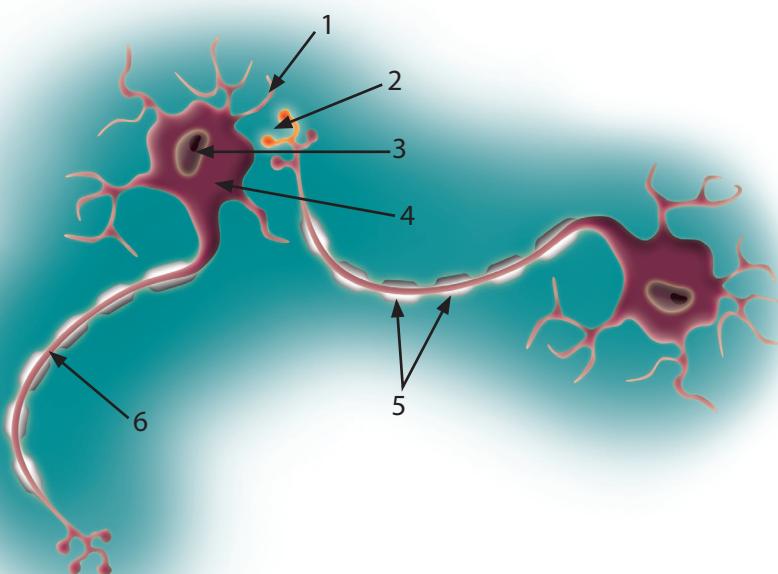
A. Complete the organizer.



B. Label the parts of the neurons

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1. *dendrite*
2. *synapse*
3. *nucleus*
4. *cell body*
5. *axon*
6. *myelin sheath*



C. Complete the sentences.

7. The command center for the body is the brain.
8. The parts of the brain are the cerebrum, the cerebellum, and the brain stem.
9. The cerebrum is divided into distinct areas called lobes.
10. The spinal cord is the main pathway of information connecting the brain to the rest of the body.

D. Write the correct answers.

- neuron 11. A nerve cell is called a ____.
- impulse 12. An ___ is an electrical message that passes along neurons to the brain.
- dendrite 13. The ___ receives the impulse from another neuron.
- cell body 14. The impulse moves from the dendrite to the ____.
- axon 15. The cell body passes the message to the ___, which sends the impulse on to the next neuron.
- synapse 16. The gap between the neurons over which the impulse crosses is called the ____.

E. Answer the questions.

17. How are sensory neurons different from motor neurons? Sensory neurons carry messages to the brain. Motor neurons send messages from the brain and the spinal cord to the muscles.

18. What is a reflex? an action that occurs before the brain has time to think about the action

Reaction Time

Name _____

Student Text pages 344–45



Problem

How does changing a variable affect my reaction time?

Materials

assorted 3 cm × 30 cm strips of poster board, one white and three of different colors
centimeter ruler

additional testing items:

Procedure

	Test 1	Test 2	Test 3	Average
Strip color: white				
Strip color: _____				

Compare the average measurements. How did changing the variable of color affect your reaction time?

Remember: A shorter measurement means a faster time.



Variables	Prediction	Test 1	Test 2	Test 3	Average
1.					
2.					
3.					

Conclusions

1. Compare the averages for the variables you chose to the average for the white strip. Did your results match your predictions? Explain.

2. Compare the average measurements of all your tests. Which method gave you the fastest reaction time? Why do you think changing this variable helped?

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Study Guide

Student Text pages 346–49

Name _____



A. Complete the sentences.

nervous _____

brain _____

auditory nerve _____

upside _____

optic nerve _____

taste buds _____

smell _____

olfactory nerve _____

touch _____

1. Your senses can function only with the help of the ___ system.
2. Information from the senses is interpreted by the ___.
3. Impulses are carried from the ear to the brain through the ___.
4. The brain receives images sent from the eye ___ down.
5. The brain is connected to the eye by the ___.
6. Located inside the bumps on the tongue are your ___.
7. Your sense of taste is affected by your sense of ___.
8. The impulses from your nose are sent to the brain through the ___.
9. The only sense located all over your body is the sense of ___.

B. Answer the questions.

10. Describe the relationship of the senses to the brain. *The senses gather information from the world around us. Neurons send that information to the brain. The brain interprets the information.*
11. What bones help transfer sound vibrations from the eardrum to the cochlea? *hammer, anvil, stirrup*
12. Explain why our eyes do not actually see.
The eye only provides the sensory information to the brain. The brain interprets the message so we can "see."
13. Why might a person hold his nose while taking bad-tasting medicine? *The sense of smell affects taste. Holding one's nose helps to reduce the taste of the medicine.*
14. Why can the senses not always be trusted?
Possible answers: Senses adapt to the environment around the body. The information gathered may be inaccurate. The brain's interpretation may not be accurate. People do not have all knowledge.
15. What is the only completely accurate source of information? *the Bible*





Touch Tester

Student Text pages 350–51

Name _____

Problem

Which place on your body—the arm, finger, palm, or neck—is most sensitive to touch?

Materials

Touch Tester
scissors
2 toothpicks
tape
blindfold (optional)

Procedure

Place on body	Predicted rank (1–4)	Measured distance (in.)	Actual rank
finger			
inside of arm			
neck			
palm			



Conclusions

1. Did your results match your predictions? _____

2. Which place listed is the most sensitive? _____

3. What makes some places on your body more sensitive than other places? *There are more neurons in certain places of the body.* _____

4. Think how you use the different parts of your body. Why do you think God made some areas of your body more sensitive than other areas? *Answers may vary.* _____

Memory and Sleep

Name _____

Student Text pages 352–55

A. Match each description to its term.

- B 1. stores information for months, years, or a lifetime
A 2. measures the electrical impulses produced by the neurons in the brain
D 3. stores information only temporarily
C 4. rapid eye movement

- A. EEG
B. long-term memory
C. REM
D. short-term memory

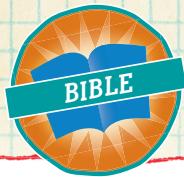
B. Write **T** if the statement is true. If the statement is false, draw a line through the incorrect part and write the correction on the blank.

