BUILDING SKILLS
Reading and Writing

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# LIFE SCIENCE

## Unit A Literature

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Adventures in Eating

Read the Literature feature in your textbook.

Write About It

Response to Literature  This article tells about different adaptations for eating. Research two more animals that have interesting adaptations. Write a report that explains how these adaptations help the animals eat. Compare these adaptations to the ones you read about in the article.

Paragraphs should have a clear topic sentence that directly identifies the eating adaptations of each animal that they research. The sentences that follow the topic sentence should support the topic sentence by describing how each animal eats and how these adaptations compare to those that students read about in the article. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will stay on topic, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from one idea to the next.
Cells and Kingdoms

Complete the concept map by filling in answers where blanks appear.

All Living Things

- **Are Made of**
  - CELLS

- **There are two types of cells.**
  - Plant Cells
  - Animal Cells

  - Each type of cell has certain unique parts.
    - Chloroplasts
    - Centrioles
    - Large Vacuole
    - Cell Wall

- **Are Classified into**
  - KINGDOMS

- **There are two types of kingdoms.**
  - Multicellular
    - Fungi
    - Animals
    - Plants
  - Unicellular
    - Ancient Bacteria
    - True Bacteria
    - Protists
Cells
Use your textbook to help you fill in the blanks.

What are cells?

1. All organisms, or living things, are made of _______________ cells.

2. Every cell in every living thing comes from another cell that ______ splits or divides______.

3. A single-celled organism that can carry on all its life processes is called _______________ unicellular.

4. Organisms made up of more than one cell are called _______________ multicellular.

How plentiful are unicellular and multicellular organisms?

5. Scientists have identified more than __________100,000________ different kinds of unicellular organisms.

6. One hundred times more types of __________animals________ than unicellular organisms have been identified.

What is in an animal cell?

7. Both plant and animal cells perform life processes by using _______________ organelles.

8. All cells are surrounded by a(n) _______________ cell membrane that controls the materials that move in and out of the cell.

9. The region between the cell membrane and the nucleus is filled with _______________ cytoplasm.

10. The cell’s control center is called the _______________ nucleus.
11. The tiny power plants in the cell where food is burned and energy is released are called mitochondria.

12. A structure in a cell used for storage of water, food, and waste is the vacuole.

What is inside a plant cell?

13. Plant cells have a(n) cell wall; a rigid structure that serves as an outer covering.

14. A green structure, called a(n) chloroplast, uses the energy from the sun to produce food for the plant.

How are cells organized?

15. Cells working together at the same job form a(n) tissue.

16. Groups of tissues working together form organs, and groups of organs working together form organ systems.

Critical Thinking

17. Compare and contrast the cells of plants, animals, and unicellular organisms.

All cells come from the division of other cells. Cells can carry on basic life processes. Plants and animals are multicellular organisms. They have specialized cells that group together to form tissues, organs, and organ systems. Only by grouping and working together can plant and animal cells carry out all the necessary life processes. Plant and animal cells have cell membranes, nuclei, cytoplasm, and organelles such as mitochondria and vacuoles. Plant cells have structures that animal cells lack, such as cell walls and chloroplasts.
Cells

Read each clue and fill in the crossword puzzle.

Across
2. The smallest unit of a living thing that can carry out the basic processes of life.
3. Similar cells working together at the same job.
5. A green chemical that absorbs sunlight.
7. Another name for a living thing.

Down
1. Organisms that contain many different types of cells.
4. Organs that work together to do a certain job.
6. A group of tissues working together to perform a specific job.

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Chapter 1 • Cells and Kingdoms
Reading and Writing
When we talk about living things, we can break them down into smaller things. All living things are made up of units called ___________ cells. Some organisms are ___________ unicellular; that is, they consist of only one cell. More complex organisms, including plants and animals, are called ___________ multicellular organisms.

All cells are surrounded by a(n) ___________ cell membrane that controls what moves into and out of the cell. The insides of cells are filled with a gel like fluid called ___________ cytoplasm. Within this liquid are the cell ___________ organelles. Both plant and animal cells, as well as many unicellular organisms, contain a(n) ___________ nucleus and ___________ mitochondria, which supply energy for the cell. Plant cells have a(n) ___________ cell wall, one large central vacuole, and chloroplasts. Chloroplasts contain chlorophyll which uses energy from sunlight to produce food for the plant.
Classifying Life

Use your textbook to help you fill in the blanks.

How are organisms classified?

1. Scientists sort, or __________ classify __________, living things into groups according to shared traits.

2. All organisms are divided into six major groups called __________ kingdoms __________.

3. The six subgroups used to classify organisms within kingdoms are __________ phylum __________, class, __________ order __________, family, genus, and __________ species __________.

4. The scientific name of an organism consists of its __________ genus and species __________.

What are animals?

5. The two kingdoms that include only multicellular organisms are __________ plants and animals __________.

6. Plants can make their own food, but __________ animals __________ obtain energy from other organisms.

7. The two major groups of animals are __________ vertebrates __________ and __________ invertebrates __________.

What are plants and fungi?

8. Although they are from two different kingdoms plants and fungi always have __________ cell walls __________.
9. The two major groups into which plants are organized are **vascular** and **nonvascular**.

10. Unlike plants, **fungi** get food by breaking down dead organisms.

11. A fungus that makes bread rise is called **yeast**.

**What are bacteria and protists?**

12. Bacteria are unicellular organisms with no **nucleus** or mitochondria.

13. The two kingdoms used to classify bacteria are the **“true” bacteria** and **“ancient” bacteria**.

14. Protists can be **unicellular** or multicellular.

15. Unlike bacteria, protists have large cells, a nucleus, and **bound organelles**.

**What are viruses?**

16. Viruses are not classified as living organisms because they carry out no life processes except **reproduction**.

**Critical Thinking**

17. What makes plants and animals different from bacteria?

   Plants and animals are multicellular. Bacteria are unicellular. Bacteria cells have no nucleus or mitochondria. Plants make their own food; bacteria cannot make their own food.
Classifying Life

Match the correct letter with the description.

1. _____ e contains only closely related organisms
2. _____ c the broadest group into which an organism can be classified
3. _____ a helps scientists identify, study, group, and name organisms
4. _____ f means “contains tubes or vessels”
5. _____ b animal without a backbone
6. _____ d type of plant that tends to be small and close to the ground
7. _____ g animal with a backbone, nervous system, and brain
8. _____ h organism that carries out only one life process, reproduction
Classifying Life

Fill in the blanks.

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Living things are often similar to each other. Scientists classify living things by similarity into smaller and more specific groups. The largest group into which an organism is classified is its kingdom. The six kingdoms include plants, animals, fungi, protists, “true” bacteria, and “ancient” bacteria.

Each kingdom is divided into progressively smaller groups, as follows: phylum, class, order, family, genus, and species. The narrowest group into which an organism can be classified is a(n) species. Two words make up the scientific name of a living thing. The first is the genus name. The second is the species name.

The “true” bacteria and the “ancient” bacteria are unicellular organisms with no nucleus or mitochondria. “Ancient” bacteria usually live in very harsh environments in which other organisms could not survive.
Meet Angelique Corthals

Getting Ideas
Underline the sentence or sentences in each paragraph that state the main idea of the paragraph.

How can you fit thousands of organisms into one small room? Angelique Corthals knows. She’s a scientist at the American Museum of Natural History, and she’s been busy preserving tissue samples of many different organisms from around the globe, including samples from species that have become extinct or died out. Angelique is an archaeologist. That’s a scientist who studies the past.

Angelique works in the museum’s frozen tissues lab. She specializes in the preservation of the information in cells. From bacteria to insects to mammals, she collects, preserves, and organizes the cells of all sorts of living things. Angelique stores the organisms’ cells and freezes them in small plastic tubes the size of your finger. Just as food stays fresh in the freezer, freezing cells prevents them from spoiling or decomposing. The tubes are stored in large tanks containing liquid nitrogen. At -150°C (-238°F), this liquid is so cold that all of the cells’ biological processes stop.

By using this freezing process, the cells can be preserved for many years. When a scientist needs to study an organism, she can request a cell sample from the lab. Whether it’s from a small fly or a large humpback whale, each cell contains information about the whole organism. Scientists can use this information to learn how different organisms are related. They can also use this information to learn about living things that have already become extinct and to understand why they died out.
Write About It

**Summarize** Make a chart that tells the steps for preserving cells. Use your chart to write a summary of the process Angelique uses to freeze cells from organisms.

**Sequence** Make a chart that tells the steps for preserving cells. Use the blank boxes below.

<table>
<thead>
<tr>
<th>First</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelique Corthals collects the tissues of many different types of organisms— from bacteria to insects to mammals.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Next</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corthals places the samples in fingerlike plastic tubes that are placed in large tanks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tanks are filled with liquid nitrogen which, at -238°F, causes the cells’ biological processes to stop. The cells are therefore preserved.</td>
</tr>
</tbody>
</table>

**Summarize** In a paragraph, summarize the process that Corthals uses to freeze cells.

Angelique Corthals collects tissue samples from many different types of organisms. She then freezes those samples in finger-shaped tubes in tanks of liquid nitrogen. As a result of the nitrogen’s very low temperature, the tissue samples are preserved.
Plants

Use your textbook to help you fill in the blanks.

How are plants classified?

1. Small plants such as mosses which survive without a transport system, are called nonvascular plants.

2. Plants that have a system of hollowed-out tubes to transport water and nutrients are called vascular plants.

3. A seed plant that does not produce flowers or fruits is called a(n) gymnosperm.

4. A seed plant that produces flowers and some kind of fruit is called a(n) angiosperm.

What are roots?

5. Roots absorb minerals and water, store food, and anchor plants.

6. Root hairs absorb water and minerals, and root caps protect root tips.

7. The epidermis is on the outside of the root; just beneath it is the cortex, used to store food; and at the center of the root is the vascular system.
What are stems?

8. Stems have two main functions: ______ support ______ and transport.

9. Grasses have ______ soft ______ stems that are green and bendable; trees have ______ woody ______ stems.

10. Two kinds of cells make up the transport system of plants. Cells that move water and minerals up the plant are ______ xylem ______. Cells that move food from the leaves to other plant parts are ______ phloem ______.

What are leaves?

11. The function of leaves is to perform ______ photosynthesis ______.

12. To perform photosynthesis, chloroplasts need ______ carbon dioxide ______ from the air, water from the soil, and ______ sunlight ______.

13. Air enters and exits plants through ______ stomata ______: pores on the underside of the leaves.

Critical Thinking

14. Why do you think some plants have woody stems and some have soft stems?

Larger plants need to hold up more weight than smaller plants. This could lead to them having woody stems. Some plants may have woody stems to protect them from being eaten. Their bark protects the stem and therefore the plant. Smaller plants may need more than just their leaves to produce food and so have soft stems that contain chlorophyll. The soft stems help them make more food.
Plants

Fill in the blank with a term from the box.

| angiosperm | gymnosperm | transpiration |
| cambium | phloem | xylem |
| cellular respiration | photosynthesis |

1. A seed that does not produce a flower is called a(n) _______.
   angiosperm

2. Cells that move sugars up, down, and all around a plant are called _______.
   phloem

3. A layer in the plant stem that separates xylem and phloem is called the _______.
   cambium

4. The break down of sugars in plant and animal cells to produce energy and carbon dioxide is called _______.
   cellular respiration

5. A seed that produces a flower is called a(n) _______.
   angiosperm

6. Cells that transport water and minerals from roots to shoots in plants are called _______.
   xylem

7. The process that plants use to produce their food and give off oxygen is called _______.
   photosynthesis

8. When water moves up the vascular tubes through stomata, _______ occurs.
   transpiration
Plants

Fill in the blanks.

<table>
<thead>
<tr>
<th>angiosperms</th>
<th>gymnosperms</th>
<th>stomata</th>
</tr>
</thead>
<tbody>
<tr>
<td>cellular respiration</td>
<td>photosynthesis</td>
<td>sugar</td>
</tr>
<tr>
<td>chloroplasts</td>
<td>stems</td>
<td></td>
</tr>
</tbody>
</table>

Seed plants can be divided into two main groups. Scientists call these groups **angiosperms** (flowering plants) and **gymnosperms** (plants without flowers or fruits). Seed plants have three basic parts—leaves, roots, and **stems**.

The function of leaves is to absorb sunlight to make sugars, a process called **photosynthesis**. The energy of sunlight is captured by **chloroplasts** and used to combine carbon dioxide and water. The carbon dioxide comes into the leaf through **stomata**. The sugar made during photosynthesis travels to cells all over the plant, where it is used for **cellular respiration**. During this process, **sugar** is broken down to release energy to power the cell's functions. The by-products are carbon dioxide and water.
Saving Water the Yucca Plant Way

Read the Writing in Science feature in your textbook.

Write About It

Explanatory Writing Write an article for young gardeners. Explain the process of CAM photosynthesis. Research facts and details for your article.

Planning and Organizing

Help Ray create an outline for his article. Here are some topics he wants to cover. Place them in the outline form below.

- What happens during the day in CAM photosynthesis?
- What is the purpose of CAM photosynthesis?
- What is photosynthesis?
- What happens at night during CAM photosynthesis?
- How does the process of CAM photosynthesis work?