- T 5. Memory is the ability to store and retrieve information.
long-term 6. Emotions can play a part in transferring information to ~~short term~~ memory.
Long-term 7. ~~Short term~~ memories can be described as declarative or procedural.
T 8. Remembering the number of goals made at a soccer game is a short-term memory.
T 9. Remembering how to play the piano is a long-term memory.
T 10. The nervous system remains active while a person sleeps.



C. Complete the section.

11. How is declarative memory different from procedural memory? Declarative memory recalls factual knowledge, and procedural memory recalls knowledge of activities or skills that one has learned.
12. How is declarative memory similar to procedural memory? Both recall knowledge that has been learned or experienced.
13. List two things that scientists know about learning. Possible answers: People learn in different ways. The ability to learn changes as a person grows older. Some things are easier to learn as a child and others require maturity.
14. Name two reasons that REM sleep is important to the body. REM sleep helps the brain develop. During REM sleep the brain sorts through and organizes information received throughout the day.



Remembering

Name _____

Have you ever forgotten something? Did you decide to forget? It seems that forgetting happens without trying, but remembering takes work. Making and keeping memories involves the whole brain. Memory is very important.

A. Scripture says God remembers. Complete the sentences.

1. God says He will remember His covenant never to destroy all life again by a **flood** (Gen. 9:15).
2. God said He would remember the covenant of **Jacob**, **Isaac**, and **Abraham** to send a Savior (Lev. 26:42).
3. God says He will not remember the **sins** of my youth and my transgressions, but He remembers me because of His goodness (Ps. 25:7).

B. Scripture commands us to remember. Complete the sentences.

4. The Israelites were to remember that they were slaves in Egypt, that God **brought** them out of Egypt, and that He protected them (Deut. 5:15).
5. We are to remember the **name** of the Lord (Ps. 20:7).
6. We are to remember the miracles of God and the **judgments** pronounced from His mouth (Ps. 105:5).
7. We are to remember how Jesus is **risen** (Luke 24:6).
8. Remember that Jesus said it is more blessed to give than to **receive** (Acts 20:35).

C. Scripture tells us to remember one another in prayer. Use this section to write down prayer requests and answers to prayer. Remember what the Lord has done for you.

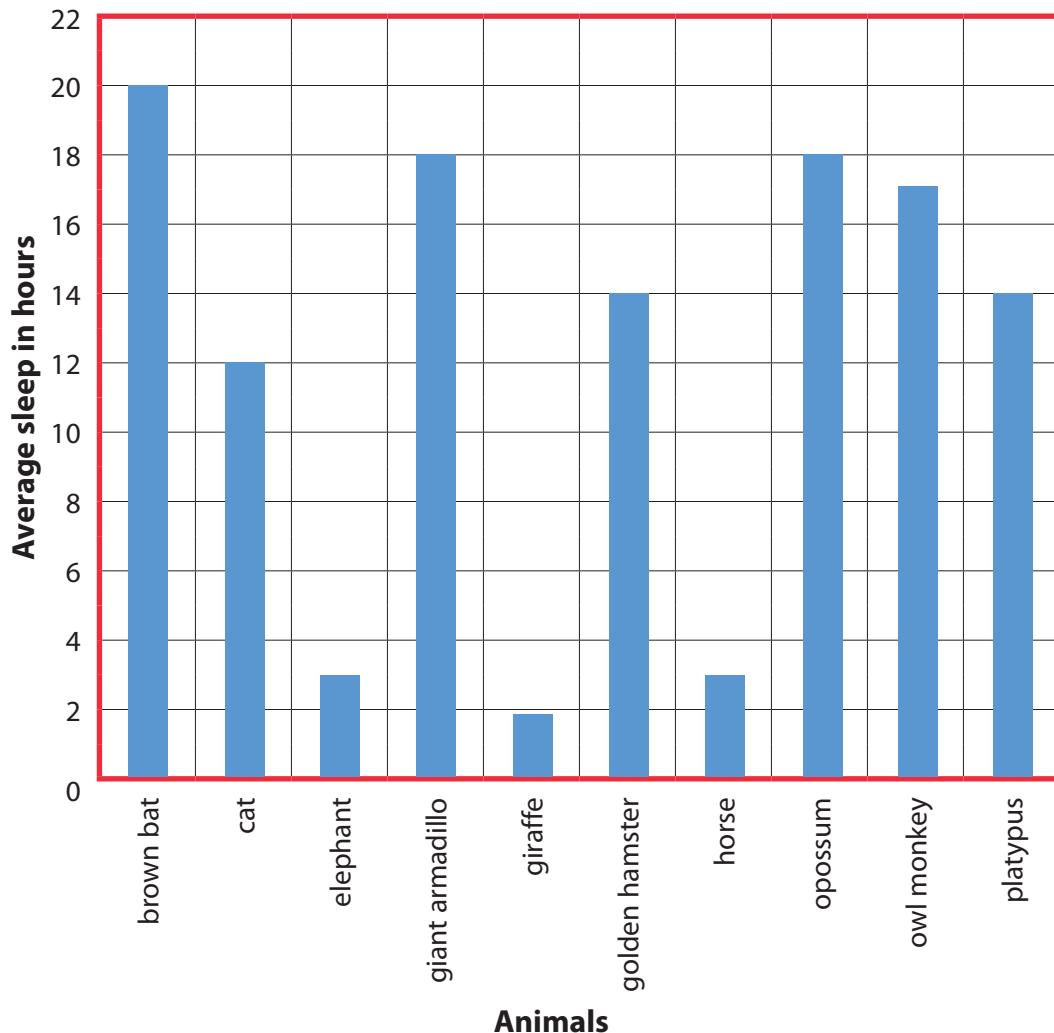
Prayer Requests	Answers to Prayer

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Sleepy Animals

Name _____

Average Sleep Time for Some Animals

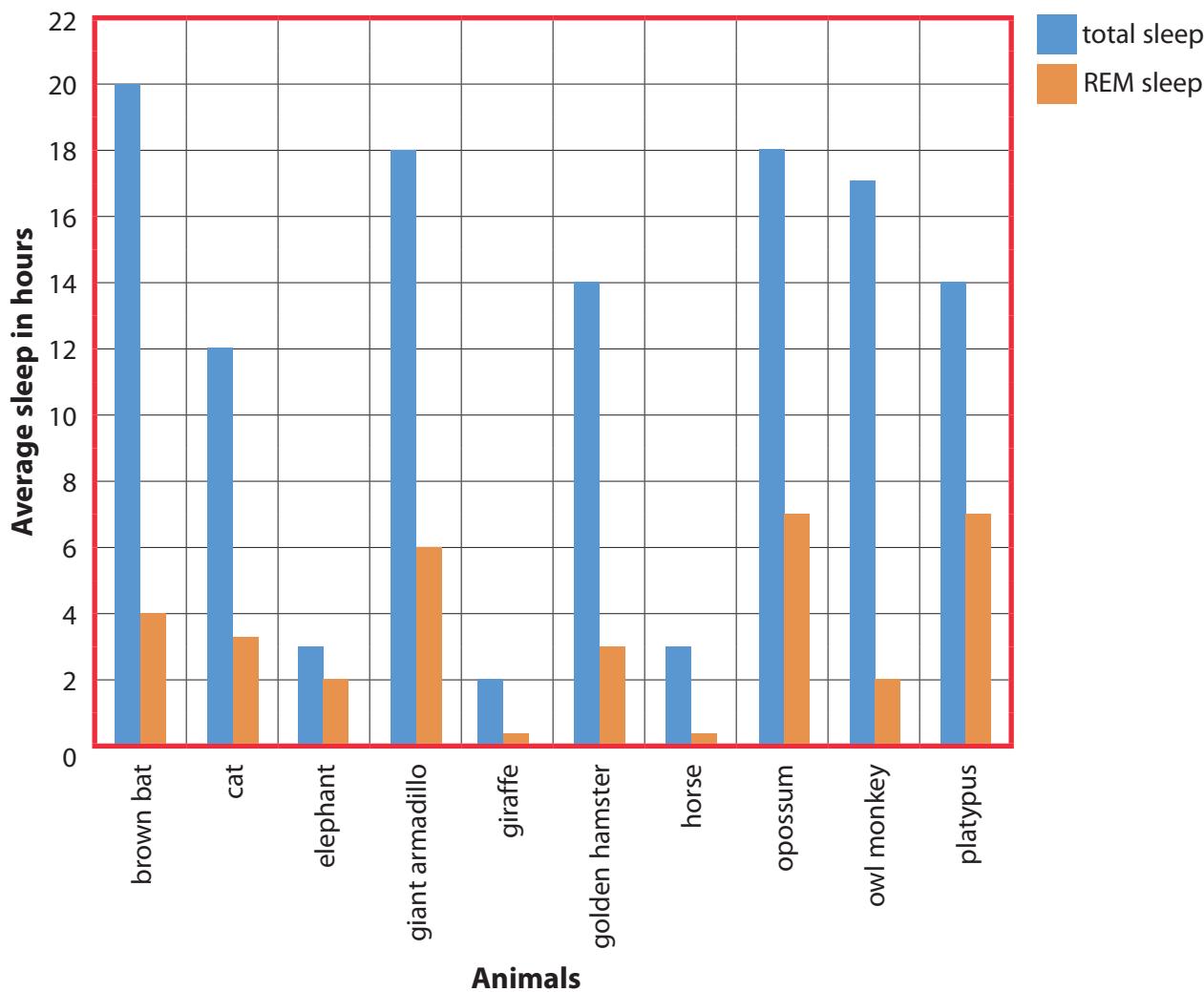


A. Use the graph to answer the following questions.

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1. Which of these animals sleeps the most? *brown bat*
2. Which animal needs about the same amount of sleep as the giant armadillo? *opossum*
3. Which animal needs more sleep—a cat or a golden hamster? *golden hamster*
4. About how much sleep does the owl monkey need? *17 hours*
5. Which animal spends the least amount of time in sleep? *giraffe*
6. Which two animals need only about 3 hours of sleep? *elephant and horse*
7. What general relationship do you notice about the size of an animal and its average sleep time?
The larger the animal is, the less sleep it needs.