I. What is photosynthesis?

II. What is the purpose of CAM photosynthesis?

III. How does the process of CAM photosynthesis work?

A. What happens at night during CAM photosynthesis?

B. What happens during the day in CAM photosynthesis?

IV. Why is the yucca plant special?

Now create an outline for your own article on a separate sheet of paper. Make it as detailed as possible. Add A, B, C points and subpoints (1, 2, 3) under these as necessary.
Now use a separate sheet of paper to write the first draft of your article.

Revising and Proofreading
Here is part of the report that Ray wrote. Help him combine his sentences. Use the transition word in parentheses. Make sure you punctuate the new sentence correctly.

1. In CAM photosynthesis, the stomates open at night. The air is cooler and the humidity is higher. (when)

   In CAM photosynthesis, the stomates open at night when the air is cooler and the humidity is higher.

2. CAM photosynthesis is effective. It results in more efficient water use. (since)

   CAM photosynthesis is effective since it results in more efficient water use.

Now revise and proofread your article. Ask yourself:

► Have I introduced my main idea about photosynthesis in yuccas?

► Have I included facts and details to show how this process works?

► Have I used examples and language appropriate for my audience?

► Have I used transition words and phrases to connect ideas?

► Have I ended with a strong conclusion about why yucca plants are special?

► Have I corrected all grammar errors?

► Have I corrected all problems in spelling, punctuation, and capitalization?
Classifying Animals

Use your textbook to help you fill in the blanks.

What are simple vertebrates?

1. The simplest animals are __________ sponges __________. They are without real tissues or organs and have a(n) ______ asymmetrical ______ body plan.

2. Jellyfish and hydrras are ______ cnidarians ______. They possess a mouth and muscle tissue and are ______ radially ______ symmetrical.

3. Worms that have flat bodies with one body opening and simple eyes are called ______ flatworms ______.

4. Worms that have simple digestive and nervous systems are called ______ roundworms ______.

What are complex invertebrates?

5. Clams and squids are __________ mollusks ______. They have ______ bilateral ______ symmetry, a muscular foot, a mantle, and several specialized organs.

6. Sea stars and sea cucumbers are ____ echinoderms _____. They have ______ tubed ______ feet and a water pressure system that helps them feed, breathe, and move.

7. Crabs and insects belong to the largest animal group on Earth, the ______ arthropod ______ phylum.
What are vertebrates?

8. There are three kinds of fish: ______ jawless fish ______, such as lamprey and hagfish; ______ cartilaginous fish ______, such as sharks and skates; and ______ bony fish ______.

9. Frogs, toads, and salamanders are ______ amphibians ______.

10. Lizards, snakes, turtles, and alligators are ______ reptiles ______.
   They are ______ cold-blooded ______, which means that their body temperature is not steady.

11. Birds are designed for flying: they are warm-blooded and have ______ bones ______ and feathers that are light and strong.

What are mammals?

12. Animals that are warm-blooded and have hair are called ______ mammals ______.

13. A duck-billed platypus lays eggs. It is a(n) ______ monotreme ______.

14. A kangaroo is a(n) ______ marsupial ______. It gives birth to partially developed offspring.

15. Lions, whales, and humans are ______ placental mammals ______. Their offspring develop within the mother.

Critical Thinking

16. Compare 4 different vertebrates.
   
   Answers will vary. Example answer: Mammals are the only vertebrates that have live birth. Fish are invertebrates that live and breathe under water. Amphibians can breathe both under water and on land. Birds have hollow bones that help them fly.
### Classifying Animals

Read each clue and fill in the blank with the correct answer.

<table>
<thead>
<tr>
<th>asymmetrical</th>
<th>invertebrates</th>
<th>monotreme</th>
<th>radial</th>
</tr>
</thead>
<tbody>
<tr>
<td>bilateral</td>
<td>marsupial</td>
<td>placental</td>
<td>vertebrates</td>
</tr>
</tbody>
</table>

1. **marsupial**  
   A koala is one. It gives birth to partially developed offspring.

2. **bilateral**  
   Worms have this kind of symmetry because they can be divided along only one plane.

3. **vertebrates**  
   Fish, birds, amphibians, reptiles, and mammals.

4. **placental**  
   A whale is an example of this kind of mammal.

5. **radial**  
   Cnidarians have this kind of symmetry.

6. **monotreme**  
   A mammal that lays eggs.

7. **asymmetrical**  
   A type of body plan that has no definite shape.

8. **invertebrates**  
   Sponges, coelenterates, echinoderms, mollusks, and arthropods.
The animal kingdom contains all the animals. The animal kingdom is separated into two large groups—animals with backbones **vertebrates** and animals without backbones **invertebrates**. These two groups are divided into smaller groups called phyla.

Vertebrates include fish, amphibians, reptiles, birds and mammals. Fish live in the water and breathe through gills. Vertebrates that spend part of their lives in water and part on land are called **amphibians**. Lizards, snakes, turtles, alligators, and crocodiles are **reptiles**. Birds are designed for flying. Their bones are **hollow** and light. Mammals produce milk to feed their young.

Invertebrates include sponges, coelenterates, worms, and arthropods. The most primitive of the animal groups are called **sponges**. Coelenterates have mouths surrounded by stinging **tentacles**. The largest of all the animal groups are called arthropods.
The Underground Life of Mole Rats

Write About It

Find out the scientific name of an animal you think is cute or ugly. Write a description of the animal. Use words and details that appeal to the senses in your description.

Getting Ideas

Choose an animal to describe. Then use the web below to brainstorm ideas. Write its scientific name in the center circle. Write details that describe it in the outer circles. You can add circles to the web if you like.

Students answers will vary.

Planning and Organizing

Janine wants to describe a ferret. Here are some sentences that she wrote. Write Yes if the sentence contains words and details that create a vivid impression of the ferret. Write No if it does not.

1. Yes The dark black marks around its eyes make it look like a bandit.

2. Yes Its long, lean body curves upward as though in surprise.

3. No The ferret has four legs and a tail.
Drafting
Write a sentence to begin your description. Tell what animal you will describe. Make sure your sentence expresses the impression you want to create.

Students’ sentences will vary. Sample sentence: If you want to see an animal that defines the word cute, look at the ferret.

Now write your description. Use a separate piece of paper. Begin with the sentence you wrote above. Tell the animal’s scientific name. Include descriptive words and vivid details to help readers experience the animal.

Revising and Proofreading
Here are three sentences that Janine wrote for her description. Help her improve them. Replace each italic word or words with a more descriptive or precise word. Choose a word from the box. Write it in the blank.

<table>
<thead>
<tr>
<th>bushy</th>
<th>carnivores</th>
<th>nocturnal</th>
</tr>
</thead>
</table>

1. ______ nocturnal Since ferrets are active during the night, you will probably find them curled up and sleeping most of the day.

2. ______ bushy Some ferrets have a hairy tail with an inky-black tip.

3. ______ carnivores Ferrets are animals that eat meat. They may eat squirrels, mice, and even prairie dogs.

Now revise and proofread your writing. Ask yourself:

- Did I create a vivid impression of the animal I chose?
- Did I use sensory words and vivid details?
- Did I correct all mistakes in grammar, spelling, punctuation, and capitalization?
Animal Systems

Use your textbook to help you fill in the blanks.

What are the skeletal and muscular systems?

1. Bones, tendons, and ligaments make up the ________ skeletal ________ system.

2. Muscles are attached to bones by ________ tendons ________.

3. When a muscle receives a nerve signal, it ________ contracts ________ and pulls on a tendon.

What are the digestive and excretory systems?

4. From the mouth, food travels down the muscular ________ esophagus ________ to the stomach.

5. Food is churned with strong acids in the ________ stomach ________.

6. The system that removes wastes such as water, salt, carbon dioxide, and nitrogen from the body is called the ________ excretory system ________.

7. The blood carries wastes to the ________ kidneys ________ , which filter the wastes from the blood.

What are the respiratory and circulatory systems?

8. The ________ lungs ________ and the passageways that lead to them make up the respiratory system in mammals.

9. The heart pumps oxygen-poor blood to the alveoli, where the oxygen enters the blood and ________ carbon dioxide ________ leaves the blood.
LESSON 10.
The blood travels to the small intestines and picks up nutrients. Next, nutrient and oxygen-enriched blood travels through smaller and smaller blood vessels to body cells.

11. Nutrients and oxygen pass into the body cells and waste materials pass out of the cells into the blood through the capillaries.

12. In vertebrates and some other animals, blood is carried in blood vessels. These animals have a(n) closed circulatory system. Arthropods and some other invertebrates have open circulatory systems.

What are the nervous and endocrine systems?

13. Your brain, spinal cord, nerves, and sense organs are part of your nervous system.

14. The endocrine system sends out hormones that cause changes in your body.

Critical Thinking

15. Name two organ systems that work closely together and explain how they interact.

Answers will vary. Example answer: The circulatory and respiratory system work closely together. The respiratory system takes in oxygen and the circulatory system takes oxygen to the cells. The circulatory system takes carbon dioxide from the cells and the respiratory system takes the carbon dioxide out of the body.
Animal Systems

Who am I? What am I?

Match the correct letter with the description.

1. ______ b  I am a long tube in which food is broken down into nutrients your body can use. Who am I?
2. ______ c  I produce hormones that are released into your body to change body activity. Who am I?
3. ______ g  Through me, your blood takes in oxygen from the air.
4. ______ e  I cause your bones to move. Who am I?
5. ______ a  I carry oxygen and nutrients to all your body cells. Who am I?
6. ______ d  I remove wastes from your blood. Who am I?
7. ______ f  Because of me, you can see, hear, feel, taste, think, and move. Who am I?
8. ______ h  I am the framework for your body, and I protect your internal organs. Who am I?
**Animal Systems**

*Fill in the blanks.*

<table>
<thead>
<tr>
<th>circulatory system</th>
<th>endocrine system</th>
<th>nervous system</th>
</tr>
</thead>
<tbody>
<tr>
<td>digestive system</td>
<td>excretory system</td>
<td>respiratory system</td>
</tr>
</tbody>
</table>

Your body is made up of several organ systems that work together to carry out basic life functions. The system that is made up of the heart, blood, and blood vessels is called the **circulatory system**. The system that brings air into the body and removes carbon dioxide is the **respiratory system**.

A long tube in which food is broken down into the nutrients that the body needs for energy, growth, and repair is called the **digestive system**.

The **endocrine system** is made up of a group of glands that produce hormones. Hormones are chemicals that control body functions, such as heart rate. The brain, spinal cord, and nerves make up the **nervous system**, which sends, receives, and processes nerve impulses throughout the body.

The kidneys are a part of the **excretory system**. They eliminate waste from the blood and form urine.
### Cells and Kingdoms

Choose the letter of the best answer.

1. The flexible wrapping that surrounds all cells is called the
   - a. cytoplasm.
   - b. cell wall.
   - c. cell membrane.
   - d. vacuole.

2. Which of these structures is found in a plant cell, but not in an animal cell?
   - a. central vacuole
   - b. mitochondria
   - c. nucleus
   - d. organelles

3. Which of the following is in the correct order, from simplest to most complex?
   - a. cells, tissues, organs, organism, organ systems
   - b. cells, tissues, organs, organ systems, organism
   - c. cells, organs, tissues, organ systems, organism
   - d. cells, tissues, organ systems, organs, organism

4. Which phylum has the most species?
   - a. echinodermata
   - b. molluska
   - c. chordata
   - d. arthropoda

5. In which kingdom do all of the members obtain energy by breaking down dead organisms?
   - a. plants
   - b. animals
   - c. fungi
   - d. protists

6. Which life process do viruses carry out?
   - a. reproduction
   - b. movement
   - c. growth
   - d. use of energy

7. Which structure is found in vascular plants, but NOT in nonvascular plants?
   - a. flower
   - b. xylem
   - c. leaf
   - d. seed
Choose the letter of the best answer.

8. A fir tree is an example of a(n)
   a. nonvascular plant.
   b. angiosperm.
   c. seedless plant.
   d. gymnosperm.

9. A carrot root is an example of a(n)
   a. taproot.
   b. prop root.
   c. fibrous root.
   d. aerial root.

10. Which of the following moves sugars that are made in the plant’s leaves?
    a. xylem
    b. phloem
    c. cambium
    d. bark

11. Which group includes the simplest animals?
    a. worms
    b. mollusks
    c. sponges
    d. cnidarians

12. Which animals have radial symmetry?
    a. sponges
    b. worms
    c. mollusks
    d. cnidarians

13. Which vertebrates have gills when they hatch, and lungs when they are adults?
    a. amphibians
    b. reptiles
    c. fish
    d. birds

14. Which organ filters wastes from the blood?
    a. bladder
    b. kidneys
    c. large intestine
    d. small intestine

15. Where does blood travel next after returning from the body cells?
    a. to the small intestine
    b. to the lungs
    c. to the liver
    d. to the kidneys
Parents and Offspring

Complete the concept map with information you have learned about different types of reproduction. Some answers have been written for you.

<table>
<thead>
<tr>
<th>Types of Reproduction</th>
<th>Organisms that use this type of reproduction</th>
<th>Does this type of reproduction enhance genetic variation?</th>
<th>Disadvantages or Advantage to this type of reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEXUAL</td>
<td>animals</td>
<td>yes</td>
<td>Disadvantage: Animals have to find mates.</td>
</tr>
<tr>
<td>ASEXUAL</td>
<td>bacteria</td>
<td>no</td>
<td>Bacteria can reproduce very quickly this way.</td>
</tr>
</tbody>
</table>
Reproduction

Use your textbook to help you fill in the blanks.