Average REM and Non-REM Sleep Time for Some Animals



B. Use the graph to answer the following questions.

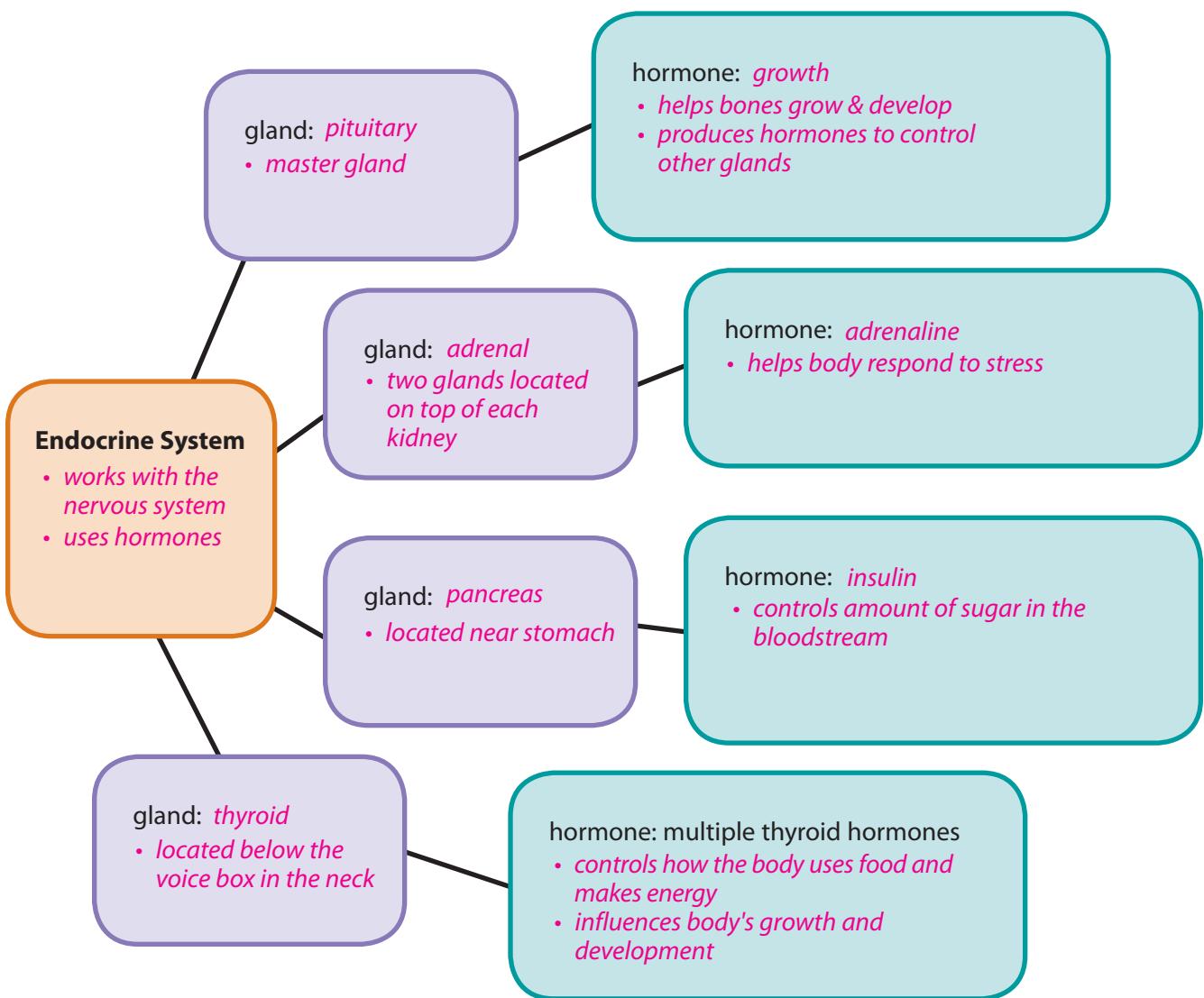
8. About how many hours does the opossum usually spend in REM sleep? *7 hours*
9. Which animals spend less than one hour in REM sleep? *giraffe and horse*
10. What fraction of a cat's sleep time is spent in REM sleep? *$\frac{3}{12}$ or $\frac{1}{4}$*
11. How many hours of the owl monkey's sleep is not REM sleep? *15 hours*
12. What fraction of sleep time does the platypus spend in REM sleep? *$\frac{7}{14}$ or $\frac{1}{2}$*
13. Which animal spends about 6 hours of its sleep time in REM sleep? *giant armadillo*
14. Which animal spends more time in REM sleep than in non-REM sleep? *elephant*

Connections

Student Text pages 356–59

Name _____

A. Complete the web. Possible answers provided.



B. Answer the questions.

1. What two systems control all of the functions of the body? *nervous system and endocrine system*
2. How do the hypothalamus and pituitary gland connect the nervous system and endocrine hormones? *The hypothalamus is part of the brain. Its neurons regulate the pituitary gland. The pituitary gland produces hormones that control other glands in the endocrine system.*
3. What are two causes of nervous disorders? *Answers should include two of the following: inherited problems, head or back injuries, problems since birth, drug abuse, and unhealthy habits.*
4. What does it mean to abuse a drug? *whenever a person uses medicine in excess or in a manner that it is not meant to be used*



Study Guide

Student Text pages 352–59

Name _____

A. Fill in the blanks.

1. The ability to store and retrieve information is called *memory*.
2. A person's *short-term memory* stores information only temporarily.
3. A person's *long-term memory* stores information for months, years, or a lifetime.
4. The nervous system remains *active* while a person sleeps.
5. Chemical messengers called *hormones* influence almost all cells, organs, and functions of the body.
6. Most of the body's hormones are produced in the *endocrine glands*.
7. The *pituitary gland* produces a growth hormone and hormones that control other glands.
8. Drugs like cocaine and marijuana *change* the way the brain sends and receives information.

B. Write the letter of the correct answer.

- B* 11. causes neurons in the brain to send impulses too quickly and irregularly
- C* 12. destroys the myelin sheaths of some neurons, possibly resulting in muscle weakness, paralysis, or vision loss
- D* 13. damages the brain cells that control movement
- A* 14. causes damage to brain cells that control thinking processes

- A. Alzheimer's disease
B. epilepsy
C. multiple sclerosis
D. Parkinson's disease

C. Answer the questions.

15. What are two differences between the nervous system and the endocrine system? *The endocrine system works slower than the nervous system. The endocrine system uses chemical messengers instead of electrical impulses.*
16. When does REM sleep occur and why is it important to the body? *REM sleep happens after periods of light and deep sleep. REM sleep helps the brain develop. During REM sleep the brain sorts through and organizes information received throughout the day.*
17. Where is the hypothalamus located and how does it relate to the endocrine system? *The hypothalamus is a group of special cells located near the base of the brain. The neurons in the hypothalamus help regulate the pituitary gland in the endocrine system.*

Thinking It Through

Name _____

Student Text pages 336–60



Plan and write a paragraph answering each question.