What are sexual and asexual reproduction?

1. Survival of a(n) ____________ species depends on its ability to produce offspring.

2. Every organism comes from a parent through the process of ____________ reproduction.

3. The transfer of ____________ genetic material from parents to their offspring is known as reproduction.

4. Genetic material contains the information that controls an organism's ____________ structure and function.

5. The production of a new organism from two parents is called ____________ sexual reproduction.

6. When an egg cell joins with a sperm cell, ____________ fertilization occurs.

7. A fertilized egg develops into an individual with traits from each ____________ parent.

8. The production of a new organism from a single parent is called ____________ asexual reproduction.

9. Most bacteria and unicellular protists reproduce by making a copy of their genetic material and ____________ splitting.

10. Cnidarians, sponges, and some fungi can reproduce through ____________ budding.
11. The eggs of insects, fish, frogs, and lizards sometimes develop into new animals without being fertilized.

12. New plants can grow from leaves, roots, or stems. This type of asexual reproduction is called vegetative propagation.

13. Strawberry plants and ferns can reproduce asexually by forming runners.

How do sexual and asexual reproduction compare?

14. An organism that reproduces asexually does not have to find a(n) mate.

15. Organisms that reproduce asexually tend to be well suited to their environments.

16. A major advantage of sexual reproduction is that it promotes variety in a species.

Critical Thinking

17. Why is sexual reproduction better than asexual reproduction for ensuring the survival of a species in a changing environment?

Possible answer: Sexual reproduction produces fertilized eggs that have genetic material from both parents. Each offspring has a unique combination of traits from both parents. This gives a better chance that at least some of the offspring will be better adapted to a changing environment. There is no combination of sex cells during asexual reproduction. They are genetically identical to the parent. Without variation, offspring may not be as well adapted to a changing environment.
Reproduction

Read each clue. Write the answer in the blanks using the words below. Then fill in the crossword puzzle.

<table>
<thead>
<tr>
<th>asexual</th>
<th>runners</th>
<th>splitting</th>
<th>variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>budding</td>
<td>sexual</td>
<td>trait</td>
<td>vegetative</td>
</tr>
</tbody>
</table>

1. budding
2. runners
3. variation
4. splitting
5. trait
6. asexual splitting
7. splitting
8. variation

Across
3. Plant stems that run along the ground and sprout as new plants.
5. Any characteristic of a living thing.
6. The production of a new organism from one parent is called asexual reproduction.
7. Bacteria reproduce by splitting.
8. Sexual reproduction gives rise to variation in a species.

Down
1. A bud growing from a fungus to become a new individual.
2. A new plant growing from a leaf is vegetative propagation.
4. A new organism from two parents is sexual reproduction.
No organism lives forever. This means all organisms must reproduce. There are two types of reproduction: sexual and asexual. Sexual reproduction requires two parents. A female egg cell unites with a male sperm cell to produce a fertilized egg. The fertilized egg grows into a new, unique individual. Asexual reproduction requires only one parent and results in offspring that are genetically identical to the parent.

The main advantage of sexual reproduction is that it promotes variety within a species. An advantage of asexual reproduction is that it does not require finding a(n) mate. There are several methods of asexual reproduction. Simple, one-celled organisms, like bacteria and protists, undergo fission. Animals such as cnidarians, sponges, and fungi undergo a process called budding.
How Do Sea Stars Regenerate?

Write About It
The article you just read explained how the sea star can produce offspring using regeneration. Choose another animal that can reproduce without two parents. Write an explanation of how this process takes place.

Getting Ideas
Choose an animal to write about. Think about how it reproduces without parents. Write the steps below.

Planning and Organizing
Xavier wants to explain how flat worms reproduce. Here are three sentences he wrote. Put them in order.

3. Finally, each half grows into a separate flat worm.
1. First, the flat worm divides in two.
2. Stem cells turn into the types of cells needed to reproduce the missing part.
Drafting
Write a sentence to begin your explanation. Name the animal you are writing about. Tell your main idea about how this animal reproduces. This is your topic sentence. Students’ sentences will vary.

Now write your explanation. Use a separate piece of paper. Begin with your topic sentence. Explain how the animal reproduces. Write the steps in time order.

Revising and Proofreading
Here are some sentences Xavier wrote. Combine each pair. Use the time order word in parentheses. Write the new sentence on the line.

1. The stem cells multiple. They turn into specialized cells. (before)

   The stem cells multiple before they turn into specialized cells.

2. A message is sent out to specialized cells. The cells near the wound cover it. (after)

   A message is sent out to specialized cells after the cells near the wound cover it.

Now revise and proofread your writing. Ask yourself:

- Did I explain how the animal can reproduce without parents?
- Did I include time order words?
- Did I correct all mistakes?
Plant Life Cycles

Use your textbook to help you fill in the blanks.

**What are seedless plant life cycles?**

1. Plant life cycles have two alternating phases, one sexual and one asexual. This type of life cycle is called __________.

2. During the asexual phase, moss plants form capsules that contain __________.

3. During the sexual phase, moss spores grow into plants with male and female branches. Rainwater carries sperm to egg cells, and __________ occurs.

**What are the parts of a flower?**

4. The male part of a flower is called the __________; the female part is called a pistil.

5. At the top of the filament is the __________, where pollen is produced.

6. The pistil is made up of a stigma, a style, and a(n) __________ (which contains the egg cells).

7. A perfect flower has both a stamen and a pistil; a(n) __________ flower lacks one part or the other.

**What is an angiosperm life cycle?**

8. The transfer of pollen from stamen to pistil is called __________.
9. After pollination, sperm cells from pollen move down the ________ of the pistil to the ovary.

What is in a seed?
10. The ovary enlarges to become a(n) ________ as the seeds develop.

11. In addition to the embryo, a seed contains a food supply called the ________ .

12. The development of a seed into a new plant is called ________ .

What is the conifer life cycle?
13. Cone-bearing plants, such as pines and firs, are called ________ .

14. After a conifer egg is fertilized, it develops into a seed on the ________ .

Critical Thinking
15. Compare and contrast the reproduction of mosses, ferns, gymnosperms, and angiosperms.

Ferns and mosses have an asexual phase in which spores are produced. The spores grow into plants that produce egg and sperm cells. The fertilized eggs grow into plants that produce spores. Both gymnosperms and angiosperms produce egg and sperm cells, and their fertilized eggs grow into seeds. In gymnosperms, the seeds develop on the female cones. In angiosperms, the fertilized eggs develop into seeds in the ovary, which enlarges to become a fruit.
Plant Life Cycles

Who am I? What am I?

Choose a word from the word box that answers each question.

| a. conifer | b. dicot | c. embryo | d. germination | e. monocot | f. pollen | g. pollination | h. seed coat |

1. ______ a I am a cone-bearing tree. Who am I?

2. _______ g I take place when pollen from the stamen reaches the pistil. What am I?

3. ______ c I am the tiny offspring inside a seed that can grow into a new plant. Who am I?

4. ______ d I am the development of a seed into a new plant. What am I?

5. ______ f I contain a flowering plant’s sperm cells. Who am I?

6. ______ b I have seeds with two cotyledons. Who am I?

7. ______ e I have seeds with one cotyledon. Who am I?

8. ______ h I am the tough, outer covering on a seed. What am I?
All plants have a life cycle with two phases—one sexual and one asexual. This type of life cycle is called **alternation of generations**. In gymnosperms and angiosperms, the asexual phase is much reduced, and the **sexual phase** is the dominant part of the life cycle. Gymnosperms produce male and female __________ cones. When pollen from the male cones reaches the female cones, __________ pollination occurs. The fertilized eggs stay attached to the female cones as they develop into __________ seeds. Angiosperms produce reproductive organs called __________ flowers.

Moss and fern plants produce __________ spores during their asexual phases. In ferns, spores are produced in __________ spore cases on the underside of the fronds. When the eggs are fertilized, they grow into fern fronds.
Animal Life Cycles

Use your textbook to help you fill in the blanks.

What are animal life cycles?

1. Some animals go through a series of distinct growth stages called ______ metamorphosis ______.

2. A butterfly hatches from an egg as a larva. The larva feeds and grows until it forms a(n) ______ pupa ______.

3. Inside the pupa, a larva's body changes completely into a(n) ______ adult ______ butterfly.

4. Grasshoppers emerge from their eggs as ______ nymphs ______, which are similar to the adult but lack wings and reproductive organs.

How does fertilization occur in animals?

5. Sperm and egg cells must stay protected and ______ wet ______ for fertilization to occur.

6. Fish and amphibians release their sex cells into the surrounding water, where ______ external ______ fertilization takes place.

7. Fish and amphibians must release large amounts of sex cells because the chances of ______ fertilization ______ in open water are low.

8. The joining of sperm and egg cells inside the female's body is called ______ internal fertilization ______.
9. Animals that use internal fertilization include ___________ reptiles ___________ , birds, and mammals.

10. Internal fertilization increases the chances that eggs will be ___________ fertilized ___________ and offspring will survive.

What happens to a fertilized egg?

11. Animals that lay their eggs in open water include fish and ___________ amphibians ___________.

12. The egg’s ___________ yolk ___________ provides food for a developing embryo.

13. Reptiles and birds have eggs filled with a liquid and surrounded by a tough ___________ shell ___________ , so their eggs can be laid on land.

14. The embryos of most ___________ mammals ___________ develop inside the mother.

Critical Thinking

15. Compare and contrast complete and incomplete metamorphosis. Give an example of an organism that undergoes each.

Animals that undergo complete metamorphosis develop in four separate stages—egg, larva, pupa, and adult. During these phases, a butterfly develops from an egg to a caterpillar to a pupa (also known as a chrysalis) to a winged adult. Animals that undergo incomplete metamorphosis experience three distinct levels of development—egg, nymph, and adult. Dragonflies exhibit incomplete metamorphosis, becoming wingless nymphs before becoming adults.
Animal Life Cycles

Read each clue. Write the answer in the blanks using the words below. Then fill in the crossword puzzle.

<table>
<thead>
<tr>
<th>complete</th>
<th>incomplete</th>
<th>larva</th>
<th>nymph</th>
</tr>
</thead>
<tbody>
<tr>
<td>external</td>
<td>internal</td>
<td>metamorphosis</td>
<td>pupa</td>
</tr>
</tbody>
</table>

Across
1. The immature stage that emerges from the egg during incomplete metamorphosis.
4. Larva changes to an adult inside this hard case.
5. A life cycle with three growth stages.
7. The immature stage that emerges from the egg during complete metamorphosis.

Down
2. A series of distinct growth stages.
3. A life cycle with four very distinct growth stages is called metamorphosis.
5. The joining of egg and sperm cells inside the body.
6. The joining of egg and sperm cells outside the body.
Animal Life Cycles

Fill in the blanks.

<table>
<thead>
<tr>
<th>complete</th>
<th>internal</th>
<th>sperm</th>
</tr>
</thead>
<tbody>
<tr>
<td>embryos</td>
<td>jelly-like layer</td>
<td>tough shells</td>
</tr>
<tr>
<td>external</td>
<td>metamorphosis</td>
<td>yolk</td>
</tr>
</tbody>
</table>

Animals reproduce sexually. Sexual reproduction of animals begins when egg and \[\text{sperm}\] cells unite. Fish and amphibian eggs are fertilized outside the female's body, a process called \[\text{external}\] fertilization. Land animals rely on \[\text{internal}\] fertilization.

After egg cells are fertilized, they develop into \[\text{embryos}\]. Fish and frog embryos develop inside soft eggs. The eggs are somewhat protected by a(n) \[\text{jelly-like layer}\] around them. Reptiles and birds lay eggs covered by \[\text{tough shells}\]. Their eggs contain an embryo, a watery fluid, and a food source, the \[\text{yolk}\].

When most animals are born, they look like their parents. Other animals go through a series of stages called \[\text{metamorphosis}\]. Butterflies, moths, and beetles go through \[\text{complete}\] metamorphosis. Grasshoppers, and termites go through incomplete metamorphosis.
Traits and Heredity

Use your textbook to help you fill in the blanks.

What is heredity?

1. The passing of traits from one generation to the next is called _______ heredity _______.

2. Traits that offspring receive from their parents are _______ inherited _______ traits.

3. A way of acting or behaving with which an animal is born is called a(n) _______ instinct _______.

4. A behavior that develops during an animal’s lifetime is a(n) _______ learned _______ behavior.

5. When ducks hatch, they learn to recognize and follow their mother, a behavior called _______ imprinting _______.

How are traits inherited?

6. Mendel discovered that each inherited trait is controlled by _______ two factors _______, one from each parent.

7. Today scientists refer to Mendel’s factors as _______ genes _______.

8. Genes are found in the nucleus of the cell. They are stored on _______ chromosomes _______.

9. A trait that masks another trait is called a(n) _______ dominant _______ trait.

10. A trait that is masked is called a _______ recessive _______ trait.
11. In pea plants, purple flowers are a dominant trait and white flowers are a recessive trait. The purple trait is represented by \( P \) and the white trait by \( p \).

**How do we trace inherited genes?**

12. A chart used to trace the history of traits in a family is called a(n) **pedigree**.

13. On a pedigree chart, horizontal lines connect parents and vertical lines connect parents to **offspring**.

14. Males are represented by squares, and **females** are represented by circles.

15. Shaded shapes represent individuals with a particular **trait**, and unshaded shapes represent individuals without that trait.

16. Dimples are a dominant trait, represented by the letter D. A child who is a carrier of the recessive trait is represented by \( Dd \).

**Critical Thinking**

17. Both a father and mother have dimples. Their son has dimples, but their daughter does not. Which genes, \( DD \), \( Dd \), or \( dd \), does each family member have?

Both parents must have one dominant gene for dimples (\( D \)) and one recessive gene for no dimples (\( d \)). Both are carriers for no dimples (\( Dd \)). The son could have inherited either one or two dimple genes (\( DD \) or \( Dd \)). The daughter must have inherited two recessive genes (\( dd \)), one from each parent.
Traits and Heredity

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. carrier</th>
<th>b. dominant</th>
<th>c. gene</th>
<th>d. heredity</th>
<th>e. inherited</th>
<th>f. instinct</th>
<th>g. pedigree</th>
<th>h. recessive</th>
</tr>
</thead>
</table>

1. ______ e  a trait that an offspring receives from its parents
2. ______ d  the passing down of traits from one generation to the next
3. ______ f  behavior that is inherited
4. ______ b  a trait that masks another trait
5. ______ h  a trait that is masked or covered by another trait
6. ______ g  chart used to trace the history of traits in a family
7. ______ c  contains the chemical instructions for an inherited trait
8. ______ a  individual who has inherited a gene for a trait, but does not show the trait physically
Parents pass on features of themselves to their offspring. Any notable feature of an organism is called a(n) _______ trait. The passing down of traits from parents to offspring is called _______ heredity. Some traits, such as hair or eye color, are physical traits. Other inherited traits are behavioral and are called _______ instincts. An Austrian monk, _______ Gregor Mendel, discovered how traits are inherited.

Today, Mendel’s factors are called _______ genes. They are stored on the _______ chromosomes inside the nucleus of cells. Offspring receive one set of genes from an egg cell and the other from the _______ sperm cell that fertilized the egg cell.

Humans have an estimated 20,000 gene pairs. Some of these traits are easy to see. The history of a family trait and the way it has been inherited can be charted in a _______ pedigree. These charts can be used to study heredity patterns.
Genetically Modified Corn

Read the Reading in Science feature from your textbook. Look for cause and effect relationships.

**Cause and Effect**

Fill in the Cause and Effect Chart with cause and effect relationships you find in the article.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn borer eats corn</td>
<td>Corn topples over or stops growing; 39 million tons of corn are lost worldwide each year.</td>
</tr>
<tr>
<td>Bt powder sprayed on corn</td>
<td>The corn borer is killed when it eats corn: corn is protected, but spray does not kill all larvae.</td>
</tr>
<tr>
<td>Bt gene inserted in corn</td>
<td>Corn plants make Bt toxin in their own cells, so the corn plants can protect themselves.</td>
</tr>
<tr>
<td>Other living things eat Bt corn</td>
<td>Harmless insects such as Monarch butterflies may be killed; humans may be affected.</td>
</tr>
</tbody>
</table>
Planning and Organizing
Answer these questions in detail.

1. What does the Bt bacterium produce, and what effect does it have on corn borers?
   
   The Bt bacterium produces a protein that is toxic to corn borers. When the borers eat corn that has been treated with Bt, they die.

2. What enables the Bt bacterium to make a protein that is toxic to corn borers?
   
   Bt bacterium have a gene that causes them to make the poisonous protein.

3. What was transferred from the Bt bacterium to Bt corn?
   
   The gene that codes for the toxic protein was transferred from the bacterium to the corn.

4. How does Bt corn affect corn borers?
   
   Bt corn is toxic to corn borers.

5. How might Bt corn affect other living things, such as Monarch butterflies?
   
   Bt corn might also kill harmless insects that eat it—like the Monarch butterfly.

Write About It

Cause and Effect Explain how the bacterium Bt affects corn borers. Tell how genetically modified corn might cause problems for other insects and for the environment in general.

The Bt bacterium produces a protein that is toxic to corn borers. When the borers eat corn that has been treated with Bt, they die.

Bt bacterium have a gene that causes them to make the poisonous protein.

The gene that codes for the toxic protein was transferred from the bacterium to the corn.

Bt corn is toxic to corn borers.

Bt corn might also kill harmless insects that eat it—like the Monarch butterfly.
Parents and Offspring

Choose the letter of the best answer.

1. Which of the following organisms reproduces by using budding?
   a. sponge  
   b. cat  
   c. lizard  
   d. frog  

2. Which of the following plants reproduces by using runners?
   a. corn plant  
   b. moss  
   c. strawberry plant  
   d. apple tree  

3. Which of the following is an example of sexual reproduction?
   a. cloning  
   b. budding  
   c. seed production  
   d. vegetative propagation  

4. Which organism can develop from an unfertilized egg?
   a. human  
   b. sheep  
   c. bird  
   d. lizard  

5. Which of the following is an advantage of asexual reproduction?
   a. It depends on finding another organism.  
   b. It promotes variety in a species.  
   c. It is convenient.  
   d. It gives rise to offspring better suited to environmental change.  

6. Where on a flower is pollen made?
   a. stigma  
   b. style  
   c. anther  
   d. pistil  

7. Where on a plant are egg cells produced?
   a. ovary  
   b. pistil  
   c. anther  
   d. filament  

8. When a new plant sprouts from a seed, it is
   a. fertilizing.  
   b. pollinating.  
   c. beginning its asexual phase.  
   d. germinating.
Choose the letter of the best answer.

9. A flower with small, dull petals is most likely pollinated by
   a. birds.               c. bats.
   b. wind.               d. insects.

10. A dandelion seed is dispersed by
    a. clinging to the fur of animals.
    b. water.
    c. wind.
    d. being eaten by animals.

11. What is one of the main differences between a gymnosperm and an angiosperm?
    a. Only angiosperms produce seeds.
    b. Only angiosperms have leaves.
    c. Only angiosperms produce pollen.
    d. Only angiosperms produce fruits.

12. Which insect undergoes complete metamorphosis?
    a. beetle
    b. dragonfly
    c. bed bug
    d. grasshopper

13. Which of the following animals uses external fertilization?
    a. bird               c. bear
    b. frog               d. butterfly

14. Which of the following insects is a nymph at some point in its life cycle?
    a. moth
    b. grasshopper
    c. fly
    d. beetle

15. Which of the following items represents a carrier for the recessive trait?
    a. DD               c. dd
    b. Dd               d. d

16. An instinct is an example of
    a. a learned behavior.
    b. an inherited behavior.
    c. an inherited physical trait.
    d. imprinting.

17. If purple is the dominant gene for flower color, which of the following items represents a white flower?
    a. PP               c. Pp
    b. pp               d. p
The Case for Clean Water

Read the Literature feature in your textbook.

Write About It

Response to Literature  This article tells how to find out if a body of water is clean. Research additional information about the insect larvae mentioned in the article. Write a report about the effects of pollution on these insects. Include facts and details from the article and from your research.

Paragraphs should have a clear topic sentence that directly identifies how pollution affects dragonfly nymphs, midge larvae, caddis fly larvae, mayfly nymphs, and stonefly nymphs. The sentences that follow the topic sentence should support the topic sentence by stating facts and details from the article and from research about how pollution affects each insect larvae. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will stay on topic, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from facts and details about one insect larvae to facts and details about the next insect larvae.
Interactions in Ecosystems

Complete the concept map about relationships within ecosystems.

Limiting Factors

- Food
- Soil
- Shelter

such as

- Space
- Water
- Temperature

Carrying Capacity

determine the

Ecosystem

which is made up of

Communities of Organisms

in which are found

- Producers
- Consumers
- Decomposers
Energy Flow in Ecosystems

Use your textbook to help you fill in the blanks.

What is an ecosystem?

1. The living things in an environment are __________ biotic factors.

2. The nonliving things in an environment are __________ abiotic factors.

3. All the living and nonliving things interacting in an environment make up a(n) __________ ecosystem.

4. All the members of a species within an ecosystem are a(n) __________ population.

5. Together, the populations in an ecosystem form a(n) __________ community.

How are food chains alike?

6. The path that energy takes in an ecosystem as it flows from organism to organism is a(n) __________ food chain.

7. At the base of each food chain are __________ producers that use the Sun's energy to make sugar and oxygen during __________ photosynthesis.

8. The sugars provide food for __________ consumers, or plant-eating animals.
9. Organisms in an ecosystem that break down dead or decaying plants and animals are __________ decomposers ________.

10. Animals such as vultures and raccoons are __________ scavengers ________ that eat dead bodies after they have started to rot.

What are food webs made of?

11. A network of food chains that share some links is a(n) __________ food web ________.

How do energy pyramids compare?

12. A diagram that shows the energy that is available at each level of an ecosystem is a(n) __________ energy pyramid ________.

13. At each level of an energy pyramid, about __________ 90 percent of the energy from the level below is lost.

How does change affect a food web?

14. Removing a species from a food web can throw an ecosystem out of __________ balance ________.

Critical Thinking

15. What would happen if producers were removed from an ecosystem?

Producers are the plants at the base of each food chain. They make food for all other organisms in an ecosystem. Without producers, none of the consumers would have food, and the ecosystem would collapse.
Energy Flow in Ecosystems

Who am I? What am I?

Choose a word from the word box that answers each question.

<table>
<thead>
<tr>
<th>a. community</th>
<th>b. ecosystem</th>
<th>c. energy pyramid</th>
<th>d. food chain</th>
<th>e. food web</th>
<th>f. population</th>
<th>g. predator</th>
<th>h. prey</th>
</tr>
</thead>
</table>

1. _____ a I include all living things in an ecosystem. What am I?

2. _____ c I am a diagram that shows the amount of energy available at each level of an ecosystem. What am I?

3. _____ e I am a network of food chains that are connected. What am I?

4. _____ g I am an animal that hunts other animals for food. Who am I?

5. _____ b I include all living and nonliving things in an environment. What am I?

6. _____ h Predators hunt me for food. Who am I?

7. _____ f All the members of a single species in an ecosystem are part of me. What am I?

8. _____ d I am the path that energy takes as it moves from one organism to another in an ecosystem. What am I?
Energy Flow in Ecosystems

Fill in the blanks.

| carnivores | food chain | herbivores | plants  |
| community  | food web   | omnivores  | population |

All the living and nonliving things in an environment make up an ecosystem. Within an ecosystem, all living things make up a community. All individuals of one species are a(n) population. An ecosystem can be as large as a forest or as small as a fallen log.

The path that energy takes as it moves from one organism to another in an ecosystem is a(n) food chain. A group of connected food chains is a(n) food web. Producers, such as plants and algae, are at the base of each food chain. Consumers include herbivores that eat plants and carnivores that eat other animals. Animals that eat both plants and animals are omnivores. The amount of energy available at each level in an ecosystem is shown by an energy pyramid.
Two Desert Creatures

Write About It
Choose two other organisms that share a predator/prey relationship. Write a fictional narrative in which these two organisms are in a conflict.

Getting Ideas
Select two other animals. Think about these questions: What is the problem? What happens between them? Then use the sequence chart below to plan your story.

Planning and Organizing
Andy wanted to write about a red-tailed hawk and a muskrat. Here are three sentences that he wrote. Write 1 by the event that happens first. Write 2 by the event that happens second. Write 3 by the event that happens last.

First
The hawk spies a muskrat coming out of its burrow.

Next
The muskrat tries to escape by jumping in the water and swimming away.

Last
The hawk swoops down and catches the muskrat.

Sample answer below.

The muskrat tries to escape by jumping in the water and swimming away. The hawk spied a large muskrat coming out of its burrow by the bank of the river. Seeing the hawk, the muskrat jumped in the water and tried to paddle away.
Drafting
Write a sentence to begin your fictional narrative. Introduce the predator. Tell where the story takes place. Tell what the problem is.

Students’ sentences will vary. Sample sentence: Hungry, hungry, hungry, the red-tailed hawk flew over the marshes searching for food.

Now write your fictional narrative. Use a separate piece of paper. Begin with the sentence you wrote above. Explain the conflict, or problem, between the predator and prey, and show how it is resolved. Tell these events in time order. Include dialogue to bring your characters to life.

Revising and Proofreading
Here are two sentences that Andy wrote. Each sentence is missing two punctuation marks. Rewrite them, adding punctuation marks where needed.

1. “Don’t be afraid little muskrat, shouted the hawk, I just want to be your friend.”
   “Don’t be afraid little muskrat,” shouted the hawk, “I just want to be your friend.”

2. As the hawks powerful wings and large body threw a shadow over the land the muskrat looked up in fear.
   As the hawk’s powerful wings and large body threw a shadow over the land, the muskrat looked up in fear.

Now revise and proofread your writing. Ask yourself:
- Did I include details that bring my characters to life?
- Did I present a reasonable conflict and show how it was resolved?
- Did I correct all mistakes in grammar, spelling, capitalization, and punctuation?
Relationships in Ecosystems

Use your textbook to help you fill in the blanks.

Why do organisms compete?

1. The struggle for resources among organisms in an ecosystem is called ___________.

2. Any resource that restricts the growth of populations in an ecosystem is a(n) ___________.

3. The size of the population that an area can support is its ___________.

How do organisms avoid competition?

4. An organism’s ___________ is the place in which it lives and hunts for food.

5. The specific role that an organism plays within a community is that organism’s ___________.

How do organisms benefit from interactions?