1. What are involuntary activities? Why is it important that the autonomic nervous system controls them?

Answer should include the following: Involuntary activities are activities that you do without thinking about them. They include heart rate, digestion, perspiration, breathing, and blood pressure. The autonomic nervous system controls breathing and other involuntary activities when we are asleep or unconscious. It also takes control when our body has to respond and we do not have time to consciously think about what our body needs to do.

2. Why can someone who lives near a railroad track sleep soundly as a train passes by, but an overnight guest might be awakened by the sound of the train?

Answer should include the following: God designed your senses to adapt to the environment around you to keep you from being overloaded with stimuli. The person who lives near the train track has adapted and become used to the sound of the train while the guest has not.

3. Luke was camping with his scout troop. As the campers were settling into their sleeping bags, a leader entered the tent and told the boys that a bear was sighted in the valley nearby. He reminded the boys to stay in the tent and remain quiet. What glands of the endocrine system would have become active as a result of the boys' fear? Describe some of the effects of the hormones on their bodies.

Answer should include the following: The adrenal glands help the body respond to stress and danger.

They produce adrenaline. Adrenaline increases blood pressure and heart rate and can cause the person to tremble.

4. People often disagree about whether certain drugs should be legal. Many dangerous drugs are illegal to possess and use. However, legal drugs can also be abused. What is drug abuse and why is it dangerous? Include reasons from the Bible why it is wrong.

Answer should include the following: Drug abuse is when a person uses any drug or medicine in excess or in a manner that it is not meant to be used. Abusing drugs can cause physical, emotional, or mental harm to the person and others. Some drugs are harmful to the body because they change the way neurons in the brain send and receive information. A Christian belongs to God, and he is to honor and glorify God. Verses may include Romans 12:1; 1 Corinthians 3:16–17, 6:12, 19–20, 10:31; Philippians 1:20; or James 4:17.

Looking Ahead

Name _____

A. Mark the sentence that uses the bold term correctly.

1. Mary's cold is a **noncommunicable disease** that she got from her brother.
 Jeff's grandma has cancer, a **noncommunicable disease**.
2. **Antibiotics** can be made from fungi and bacteria.
 An **antibiotic** is naturally made by the body to stop infection.
3. Jeff will probably not get chicken pox again because his body now has **antibodies**.
 The doctor can give you **antibodies** to help you get over your cold.
4. The **vaccination** explained the spread of the disease.
 Travis was given a **vaccination** to prevent polio.
5. Julie got sick with malaria because the mosquito that bit her was a **vector**.
 Lynn coughed without covering her mouth, causing many **vectors** to fly through the air.
6. The **epidemic** spread widely through the country because of the poor sanitation.
 The **epidemic** was administered to the children to help strengthen their immune systems.
7. Audrey washed her hands carefully because she wanted to avoid **pathogens**.
 Kevin's **pathogen** covered his skinned knee and kept germs from entering his body.
8. Jessica's asthma is triggered by **allergens** such as smoke and dust.
 The **allergens** inside Tom's immune system fought off the invading bacteria.
9. The **inflammatory response** from Addison's fire ant bite included swelling and pain.
 Michaela had an **inflammatory response** when she choked on some water causing her to cough and sputter.
10. John's dad is an **epidemiologist** who studies methods to treat broken bones.
 My cousin is an **epidemiologist** who studies how bacteria can spread disease.

B. Write a question for something you would like to learn about the following:

- communicable diseases

- allergies

Diseases

Name _____

Student Text pages 362–65

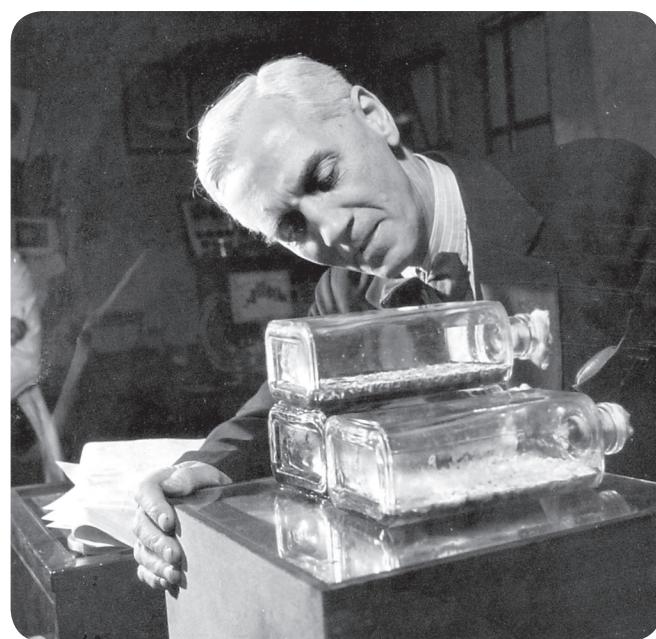
Complete the puzzle.