6. The reliance of organisms on one another for survival is known as ___________.

7. A relationship between organisms that lasts over time is ___________.

8. A symbiotic relationship in which both organisms benefit is ___________.

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Chapter 3 • Interactions in Ecosystems
Reading and Writing
9. One example of this relationship is the _______ lichen _______, which is formed by a(n) _______ fungus _______ and an alga that live together.

10. A symbiotic relationship in which one organism benefits and the other is not harmed is _______ commensalism _______.

11. One example of this type of relationship is the growth of _______ barnacles _______ on the backs of whales; in this situation, no harm comes to the whales.

What are parasites?

12. A symbiotic relationship in which one organism benefits while the other is harmed is _______ parasitism _______.

13. In this type of relationship, a(n) _______ parasite _______ benefits by living in or on a(n) _______ host _______.

14. Some parasites cause serious problems, giving people _______ diseases/illnesses _______ such as dysentery.

Critical Thinking

15. What keeps populations in a community from increasing constantly?

Two major controls on population increase are competition and limiting factors. Species must compete for limited resources. Various limiting factors, such as the amount of food and shelter in an ecosystem, restrict the size of each population that an ecosystem can support, or the ecosystem’s carrying capacity.
Relationships in Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>a. carrying capacity</th>
<th>d. limiting factor</th>
<th>g. parasitism</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. commensalism</td>
<td>e. mutualism</td>
<td>h. symbiosis</td>
</tr>
<tr>
<td>c. habitat</td>
<td>f. niche</td>
<td></td>
</tr>
</tbody>
</table>

1. The particular role that an organism plays in a community is its ____c____.

2. When two organisms benefit in a symbiotic relationship, the relationship is called ____e____.

3. The place in which an organism lives and hunts for food is its ____c____.

4. Water is a(n) ____d____ that restricts the growth of populations in an ecosystem.

5. A relationship in which one organism benefits and the other is not harmed is ____b____.

6. Because each area has a certain ____a____, it can support only a limited population.

7. A symbiotic relationship in which one organism benefits while the other is harmed is ____g____.

8. A special relationship between organisms that lasts a long time is ____h____.
Relationships in Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>carrying capacity</th>
<th>host</th>
</tr>
</thead>
<tbody>
<tr>
<td>commensalism</td>
<td>parasitism</td>
</tr>
<tr>
<td>compete</td>
<td>symbiosis</td>
</tr>
<tr>
<td>exceeds</td>
<td>vegetation</td>
</tr>
</tbody>
</table>

Each ecosystem has certain limiting factors that restrict the size of its populations. These include water, temperature, soil types, and the amount of vegetation available for food. The population that any area can support is its carrying capacity. When the population of an area exceeds its carrying capacity, some plants or animals begin to die off.

Living things compete for resources in an ecosystem. However, symbiosis limits competition as organisms develop relationships that allow them to live together. A symbiotic relationship that benefits only one organism but does no harm to the other is known as commensalism. In parasitism, a parasite harms the host organism it lives on or in. In the relationship called mutualism, both organisms benefit.
Adaptation and Survival

Use your textbook to help you fill in the blanks.

What is adaptation?

1. A characteristic that helps an organism survive in its natural environment is a(n) ______ adaptation.

2. Organisms that are best adapted to their environment ______ reproduce and pass on their traits to offspring.

3. A physical structure that helps an organism survive in its environment, such as the ______ color of an animal’s fur, is a(n) ______ structural adaptation.

4. A characteristic that is an organism’s response to its environment is a(n) ______ behavioral adaptation.

What are some plant adaptations?

5. Some plants have adapted to ______ desert/dry environments by developing thick, waxy stems to prevent water loss.

6. Plants that are common in cold climates often have ______ shortened growing periods.

7. Some plants produce bad-tasting chemicals that make them unattractive to ______ herbivores/plant-eating animals that might eat them.
What are some animal adaptations?

8. To keep warm in cold climates, animals have ____________ thicker fur.

9. In hot deserts, animals are often more active at ____________ night, when temperatures drop.

10. Any color, shape, or pattern that lets an organism blend into its environment is ____________ camouflaje.

11. A type of camouflage in which an organism’s coloring helps it blend in with its background is ____________ protective coloring.

12. When an organism matches the color, shape, and texture of the environment around it, it is showing protective ____________ resemblance.

What is mimicry?

13. An adaptation in which an organism gets protection from predators by looking like a dangerous animal is ____________ mimicry.

14. Predators also use this characteristic to fool ____________ prey; believing that the predators are harmless, prey come close enough to be caught.

Critical Thinking

15. How do adaptations help an organism survive in its environment?

Adaptations increase an organism’s ability to get food and water, withstand difficult climate conditions, find shelter, and hide from predators. All of these help organisms, and species, survive.
Adaptation and Survival

Use the clues below to help you find the words hidden in the puzzle.

1. An organism that matches the color, shape, and texture of its environment is using protective ____________.

2. A type of coloring, shape, or pattern that allows an organism to blend in with its environment is ____________.

3. Any characteristic that helps an organism survive in a certain environment is a(n) ____________.

4. An adaptation in which an animal is protected against predators by its resemblance to an unpleasant or dangerous animal is ____________.

5. A type of camouflage in which the color of an animal blends in with the animal’s background is protective ____________.
Adaptation and Survival

Fill in the blanks.

- cactus
- camouflage
- mimicry
- poisons
- prey
- seasons
- streamlined
- water

Both plants and animals have adaptations that help them survive in their environments. For example, plants such as the ___________ have thick, waxy stems that conserve ___________ in environments that are hot and dry. Plants in cold climates have shortened growing ___________. Ocean animals are more ___________ than land animals so that they can swim faster.

Some adaptations developed because of predator-___________ relationships. Plants, such as milkweed, contain ___________ that make predators avoid them. Prey can use ___________ to blend in with their environments. Some animals also demonstrate ___________, the ability to look like another animal that a predator finds unpleasant. For example, some predators stay away from the viceroy butterfly because it mimics the bad-tasting monarch butterfly.
Meet Caroline Chaboo

Read the Reading in Science feature in your textbook.

Look at the chart below. In each row, read the information in the two “What I Know” columns. Use it to infer something that is not directly stated in the text. Write that statement in the “What I Infer” column.

<table>
<thead>
<tr>
<th>Clues</th>
<th>What I Know</th>
<th>What I Infer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Sabal palm stands up to high winds, drought, and driving rain in the Caribbean region.</td>
<td>The Sabal palm is well adapted for the Caribbean region.</td>
<td>The Sabal palm is a common tree in the Caribbean.</td>
</tr>
<tr>
<td>2. The tortoise beetle harms Sabal palm trees in regions where it lives.</td>
<td>The tortoise beetle lives in the Dominican Republic.</td>
<td>The tortoise beetle is a problem for Sabal palms in the Dominican Republic.</td>
</tr>
<tr>
<td>3. The tortoise beetle weakens the Sabal palm, but does not kill it.</td>
<td>Caroline Chaboo studies plants, such as the Sabal palm, to discover whether they have adapted natural protection against insect pests.</td>
<td>Caroline Chaboo may find something in the Sabal palm one day that helps protect many plants against insect pests.</td>
</tr>
</tbody>
</table>
Write About It

Infer  Read the “Write About It” questions carefully. Use the text within “Meet Caroline Chaboo” to write your answers.

Using Ideas to Infer

To answer Question #1, first determine how a natural pesticide inside the Sabal palm would help the tree.

It would help protect the palm from insect pests.

Then, write your answer to the question:

How might a natural pesticide in the Sabal palm help other organisms?

It would help scientists make a substance that could protect other plants from pests, especially those without natural protections of their own.

Planning and Organizing

Imagine that you have been told to research tortoise beetles to find out what other plants they eat.

In order to conduct this research, first list the types of sources that would contain this information.

a. Internet websites

b. encyclopedias

c. books on insects

Then, list key words you could use to look up the information in these sources.

a. “tortoise beetle”

b. “tortoise beetle” and “plants”
Interactions in Ecosystems

Choose the letter of the best answer.

1. All the living and nonliving things in an environment make up a(n)
   a. community.
   b. ecosystem.
   c. population.
   d. species.

2. The path that energy takes in an ecosystem as it moves from one organism to another is a(n)
   a. producer chain.
   b. energy pyramid.
   c. food chain.
   d. energy web.

3. Which animal hunts other animals for food?
   a. predator
   b. producer
   c. prey
   d. herbivore

4. A diagram that shows the amount of energy available at each level of an ecosystem is a(n)
   a. energy pyramid.
   b. food web.
   c. food chain.
   d. ecosystem diagram.

5. All of the members of one species in an ecosystem are a(n)
   a. community.
   b. food chain.
   c. environment.
   d. population.

6. Which type of resource restricts population growth within an ecosystem?
   a. biotic factor
   b. limiting factor
   c. capacity factor
   d. energy factor

7. The measure of the size of a population and the area that can support it is
   a. limiting factor.
   b. ecosystem limit.
   c. carrying capacity.
   d. community.

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Chapter 3 • Interactions in Ecosystems
Reading and Writing
Choose the letter of the best answer.

8. A type of symbiosis in which both organisms benefit is
   a. commensalism.
   b. parasitism.
   c. predatorism.
   d. mutualism.

9. A type of symbiosis in which one organism benefits and the other is not harmed is
   a. commensalism.
   b. parasitism.
   c. predatorism.
   d. mutualism.

10. What is the name of the physical place in which an organism lives and hunts for food?
    a. habitat
    b. niche
    c. host
    d. community

11. Any characteristic that helps an organism survive in its environment is a(n)
    a. niche.
    b. mimicry.
    c. adaptation.
    d. abiotic factor.

12. A color, shape, or pattern that allows an organism to blend in with its environment is called
    a. mimicry.
    b. symbiosis.
    c. mutualism.
    d. camouflage.

13. A type of camouflage in which the color of an animal blends with its background is
    a. protective resemblance.
    b. commensalism.
    c. protective coloration.
    d. adaptive coloring.

14. An adaptation in which an animal is protected by its resemblance to an unpleasant animal that predators avoid is called
    a. camouflage.
    b. symbiosis.
    c. mimicry.
    d. parasitism.

15. What word refers to the special role that an organism plays in a community?
    a. symbiosis
    b. niche
    c. habitat
    d. mutualism
Ecosystems and Biomes

Complete the concept map with information you learned about ecosystems and biomes.

Land Ecosystems (biomes)
- Deciduous Forest
- Tropical Rain Forest
- Tundra
- Taiga

Ecosystems
- Desert
- Grassland

Water Ecosystems
- Running Water
- Oceanic Zone
- Standing Water
- Neritic Zone
- Wetlands
- Intertidal Zone

Freshwater Ecosystems
- Saltwater Ecosystems
Cycles in Ecosystems

Use your textbook to help you fill in the blanks.

What is the water cycle?

1. The constant movement of water as a liquid and a gas between Earth's air and its surface is the water cycle. The energy for the water cycle comes from the Sun.

2. Solar energy causes water on Earth's surface to change to gas and rise into the atmosphere during the process of evaporation.

3. As gaseous water rises and cools, it turns into droplets of liquid water during the process of condensation.

4. Water droplets may fall from the atmosphere back to Earth's surface as precipitation, such as rain and snow.

5. Some water soaks into the ground and collects in pores in soil and rock to become groundwater.

6. Plants take water from the soil and return it to the air through their leaves during transpiration.

What is the carbon cycle?

7. The constant exchange of carbon among Earth's living organisms is the carbon cycle.

8. During photosynthesis, plants take carbon dioxide from the air and use it to make food that other living things use.
9. Animals and plants burn carbon-rich foods during cellular respiration, and then release carbon dioxide to the atmosphere.

10. Fossils fuels, which form from the decayed remains of living things, release the carbon in them when they are burned.

What is the nitrogen cycle?

11. Although most of Earth’s atmosphere is nitrogen, the gas must first be fixed so that it is in a form that most living things can use.

12. Nitrogen can be fixed by volcanic action, by lightning, and by nitrogen-fixing bacteria.

13. Plants use nitrogen to make proteins, which get into the bodies of animals when they eat plants or plant-eating animals.

14. Nitrogen returns to the soil in the waste of animals, and when plants and animals decay.

How is matter recycled?

15. People can reduce their use of natural resources through recycling.

Critical Thinking

16. Why is it necessary for water, carbon, nitrogen, and oxygen to be recycled through Earth’s ecosystems?

These substances, which are necessary for all living things, would be used up and become unavailable if Earth’s systems did not recycle them.
Cycles in Ecosystems

What am I?

Choose a word from the word box below that answers each question.

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>carbon cycle</td>
<td>d</td>
<td>evaporation</td>
<td>g</td>
<td>precipitation</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>compost</td>
<td>e</td>
<td>groundwater</td>
<td>h</td>
<td>runoff</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>condensation</td>
<td>f</td>
<td>nitrogen cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. _____ **c** I am the changing of a gas into a liquid as the gas cools. What am I?
2. _____ **f** I am the continuous changing of nitrogen gas into compounds in the soil and its later release back to the air. What am I?
3. _____ **h** I am precipitation that flows over the land’s surface into rivers and lakes and is not absorbed into the ground. What am I?
4. _____ **b** I am a mixture of decayed plant and animal material that can be used as fertilizer. What am I?
5. _____ **a** I am the continuous exchange of carbon among living things. What am I?
6. _____ **d** I am the changing of a liquid into a gas. What am I?
7. _____ **e** I am water that sinks beneath the ground and collects in tiny holes in soil and rock. What am I?
8. _____ **g** I fall to Earth’s surface as rain, snow, sleet, or hail. What am I?
Cycles in Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>atmosphere</th>
<th>fixation</th>
<th>runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>decomposers</td>
<td>nitrates</td>
<td></td>
</tr>
<tr>
<td>evaporation</td>
<td>precipitation</td>
<td></td>
</tr>
</tbody>
</table>

The Sun provides energy for the water cycle. Heat causes water to rise from Earth’s surface as a gas through a process called **evaporation**. Water then condenses in the atmosphere and falls, as **precipitation**, into oceans and the ground, or over land as **runoff**.

In the carbon cycle, plants use carbon dioxide to make food. Carbon dioxide is released back into the **atmosphere** when living things use this food. Organisms called **decomposers** release carbon dioxide when they break down dead organisms.

Nitrogen **fixation** places nitrogen in a form in which it can be used by most living organisms. Plants use nitrogen in the form of **nitrates**. Other organisms get nitrogen from plants and return it to the soil through their wastes.
Changes in Ecosystems

Use your textbook to help you fill in the blanks.

How can ecosystems change?

1. Ecosystems are changed by living organisms that change the environment around them, and by natural events such as floods.

2. Humans can change or destroy the habitats of organisms when they cut forests to build homes.

What happens when ecosystems change?

3. Some organisms respond to changes in ecosystems by adapting or migrating to another place.

4. When a type of organism cannot respond to changes in an ecosystem, it may become extinct.

5. When a species is in danger of extinction, it is called an endangered species.

6. Species that could become endangered because of their low populations are known as threatened species. The biggest threat to a species is the loss of habitat.

How do ecosystems come back?

7. Over time, one group of species in an ecosystem is replaced by a different group of species through a process called succession.
8. In a region where few if any species existed before or where previous species were wiped out, **primary succession** occurs.

9. The first species to take hold in barren areas are **pioneer** species, such as mosses and lichens.

10. As larger plants and predators begin to live in an area, the community may become a(n) **grassland**, such as a prairie.

11. With enough moisture, **trees** may start to grow in a grassland.

12. In time, a fully developed ecosystem will support a(n) **climax** community, which is the final stage of succession.

**What is secondary succession?**

13. When a new community develops where a community had once existed, it is called **secondary** succession.

14. Secondary succession might occur in a forest that has been burned by a(n) **fire** or at an abandoned farm.

**Critical Thinking**

15. A volcano erupts and lava flows over what had once been a fertile farm field. Describe the type of succession that will occur, and explain why.

   Primary succession will occur because the lava will become barren rock. New soil will form, and plant and animal populations will become established.
## Changes in Ecosystems

Match the correct letter with the description.

| a. climax community | e. pioneer species |
| b. endangered species | f. primary succession |
| c. extinct | g. secondary succession |
| d. pioneer community | h. succession |

1. Establishment of the first living community to develop in an area that used to be lifeless is called _______.
2. When a species dies out completely, the species is _______.
3. The establishment of a new community where a community had already existed is called _______.
4. The process of one ecosystem gradually changing into a different type of ecosystem is called _______.
5. A species that is in danger of becoming extinct is a(n) _______.
6. In the final stages of succession, a(n) _______ develops.
7. One of the first species to live in an area that used to be lifeless is a(n) _______.
8. Succession that occurs where there is no soil and where few, if any, living things exist is _______.
Changes in Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>animal</th>
<th>plants</th>
<th>species</th>
</tr>
</thead>
<tbody>
<tr>
<td>habitat</td>
<td>primary succession</td>
<td>trees</td>
</tr>
<tr>
<td>pioneer</td>
<td>secondary succession</td>
<td></td>
</tr>
</tbody>
</table>

Ecosystems change over time. People cause some of the changes, through pollution, _______ habitat _______ destruction, or hunting, or by introducing or removing _______ species _______.

However, many ecosystem changes are natural. When land is burned by a fire or a farm field is abandoned, _______ secondary succession _______ occurs. New _______ plants _______ begin to grow in the soil. Weeds, then shrubs, and finally _______ trees _______ grow. When few, if any, living things exist in an area, _______ primary succession _______ will establish a first community. The first organisms to live in the area are called _______ pioneer _______ species. After soil is established, larger plants can grow and larger _______ animal _______ species can arrive. Eventually, forests develop. Finally, in the last stage of succession, a climax community is established.
Biomes

Use your textbook to help you fill in the blanks.

What are biomes?

1. Each of Earth’s major land ecosystems is a(n) ___________ biome. Each biome has its own specific animals, plants, soil, and ___________ climate.

2. A sandy or rocky biome with a dry climate is a(n) ___________ desert. Some organisms have ___________ adaptations that allow them to survive in dry regions.

What are some harsh biomes?

3. The ground in the ___________ tundra stays frozen all year. Trees cannot grow where this layer of constantly frozen ground called ___________ permafrost exists.

4. Some grasses, ___________ mosses, and ___________ lichens grow in the tundra.

5. Although few animals live in the tundra, ___________ polar bears, caribou, and Arctic ___________ hares or foxes do make their homes there.

6. The ___________ taiga is a cool, forest biome just south of the tundra.

7. The dominant type of vegetation in the taiga biome is ___________ conifera/evergreen trees.

8. Many of the animals in the taiga have thick ___________ coats or fur and layers of fat to protect them from cold weather.
What are some forest biomes?

9. A hot biome near the equator that has lots of rain and more plants and animals than any other biome is the _____ tropical rain forest _____.

10. This biome has four ____ layers ___, with different plants and animals in each one.

11. The _____ temperate _____ rain forest biome has lots of rain and a cooler climate than tropical forests.

12. The _____ deciduous forest _____ is a forest biome with four seasons and trees that lose their leaves in autumn.

13. Winter in the deciduous forest can be cold, and many animals hibernate, _____ migrate, or move _____ to warmer climates.

What are grasslands?

14. The _____ grassland _____ is a biome where grasses, not trees, are the main type of plant life. In North America, the _____ prairie _____ is a large area of grassland.

15. The grassland biome is wetter than that of a desert but does not have enough precipitation to support many _____ trees _____.

Critical Thinking

16. Why is climate important in determining biomes?

   Climate, which includes the temperature and precipitation common to a region, largely determines the types of plants that will grow. The plants then affect the types of animals that can live in the area.
Biomes

Use the clues below to help you fill in the blanks.

<table>
<thead>
<tr>
<th>biome</th>
<th>desert</th>
<th>taiga</th>
<th>tropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>deciduous</td>
<td>grassland</td>
<td>temperate</td>
<td>tundra</td>
</tr>
</tbody>
</table>

1. The _______ **tundra** _______ is a large, treeless biome where the ground is frozen all year.

2. A very rainy biome called the _______ **temperate** _______ rain forest is dominated by evergreen trees and has mild winters and cool summers.

3. Any of Earth’s major land ecosystems with its own typical plants, soil, and climate is a(n) _______ **biome** _______.

4. The _______ **taiga** _______ is a cool, northern forest biome dominated by conifers.

5. The _______ **deciduous** _______ forest, a forest biome with four distinct seasons, has trees that lose their leaves each year in autumn.

6. The _______ **desert** _______ is a sandy or rocky biome that has little precipitation and limited plant life.

7. With few trees, the _______ **grassland** _______ is a biome in which the main form of vegetation is grass.

8. The _______ **tropical** _______ rain forest is a hot, humid biome near the equator, that has abundant rainfall and a wide variety of life.
Earth has several major land ecosystems called biomes. Each of these has its own typical animals, plants, soil, and ______ climate. The ______ biome is hot and ______ all the time and has more types of plants and animals than any other biome. There are also ______ rain forests, which are rainy, but have a cooler climate than tropical forests. In the ______ biome, deciduous trees dominate. These are ______ trees that lose their leaves each autumn. North of this biome is the ______, with its cold, snowy climate and forests of conifers.

The coldest, harshest biome is the tundra, which is a treeless area with a layer of ______ under the surface. Another largely treeless biome is the ______, where grasses are the main type of plant life. The desert biome is sandy or rocky, with little precipitation or plant life.
Did You Know That Forests Breathe?

Read the passage titled “A Year in the Life of a Forest” in your textbook. The passage about the Howland Forest of Maine contains five paragraphs. In the blanks provided in the graphic organizer, write a sentence that summarizes the main idea of the first three paragraphs, followed by two sentences that contain supporting details. Use your own words. The first item has been done for you.

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paragraph 1 Main Idea: Scientists measure gas levels in forests throughout the year.</td>
<td>Howland Forest is a deciduous forest in Maine. The change in seasons affects the levels or carbon dioxide there.</td>
</tr>
<tr>
<td>Paragraph 2 Main Idea: During spring, the level of carbon dioxide in the air begins to rise.</td>
<td>In spring, activity increases among organisms. The increase in activity causes an increase in respiration.</td>
</tr>
<tr>
<td>Paragraph 3 Main Idea: During the summer, daytime carbon dioxide levels are low, but at night they are high.</td>
<td>During the day, trees turn carbon dioxide into food. At night, all of the life forms respire, releasing carbon dioxide into the air.</td>
</tr>
</tbody>
</table>
Write About It

Main Idea and Details 1. Tell how the levels of carbon dioxide change in the Howland Forest throughout the year.
2. Research other biomes, and explain how they change during the year.

Now, use the information in your graphic organizer to write a paragraph telling how the levels of carbon dioxide change in the Howland Forest throughout the year.

Howland Forest is a deciduous forest in Maine. Scientists measure gas levels in forests throughout the year. In spring, as activity levels of organisms increase, so does the rate of respiration, causing carbon dioxide levels to rise. Organisms are most active during summer. Carbon dioxide levels are low during the day when trees are processing carbon dioxide for food, but high at night when organisms are respiring. In fall, day and night carbon dioxide levels become more alike as trees lose leaves and organisms become less active. In winter, carbon dioxide levels are low and constant from day to night because photosynthesis cannot take place in leafless trees.

Next, you will be conducting research about the yearly changes to another biome.

1. What biome do you choose to research? ________________  
   Answers will vary.

2. What types of organisms live in this biome? ________________  
   Answers will vary.

3. What changes can be observed in this biome as the seasons change? ________________  
   Answers will vary.

4. Compare your biome research with that of the students seated closest to you. Why do seasonal changes in the different biomes vary? Give your opinion.
   Answers will vary, but a correct response will mention latitude.
Water Ecosystems

Use your textbook to help you fill in the blanks.

**What are water ecosystems?**

1. There are freshwater ecosystems and _______ saltwater _______ ecosystems.

2. Organisms that drift in the water are called _______ plankton _______. Active swimmers such as fish are called _______ nekton _______.

3. The creatures that live in the deepest part of a body of water are the _______ benthos _______. Many bottom-living creatures are scavengers or _______ decomposers _______.

4. Producers, which live at or near the surface, release the _______ oxygen _______ that allows most other water organisms to live in surface waters.

**What are freshwater ecosystems?**

5. Organisms in running-water ecosystems are adapted to how _______ fast _______ the water flows.

6. In standing-water ecosystems, such as lakes, most organisms live in the shallow water of the _______ shore _______ zone.

7. Many nekton live in the _______ open-water _______ zone, which is away from the shore.

8. Benthos, including worms and mollusks, live in the _______ bottom _______ zone beneath the open-water zone.
What are ocean ecosystems?

9. Organisms of the shallow _______ intertidal _______ zone are covered and uncovered each day by the rise and fall of tides.

10. Sunlight allows producers and the animals that depend on them to live in the _______ neritic _______ zone.

11. Large organisms live near the surface in the top part of the _______ oceanic _______ zone, which is called the bathyal zone.

12. Few creatures can live in the cold, dark waters at the bottom of the oceanic zone, which is called the _______ abyssal _______ zone.

Where do salt and fresh water meet?

13. The place where a river empties into the ocean is called a(n) _______ estuary _______. Some low areas around estuaries are permanent salt marshes or marshes.

14. When the tide comes in, an estuary’s waters are mostly _______ salty _______, but the waters are mostly _______ fresh _______ when the tide goes out.

15. Wetlands protect coastal regions during _______ storms _______ by soaking up excess water.

Critical Thinking

16. How is sunlight a limiting factor in water ecosystems?
   Most producers in water ecosystems depend on sunlight and thrive in sunlit waters. Because producers are the base of food chains, more organisms can live in these sunlit areas.
Water Ecosystems

Match the correct letter with the description and fill in the crossword puzzle.

Across
4. Place where organisms are covered and uncovered daily by the waters of changing tides
5. The larger, active swimmers in a body of water

Down
1. Creatures that drift freely in the water
2. The shallow water in standing-water ecosystems
3. Organisms that live in the deepest part of a body of water
Water Ecosystems
Fill in the blanks.

<table>
<thead>
<tr>
<th>benthos</th>
<th>nekton</th>
<th>oceanic</th>
<th>tides</th>
</tr>
</thead>
<tbody>
<tr>
<td>intertidal</td>
<td>neritic</td>
<td>running-water</td>
<td>upper</td>
</tr>
</tbody>
</table>

Water ecosystems have many forms of life. Organisms in water ecosystems are classified as plankton that float in the water; nekton that are large, free swimmers; and benthos that live in the deepest part of the water. In general, more organisms live in the upper layers of the water.