Across

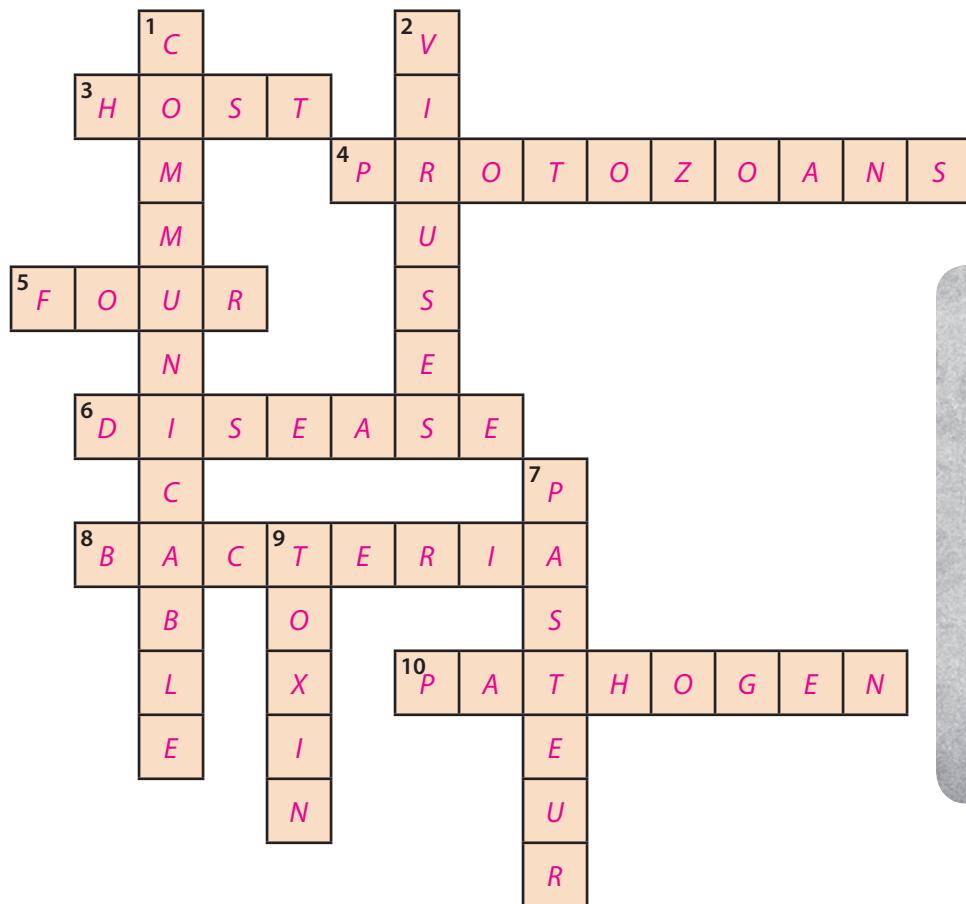
3. cell tricked by a virus into reproducing that virus
4. largest known pathogens
5. number of common types of pathogens
6. one result of Adam's sin
8. type of pathogen that causes most infections
10. anything that causes a disease

Down

1. what a contagious disease is classified as
2. some of the smallest known pathogens
7. scientist who realized that microscopic organisms can cause disease
9. another name for poison produced by some pathogens



Alexander Fleming



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Florence Nightingale

Pathogens & Noncommunicable Diseases

Name _____

Student Text pages 366–69

Complete each sentence. To complete number 12, write the circled letters in the order that they appear.

1. When a disease spreads to many people in a short time, it is called an

E P I (D) E M I C.

2. The bubonic plague was caused by B A C T E (R) I A.

3. Epidemiologists today use some of the research methods that J O H N
S N O W used to track the spread of cholera.

4. Insects and other animals that carry pathogens are called V E C T (O) R S.

5. A virus that spreads through the air is called an A I R B O R (N) E pathogen.

6. Viruses may also be spread by C O N T (A) C T.

7. A scientist who studies the causes and spread of diseases is an

E P I D E M I O L O G I (S) T.

8. Doctors can treat the (S) Y M P T O M S of noncommunicable diseases, but most of these diseases cannot be cured.

9. Noncommunicable diseases do not S P R E (A) D by contact, contamination, animals, or the air.

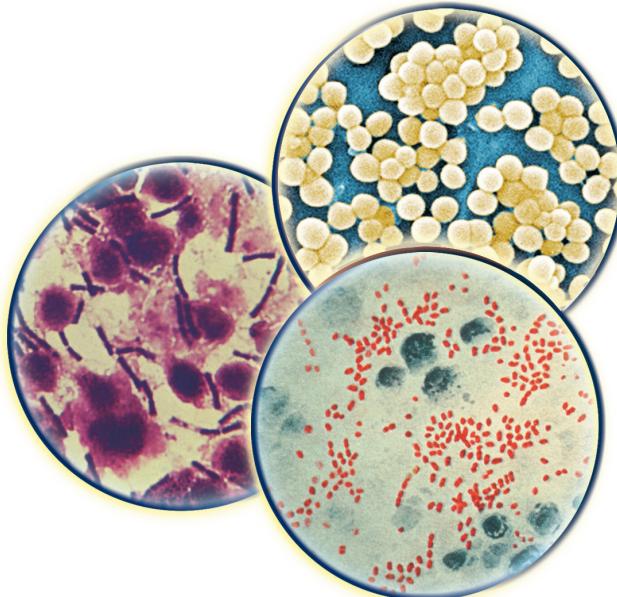
10. Food-borne and waterborne pathogens can cause illness, such as typhoid and

C H O (L) E R A.

11. Some of the most common vectors are mosquitoes, fleas, flies, lice, and T I C (K) S.

12. The scientist responsible for preventing epidemics by creating the polio vaccine is

D R. J O N A S S A L K.





Study Guide

Student Text pages 362–69

Name _____

A. Write the letter of the correct answer.

- B 1. occurs when a disease spreads to many people in a short time
- F 2. insects or other animals that carry pathogens
- D 3. noncontagious disease
- E 4. anything that may cause a disease
- A 5. contagious disease
- C 6. scientist who studies the causes and spread of disease

- A. communicable disease
B. epidemic
C. epidemiologist
D. noncommunicable disease
E. pathogen
F. vector

B. Mark all the correct answers.

7. What are the two classifications that scientists and doctors use for diseases?
 communicable bacteria
 pathogen noncommunicable
8. Which are the most common pathogens?
 viruses antibodies
 noncontagious protozoans
 bacteria fungi
9. What are ways that pathogens are spread?
 through the air through contaminated water
 vectors inflammation
 contact through contaminated food

C. Answer the questions.

10. What caused disease and pain to become part of people's lives? *Adam's sin*
11. What was Louis Pasteur's germ theory and why is it still important today? *He identified that diseases are caused by microorganisms. Killing the microorganisms causes the disease to stop spreading. His germ theory changed the way we think about and treat diseases.*
12. What kinds of things does an epidemiologist do? *looks for ways to prevent and control diseases; tracks a disease's progress; looks for source of a disease; teaches people how to prevent an outbreak, studies and teaches about health issues*
13. Which pathogen causes most infections? *bacteria*
14. How is a virus different from other pathogens? *It is not a living organism made of cells, it cannot move on its own, and it can only reproduce inside the cells of a living organism.*

The Body's Defenses

Name _____

Student Text pages 372–75

A. Complete the sentences.

defensive

1. The skin is one of the ___ barriers that keep pathogens out of the body.

scabs

2. To help prevent pathogens from entering the body, the body's defense system produces ___ to cover open wounds.

cilia

3. Tiny hairlike projections called ___ line your air passages and help to filter out pathogens in the nose.

stomach

4. Swallowed pathogens are usually killed by the hydrochloric acid in the ___.

swelling

5. Inflammatory response symptoms include ___, redness, heat, and pain.

lymphatic

6. Part of the body's specific defense (or immune response) is the ___ system, which includes your tonsils, appendix, and spleen.

nonspecific

7. Special white blood cells that protect the body before an infection and increase during an inflammatory response are a kind of ___ defense.

B. Answer the questions.

8. Describe why you think the castle walls and soldiers are pictured on pages 372 and 373.

Answers should include the following: Castles, moats, walls, and soldiers were kinds of protection for the people against enemies. Those pictures help us understand the fact that God created our bodies with defensive barriers to protect our bodies from diseases.

9. Choose one or two of your body's defenses and draw a cartoon of them attacking a disease. For example, you could draw a tear drop with a water hose blasting some bacteria that are riding on dust specks.

Immunity

Student Text pages 376–79

Name _____

A. Complete the sentences.

antibodies

- Special proteins produced by white blood cells that can destroy pathogens are called ____.

memory cells

- White blood cells that remember pathogens and the specific antibodies needed to defeat them are called ____.

immunity

- Special protection against a disease is called ____.

pathogens

- Increased body temperature, such as a fever, can kill some ____.

vaccine

- A shot that contains dead or weakened pathogens is called a ____.

antibiotics

- Chemicals made by microorganisms that are able to destroy other microorganisms are called ____.

penicillin

- Alexander Fleming discovered the first antibiotic when he noticed that a mold released a substance, ____, that killed bacteria.

immune

- Donated blood is accepted by the ____ system only if the blood types match.

blood

- Organ transplants can be successful only if ____ and tissue types match.

B. Complete the section.

10. What are two ways a person can get active immunity? *having a disease or getting a vaccine*

11. Explain why a deficient immune system may not have enough white blood cells. *Some diseases kill the white blood cells that identify the pathogen as an enemy.*

12. What is an autoimmune disease? Give an example. *a disease that happens when the body malfunctions and attacks healthy cells it should protect. Possible answers: multiple sclerosis, rheumatoid arthritis*

Study Guide

Student Text pages 372–79

Name _____



A. Complete the section.

1. What is the purpose of defensive barriers? *They keep pathogens out of your body.*
 2. Name several of the defensive barriers and what they protect. *Scabs keep pathogens from entering wounds. Sweat and natural body oils keep pathogens from entering the skin. Mucous membranes and cilia keep pathogens from entering your air passages. Hydrochloric acid kills pathogens in the stomach. Tears protect your eyes. Earwax protects your ears.*
 3. Why does the body sometimes increase its temperature during an inflammatory response? *Higher temperatures kill off some pathogens.*
 4. Why does the injured part of the body often swell during an inflammatory response? *There has been increased blood flow to the injured area.*
 5. What are three of the jobs performed by the immune system's white blood cells? *Possible answers: They identify and fight pathogens, store information about pathogens, produce and release antibodies, kill pathogens, and destroy infected host cells.*
 6. How do white blood cells travel throughout the body? *through blood and a transparent fluid called lymph*
 7. What part of the body's specific defense includes the tonsils, appendix, and spleen? *the lymphatic system*
- B. Identify each as a *nonspecific* or a *specific* defense.**
- | | |
|--------------------|--|
| <i>specific</i> | 8. also called an immune response |
| <i>nonspecific</i> | 9. an inflammatory response that may include swelling, redness, heat, and pain |
| <i>nonspecific</i> | 10. an increase in white blood cells that attack pathogens and prevent infection |
| <i>specific</i> | 11. identifies and fights pathogens using the lymphatic system |



C. Write the answers.

- C 12. occurs when the immune system attacks the healthy cells that it should protect
- E 13. contains dead or weakened pathogens for the purpose of providing immunity
- B 14. special proteins made by white blood cells that can destroy pathogens
- D 15. type of white blood cell that remembers a pathogen and the specific antibody needed to defeat it
- A 16. chemicals made by microorganisms that are able to destroy other organisms

A. antibiotics
B. antibodies
C. autoimmune disease
D. memory cell
E. vaccine

D. Fill in the blanks.

17. The body's special protection against disease is called immunity.
18. A person can get active immunity by either having had a disease or getting vaccinated.
19. A baby has passive immunity, temporary immunity before his immune system starts to produce its own antibodies.
20. Alexander Fleming discovered the first antibiotic, which was later named penicillin.
21. An allergic reaction happens when white blood cells mistakenly identify harmless foreign particles as an enemy.
22. Anything that causes the immune system to have an allergic reaction is called an allergen.