Organisms such as kelp, fish, and whales live in the ocean’s neritic zone. Sharks, squid, and octopi live in the upper part of the ocean’s oceanic zone (few animals live in the lower part of this zone).

Freshwater ecosystems are divided into running-water bodies, standing-water bodies, and wetlands ecosystems.

Organisms of the ocean’s (saltwater) intertidal zone must be adapted to rise and fall of tides. Organisms that live in estuaries are adapted to survive in both fresh and salty waters.
Keep Our Water Clean

Write About It
Write a letter to the mayor of your town. Explain a need that the students in your community have and why people should help. State your opinion clearly and support it with relevant facts and evidence organized in a logical way.

Getting Ideas
Think of an issue that clearly affects life in your community. Form an opinion about it. Write this opinion in the top box in the chart below. Then jot down reasons that support this opinion in the bottom boxes. Students’ answers will vary. Below is a sample answer.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Reason</th>
<th>Reason</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep power boats off the lake.</td>
<td>Power boats pollute the water.</td>
<td>Power boats kill fish and other water life.</td>
<td>Power boats destroy the peace and quiet of the lake.</td>
</tr>
</tbody>
</table>

Planning and Organizing
Kristin’s opinion is that the town should ban power boats from the lake. Here are three statements she wrote. Write Yes if the statement supports her opinion. Write No if it does not.

1. Yes  Power boats can pollute the water.
2. No   Power boats are a fun way to spend time on the lake.
3. Yes  Power boats kill fish and other water life.
Drafting
Write a statement to begin your letter. Make sure it clearly tells the issue you are concerned about and states your opinion.

Students’ sentences will vary. Sample sentence: Since my friends and I use our town lake for recreation, we feel that power boats should be banned from it.

Now write your letter to the mayor on a separate piece of paper. Use the form of a business letter. Start the body of your letter with the sentence you wrote above. Include reasons that will persuade the mayor to support your opinion. End by stating what you think should be done. Remember to be polite and respectful.

Revising and Proofreading
Now revise and proofread your writing. Ask yourself:

▶ Did I clearly state my opinion about a need that the students in my community have?
▶ Did I provide relevant reasons to support this opinion?
▶ Did I correct all mistakes in grammar, spelling, capitalization, and punctuation?

Students’ sentences will vary. Sample sentence: Since my friends and I use our town lake for recreation, we feel that power boats should be banned from it.
Ecosystems and Biomes

Choose the letter of the best answer.

1. Which of these is a type of precipitation?
   a. frost
   b. clouds
   c. dew
   d. hail

2. In which natural cycle must an important gas in Earth’s atmosphere be fixed before plants can use it?
   a. sulfur cycle
   b. carbon cycle
   c. nitrogen cycle
   d. oxygen cycle

3. Which of these processes is the changing of water vapor into liquid water?
   a. condensation
   b. infiltration
   c. evaporation
   d. transpiration

4. Which kind of species is in danger of totally disappearing from Earth?
   a. threatened
   b. endangered
   c. extinct
   d. pioneer

5. In the last stage of succession, the plants and animals in an ecosystem form a(n)
   a. pioneer community.
   b. endangered community.
   c. climax community.
   d. primary community.

6. Which type of succession would occur after a fire has burned a forest?
   a. primary succession
   b. tertiary succession
   c. secondary succession
   d. climax succession
Choose the letter of the best answer.

7. Which type of biome has the greatest diversity of plants and animals?
   a. tundra
   b. deciduous forest
   c. desert
   d. tropical rain forest

8. In which cold, northern biome are conifers the main type of plant life?
   a. deciduous forest
   b. tropical rain forest
   c. taiga
   d. tundra

9. In which biome do hardwood trees lose their leaves before the cold winter sets in?
   a. tundra
   b. taiga
   c. deciduous forest
   d. tropical rain forest

10. The cold temperatures and frozen ground prevent the growth of trees in the
    a. taiga.
    b. desert.
    c. tundra.
    d. grasslands.

11. Creatures that drift freely in water ecosystems are called
    a. plankton.
    b. benthos.
    c. nekton.
    d. crustaceans.

12. What are the large, active swimmers, such as fish and whales, in water ecosystems?
    a. mollusks
    b. benthos
    c. plankton
    d. nekton

13. The organisms that live along the bottom of water ecosystems are the
    a. benthos.
    b. nekton.
    c. plankton.
    d. shellfish.
The Many Sides of Diamonds
Read the Literature feature in your textbook.

Write About It
Response to Literature This article describes the formation and use of diamonds. Research additional information about the history of industrial diamonds, how they are formed, and how they are used. Write a report about industrial diamonds. Include facts and details from this article and from your research.

Paragraphs should have a clear topic sentence that directly defines industrial diamonds. The sentences that follow the topic sentence should support the topic sentence by describing facts and details about the history of industrial diamonds, about the formation of industrial diamonds, and about the use of industrial diamonds. Supporting sentences should include researched facts and details as well as facts and details from the article. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will stay on topic, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from one idea to the next.
Our Dynamic Earth

Complete the concept map by filling in answers where blanks appear.

**Forces that Change Earth’s Surface**

- Water, Ice, Wind, and Gravity
- Plate Movements
- Move over hot spots
- Slide or rub past each other
- Pull apart
- Move toward each other

**Weathering**

- Breaks down rock of all landforms.
- Fault-block mountains
- Earthquakes

**Erosion**

- Landslides, mudslides
- Cirques, u-shaped valleys

**Deposition**

- River deltas
- Sandbars, barrier islands

**Concept Map**

- Island chains
- Fault-block mountains
- Earthquakes
Earth’s Landforms

Use your textbook to help you fill in the blanks.

What are landforms?

1. A physical feature on Earth’s surface is a(n) ________ landform ________.
2. The highest of Earth’s physical features are ________ mountains ________.
3. A low area between mountains or hills is a(n) ________ valley ________.
4. Wide, flat areas of land are called ________ plains ________.
5. A large, flat area higher than the land around it is a(n) ________ plateau ________.
6. Earth’s largest bodies of water are its saltwater ________ oceans ________.
7. Natural streams of flowing water that empty into lakes, oceans, or other bodies of water are ________ rivers ________.
8. A body of water with land all around it is a(n) ________ lake ________.

What are the features of the ocean floor?

9. The largest landform under the ocean is an ocean ________ basin ________.
10. Shallow waters cover the ________ continental shelf ________, the gently sloping part of the ocean floor along the coast.
11. The sharp drop from the continental shelf to the continental rise is the ________ continental slope ________.
LESSON Outline

Name ___________________________ Date ____________

12. A wide, flat area covering about 40 percent of the ocean floor is the abyssal plain.

13. The deepest areas of the ocean floor are trenches.

How do we map Earth’s features?

14. Measurements taken by a(n) surveyor are used to make maps.

15. Elevations are shown with shading on a(n) relief map.

16. Lines are used to show elevation and steepness of slopes on a(n) topographical map.

Where are Earth’s layers?

17. The layer of air around Earth is the atmosphere.

18. Earth’s waters make up Earth’s hydrosphere.

19. Earth is made of three main layers: the crust, the mantle, and the core.

20. The part of Earth that is home for living things is the biosphere.

Critical Thinking

21. Compare the mantle and core of the Earth.

Answers will vary. Example: The mantle and core both have layers. The core has a liquid layer while the mantle is made up of hard and soft layers of rock.
Earth’s Landforms

Match the correct word with its description, and fill in the crossword puzzle.

Across
3. ____ a physical feature on Earth’s surface
5. ____ the layer of air that surrounds Earth
6. ____ the central part of Earth

Down
1. ____ formed by Earth’s liquid and solid water
2. ____ the rocky upper layer of Earth that contains continents and ocean basins
3. ____ the crust and the top of the upper mantle form it
4. ____ the layer of Earth’s interior below the crust
Earth’s Landforms

Fill in the blanks.

<table>
<thead>
<tr>
<th>crust</th>
<th>inner core</th>
<th>oceans</th>
</tr>
</thead>
<tbody>
<tr>
<td>elevation</td>
<td>landforms</td>
<td>outer core</td>
</tr>
<tr>
<td>hydrosphere</td>
<td>mantle</td>
<td>surveyor</td>
</tr>
</tbody>
</table>

The physical features of the Earth are part of the Earth’s surface. Earth’s surface has many types of landforms, from high mountains to deep valleys. There are also physical features under Earth’s largest bodies of water, the oceans. These undersea features look like the mountains, valleys, and cliffs on land.

Landforms are measured by a(n) surveyor. One important measurement is elevation, or the height of land above sea level.

Earth has several layers. Earth’s waters are its hydrosphere. The planet itself is divided into the surface crust, the mantle beneath it, and the core at the center. The crust and mantle are rock. Earth’s core is made of metal. The outer core is liquid, and the inner core is solid. The core makes up the central part of the Earth.
Plate Tectonics

Use your textbook to help you fill in the blanks.

Is Earth’s crust moving?

1. Geologist Alfred Wegener formulated the theory of ______ continental drift ______.

2. Wegener’s theory stated that Earth’s ______ continents ______ were once joined in one landmass, but gradually pulled apart and drifted.

3. Wegener’s showed that the age and composition rocks in the ______ mountains ______ on South America’s east coast matched those on Africa’s west coast.

4. Scientists also discovered evidence in ______ fossils ______ that Africa and South America were once joined.

How does the movement of Earth’s crust affect the ocean?

5. Scientists developed the ______ plate tectonics ______ model to explain how the continents have moved over millions of years.

6. Earth’s lithosphere is made of huge pieces of solid rock called ______ plates ______.

7. These solid pieces of rock rest on the hot, soft, slippery rock of Earth’s ______ asthenosphere ______.

8. Melted rock called ______ magma ______ rises up through the crack where plates move apart under the ocean.

9. As the ocean floor spreads at the plate boundary, the ______ continents ______ resting on the plates also move apart.
10. As the ridge grows higher, a(n) ________ rift ________ valley forms along the center of it.

How does the movement of Earth’s plates affect the land?

11. When plates push toward each other, a force called ________ compression ________ results.

12. Because of this force, the ground at the edges of plates is pushed upward to form ________ folded ________ mountains.

13. A mountain range in Asia, the ________ Himalayas ________, began to form in this way millions of years ago.

14. In places where one plate rubs past another, a twisting or tearing force called ________ shear ________ results.

15. This force can cause blocks of crust to break apart along deep cracks in Earth’s crust called ________ faults ________.

16. When rock on one side of a fault moves down and rock on the other side moves up, a ________ fault-block ________ mountain is formed.

17. A California mountain range, the ________ Sierra Nevada ________, is this type of landform.

Critical Thinking

18. Compare how two types of mountains are formed.

Fault-block mountains form when one side of a fault moves down and one side moves up. Folded mountains, on the other hand, are formed when two plates push against each other and both sides of the ground are pushed upward.
# Plate Tectonics

Use the terms in the box below to fill in the blanks.

<table>
<thead>
<tr>
<th>continental drift</th>
<th>mid-ocean ridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>fault-block mountains</td>
<td>plate tectonics</td>
</tr>
<tr>
<td>folded mountains</td>
<td>rift valley</td>
</tr>
<tr>
<td>geologist</td>
<td></td>
</tr>
</tbody>
</table>

1. As hardened magma builds up on both sides of a plate boundary, a(n) **rift valley** forms at the center of a mid-ocean ridge.

2. The force of compression can form **folded mountains** at the point where two plates push together.

3. The theory that states that the continents were once one landmass and that they drifted to their present positions over many years is called **continental drift**.

4. A highland in the middle of the oceans that runs parallel to the continents is called a(n) **mid-ocean ridge**.

5. A scientist who studies Earth’s structure and history is called **geologist**.

6. Shear forces at a fault can form **fault-block mountains**.

7. The model that states that Earth’s surface is composed of large rock plates that fit together like jigsaw puzzle pieces is called **plate tectonics**.
The continents were not always where they are today. About 100 years ago, Alfred Wegener developed the theory of **continental drift**. The theory states that Earth's **continents** were once one landmass. The landmass broke up millions of years ago, and the continents drifted to the positions we know today. Wegener supported his theory with evidence from rocks and **fossils**. Later, scientists developed the theory of **plate tectonics**.

When plates push together, they produce the force of **compression**. This force can push the ground at the boundary upward, forming **folded** mountains. When plates slide past each other, they create **shear**. This force can make huge blocks of crust break apart along faults. Over millions of years, the blocks can shift upward to form fault-block mountains.
Pangea and Other Supercontinents

Write About It
What evidence do scientists have that Rodinia and Pannotia existed? Research this evidence and select a main idea. Write an expository essay with details to support your main idea.

Getting Ideas
Do some research to find out whether Rodinia and Pannotia actually existed. Use the chart below. In the boxes on the top, write details that you find. In the box on the bottom, summarize this information.

Planning and Organizing
Here are two sentences that Mai wrote. Write Yes if the sentence supports the idea that Rodinia and Pannotia actually existed. Write No if it does not.

1. There are common rock types and structural features along the coastlines of continents today. ____Yes____

2. Figuring out how supercontinents formed and broke apart is a lot like detective work. ____No____
Drafting

Write a sentence to begin your essay. This sentence should tell your main idea about Rodinia and Pannotia.

Students’ sentences will vary.