E. Write **antibody** or **antibiotic** for each description.

- antibiotic 23. can only work against bacterial infections and some types of fungi
- antibiotic 24. able to fight against more than one kind of bacterial infection
- antibody 25. able to destroy all types of pathogens
- antibody 26. made by the body to fight specific pathogens
- antibiotic 27. cannot work against viruses

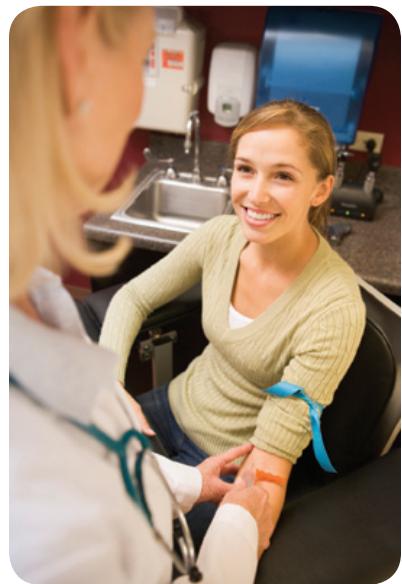
Blood Donation

Student Text pages 375–79

Name _____

Blood transfusions have become possible and even commonplace within the last sixty years. In times past, some doctors believed that sickness was caused by bad blood. In order for a sick person to become well again, the bad blood needed to be removed from the person's body. This "bleeding" was done either by attaching leeches or by making small incisions on the arms or legs. Some doctors even thought that injecting milk into a person's bloodstream would make him well again! Often these methods were more harmful than helpful.

Transfusions today are much more regulated and organized. A blood donor answers questions about his health and takes a few quick tests to ensure he is healthy enough to donate blood. Sterilized equipment is used both in the taking of blood and in its storage and distribution. Once the blood has been donated, it is tested to make sure that it meets health standards. Only about 5 percent of people who are eligible to give blood donate on a regular basis. Blood has a shelf life of only forty-two days after it has been donated.



Use the chart below to make a list of positive and negative aspects of blood donation. Then write a paragraph persuading a friend of your position concerning blood transfusions.

Positive	Negative



Robotic Surgery

Student Text pages 380–81

Name _____

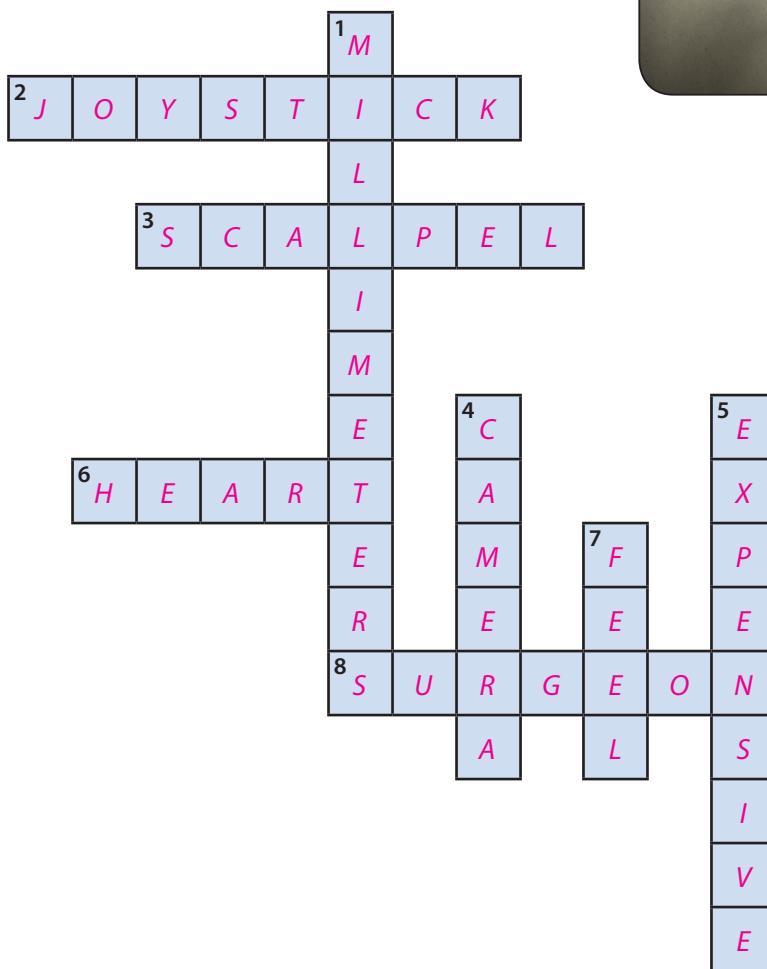
Complete the puzzle.

Across

2. what the surgeon's controls are similar to
3. a surgical instrument that might be found on a robotic arm
6. a type of surgery sometimes done by robotic surgery
8. doctor who performs surgeries

Down

1. distance the robot might move when the surgeon's hand moves a few centimeters
4. shows the surgeon a 3-D image of the inside of the patient
5. describes the cost of robotic operating systems
7. what a robot cannot do but a surgeon can



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Thinking It Through

Student Text pages 362–84

Name _____



Plan and write a paragraph answering each question.

- When Lynn had an ear infection, the doctor prescribed an antibiotic. Her ear started feeling better after a couple of days. Why is it important for her to finish taking all of the antibiotic that the doctor prescribed?

Answer should include the following: If she does not finish all of the medicine, some of the bacteria could survive. These bacteria might become harder to kill the next time and could cause another infection.

- Every spring when tree pollen is in the air, Ryan gets a stuffy nose and watery eyes. He also sneezes a lot during that time. Does he have a contagious disease? Why does his body probably react this way?

Answer should include the following: He probably does not have a contagious disease but is having an allergic reaction. For Ryan, tree pollen is an allergen. His body is mistakenly trying to destroy the pollen as if it were a pathogen.

3. Why must a person who receives an organ transplant be careful to avoid being exposed to germs?

Answer should include the following ideas: The person has to take medicines that suppress his immune system to keep his immune system from identifying the new organ as an enemy and attacking it. Since the medicines suppress his immune system, he would be more susceptible to pathogens (germs) and any illness they may cause. Once he has an illness, his immune system may not be able to fight it, and it could become serious.

4. What are some advantages and disadvantages of robotic surgery?

Answer should include the following: Advantages—quicker recovery from less invasive surgery, long surgeries less tiring for the surgeon, surgeons can perform surgery at a different location from where the patients are; Disadvantages—very expensive, surgery takes longer than traditional surgeries, surgeon is unable to feel the tissue