Review the evidence you found and your summary. Now write the first draft of your essay. Use a separate piece of paper. Include facts and details that back up your main idea. Draw a conclusion at the end.

Revising and Proofreading

Help Mai revise her writing. Use the word but to combine each pair of sentences. Put a comma before this word. Write the new sentence on the lines.

1. Pangea was a supercontinent. It was not the earliest supercontinent.
   
   Pangea was a supercontinent, but it was not the earliest supercontinent.

2. Rodinia and Pannotia were both supercontinents. They were formed at different times.

   Rodinia and Pannotia were both supercontinents, but they were formed at different times.

Now revise and proofread your writing. Ask yourself:

▶ Did I clearly state my main idea?
▶ Did I include facts and details to back up my idea?
▶ Did I reach a sound conclusion at the end?
▶ Did I correct all mistakes?
Volcanoes

Use your textbook to help you fill in the blanks.

Where are volcanoes found?

1. Most of Earth’s volcanoes are located at edges of _______ plates _______.

2. A string of volcanoes at plate boundaries around the Pacific Ocean is known as the __________ Ring of Fire _______.

3. Volcanoes often erupt at places where one plate _______ dives under _______ the other.

4. The bottom edge of the diving plate melts in the heat of the _______ mantle _______.

5. The melted rock rises within the crust, forming a hot pool of _______ magma _______.

6. The hot rock sometimes erupts through openings in Earth’s surface as a(n) _______ volcano _______.

How do volcanoes build land?

7. When magma hardens inside Earth’s crust, it can form vertical _______ dikes _______ and horizontal sills.

8. Magma pushed into a thick sill can form a(n) _______ laccolith _______.

9. The largest underground magma formations are _______ batholiths _______, which can form large hills.

10. Magma that reaches Earth’s surface is _______ lava _______.

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11. A volcano that is _______active______ can erupt with lava, ash, gas, or rock.

12. When a volcano stays quiet for a time, it is _______dormant________.

13. A volcano that no longer erupts is _______extinct______ or dead.

**How do volcanoes build islands?**

14. The Hawaiian Islands formed over a stationary pool of magma below Earth’s crust called a(n) _______hot spot________.

15. When the mountains grew high enough to break the ocean’s surface, they became volcanic _______islands______.

16. As the plate moved slowly from southeast to northwest, the Hawaiian Island _______chain________ formed.

17. Where two ocean plates meet and one is pushed under the other, an island _______arc________ may form.

18. Magma from edge of the lower plate rises and builds volcanic islands along the plate _______boundary______.

19. An example of an island arc is the _______Aleutian Islands________ in Alaska.

**Critical Thinking**

20. Why do volcanoes form when one plate dives under another?

   When one plate dives under another and reaches the mantle, the rock melts and forms magma. Magma can rise through cracks in the crust and form volcanoes.
Volcanoes

Match the correct letter with the description.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>cinder-cone volcano</td>
<td>f.</td>
<td>island chain</td>
</tr>
<tr>
<td>b.</td>
<td>composite volcano</td>
<td>g.</td>
<td>lava</td>
</tr>
<tr>
<td>c.</td>
<td>crater</td>
<td>h.</td>
<td>shield volcano</td>
</tr>
<tr>
<td>d.</td>
<td>hot spot</td>
<td>i.</td>
<td>volcano</td>
</tr>
<tr>
<td>e.</td>
<td>island arc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. _____ g magma that reaches Earth's surface
2. _____ e a series of volcanic islands that form along a plate boundary
3. _____ h a broad volcano with gently sloping sides formed from thin, fluid lava
4. _____ i an opening in Earth's crust through which magma flows
5. _____ d a stationary pool of magma below Earth's crust
6. _____ b a large, cone-shaped volcano built from alternating layers of cinders and hardened lava
7. _____ f a line of islands
8. _____ c a cup-shaped depression that forms around a volcano's vent
9. _____ a a cone-shaped volcano of cinders, with a narrow base and steep sides
Volcanoes

Fill in the blanks.

<table>
<thead>
<tr>
<th>cinder-cone</th>
<th>lava</th>
<th>plates</th>
<th>volcano</th>
</tr>
</thead>
<tbody>
<tr>
<td>composite</td>
<td>mantle</td>
<td>shield</td>
<td></td>
</tr>
</tbody>
</table>

Openings on the Earth’s surface appear on the edges of the crust’s plates. An opening in Earth’s crust from which magma flows is a(n) _______ volcano. Most volcanoes form in places where ______ plates push toward each other, and one dives under the other. The lower edge of the diving plate melts in the ______ mantle, producing hot magma that rises in the crust. Magma that breaks through to Earth’s surface is ______ lava.

There are three types of volcanic mountains. A large, broad mountain composed of hardened lava is a(n) _______ shield volcano. A narrow, steep mountain formed from cinders is a(n) _______ cinder-cone volcano. A large, cone-shaped mountain formed by layers of lava and cinders is a(n) _______ composite volcano. Volcanoes are built up over time as more material is deposited.
Earthquakes

Use your textbook to help you fill in the blanks.

What is an earthquake?

1. Earthquakes happen when the layers of rock on both sides of a(n) ________ fault suddenly slip.

2. Waves of energy spread out from the ________ focus, the place where the slipping began.

3. When they reach the surface, waves spread out from the ________ epicenter of the earthquake (the point directly above the focus).

4. Most earthquakes happen at faults that are near the boundaries of ________ tectonic plates.

What waves are produced in an earthquake?

5. Scientists use a(n) ________ seismometer to detect and measure earthquake waves.

6. The fastest earthquake waves, ________ primary or P waves, pass through solids and liquids and move back and forth.

7. An earthquake’s ________ secondary or S waves do the most damage because they move up and down and from side to side.

8. The slowest-moving waves, ________ surface or L waves, move across Earth’s surface like ripples on a pond.

How are earthquakes measured?

9. Scientists use the ________ Richter scale to measure earthquake magnitude.

10. A measure of the amount of ________ energy that an earthquake releases is magnitude.
Outline

11. Scientists use the __________ Mercalli scale to measure an earthquake’s effects.

12. An underwater earthquake can produce a large wave called a(n) __________ tsunami.

13. Underwater earthquakes with a magnitude of __________ 6.5 or greater on the Richter scale are most likely to cause tsunamis.

How can people prepare?

14. Layers of rubber and steel between a building and its foundation allow the building to __________ sway, reducing the damage caused by up-and-down motions.

15. Before an earthquake, people should secure heavy or tall furniture to __________ walls to prevent it from falling and causing injury.

16. In their attempt to tell when earthquakes might happen, scientists look for possible warning signs such as changes in the angle of the __________ ground.

17. Earthquakes are hard to __________ predict, but the ability to do so would allow early warnings that could save lives.

Critical Thinking

18. Which scale do you think would better explain an earthquake to you, the Richter scale or the Mercalli scale? Why?

Answers will vary. Example: The Mercalli scale would better explain an earthquake to me. It’s based on how people see the damage from the earthquake around them. I would see what was damaged and then look up the appropriate number on the scale.
Earthquakes

Use the clues below to find the words hidden in the puzzle.

1. A sudden movement of Earth’s crust is a(n) _______ earthquake _______.

2. The point on the surface directly above an earthquake’s focus is its _______ epicenter _______.

3. A crack in Earth’s crust is a(n) _______ fault _______.

4. The place along a fault where the slipping that causes an earthquake begins is the earthquake’s _______ focus _______.

5. A measure of the energy that an earthquake releases is its _______ magnitude _______.

6. A large ocean wave caused by an underwater earthquake is a(n) _______ tsunami _______.

7. The scale that measures the magnitude of an earthquake is called the _______ Richter _______ scale.
The plates of the Earth are in motion. A sudden movement of Earth's crust is a(n) \underline{\text{earthquake}}. Most earthquakes occur near plate boundaries, when layers of rock that usually adhere to each other suddenly slip at a(n) \underline{\text{fault}}. The scale that measures the magnitude of an earthquake is called the \underline{\text{Richter}} scale. The scale that measures how severe an earthquake feels and the amount of damage the quake does to objects is called the \underline{\text{Mercalli}} scale.

The movement of plates during an earthquake sends out waves of \underline{\text{energy}} that shake the ground. When an earthquake occurs, \underline{\text{primary or P}} waves move back and forth very rapidly. An earthquake's \underline{\text{secondary or S}} waves do the most damage because they move both up and down and from side to side. The slowest waves are surface or L waves.
How Earthquakes Help Predict Volcanic Eruptions

Write About It
What are the differences between short-period and long-period earthquakes? Research these earthquakes. Write an explanatory essay with details that support your main idea.

Getting Ideas
Find out more about these types of earthquakes. Use the chart below to record information. Write the cause of each type of earthquake in the left-hand box. Write the type of earthquake in the right-hand box.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students’ answers will vary.</td>
<td>short-term earthquake</td>
</tr>
<tr>
<td>Sample answer: Rocks break as magma forces its way upward.</td>
<td></td>
</tr>
<tr>
<td>Gas pressure beneath the surface increases.</td>
<td>long-term earthquake</td>
</tr>
<tr>
<td>Magma moves just below the surface.</td>
<td>harmonic-tremor earthquake</td>
</tr>
</tbody>
</table>

Planning and Organizing
Hector wants to write first about short-term earthquakes, then about long-term earthquakes, and finally about harmonic-tremor earthquakes. Here are three sentences he wrote. Help him organize them. Then write 1 by the sentence that should come first. Write 2 by the sentence that should come second. Write 3 by the sentence that should come last.
1. **Seismographs can detect the ongoing flow of magma in a harmonic-tremor earthquake.**

2. **A short-term earthquake may be too small to be felt.**

3. **When the gas builds up, you have a long-term earthquake.**

**Drafting**

Write a sentence to begin your explanation. Tell your main idea about the types of earthquakes you have researched.

*Students’ sentences will vary. Sample Answer: Different types of earthquakes can help scientists predict earthquakes.*

Now write your explanatory essay on a separate piece of paper. Tell how each type of earthquake occurs. Use time-order or spatial words to make your explanation clear.

**Revising and Proofreading**

Here is part of Hector’s explanatory essay. Add a time-order word or a spatial-order word in each blank to make the meaning clearer.

When magma pushes its way up to the surface, the rocks begin to break. **Next or Then** long-term earthquakes begin. Finally, magma flows near the surface and breaks through.

Now revise and proofread your writing. Ask yourself:

- Did I discuss each type of earthquake and explain the difference?
- Did I include clear details that are easy to follow?
- Did I include time-order words or spatial order words?
- Did I correct all mistakes?
Shaping Earth’s Surface

Use your textbook to help you fill in the blanks.

What is weathering?

1. The process that breaks down rock into small pieces is called ________ weathering ________.

2. Impacts, temperature changes, and ice expanding in cracks breaks down rock in the process of ________ physical weathering ________.

3. When rock’s composition is broken down and changed, ________ chemical weathering ________ occurs.

What is erosion?

4. Pieces of weathered rock are moved from place to place by ________ erosion ________.

5. When rock and soil on a slope become loose, gravity can move them downhill in a ________ landslide ________.

6. A large mass of flowing ice, called a ________ glacier ________, can erode the rock and soil beneath it.

7. The process of ________ deposition ________ picks up eroded material and leaves it in a different place.

How do erosion and deposition work together?

8. The running water of ________ rivers ________ erodes rock and soil and washes it downstream.

9. Slow-moving rivers can flow in gentle loops called ________ meanders ________.
10. Rivers slow down and deposit sediment at their mouths in fan-shaped landforms called _______ *deltas* _______.

11. Waves can move sand along beaches or deposit it offshore to build strips of sand called _______ *sandbars* _______.

**How are shorelines changed?**

12. During floods, rivers deposit sediment on _______ *floodplains* _______ along their banks.

13. Deposits of sand along the shore can form _______ *barrier* _______ islands that protect the beaches behind them from storm waves.

14. Wind deposits sand along the shoreline in hills of sand called _______ *dunes* _______.

**How can shorelines be protected?**

15. People build walls called _______ *levees* _______ along rivers to prevent floods.

16. Natural _______ *wetlands* _______ along rivers soak up water and reduce the chance of flooding.

17. Fences and _______ *plants* _______ protect dunes by preventing sand from blowing away.

**Critical Thinking**

18. How can people help stop erosion on a beach?

   People can plant grasses or other plants to help keep the sand in place. People can also put up fences near dunes to slow down the wind near the sand.
Shaping Earth’s Surface

Who am I? What am I?

Choose a word from the word box below that answers each question.

| a. acid rain | d. erosion | g. meander |
| b. delta     | e. floodplain | h. sediment |
| c. deposition| f. glacier    | i. weathering |

1. ______ f I am a huge mass of ice. I erode the rock beneath me as I flow over it. Who am I?

2. ______ h I am particles of rock. Moving water deposits me when it slows down. What am I?

3. ______ a I wear away stone and metal surfaces when I fall from the sky. What am I?

4. ______ e I am a flat area along a riverbank. Rivers deposit sediment on me when they flood. Who am I?

5. ______ c I drop eroded sediment in a different place after I picked it up. What am I?

6. ______ b I am a fan-shaped piece of land. I form from deposits at the mouths of rivers. Who am I?

7. ______ i I break down rock into smaller pieces. What am I?

8. ______ g I am a gentle loop in a slow-flowing river. What am I?

9. ______ d I pick up and move pieces of weathered rock. What am I?
Rocks are constantly being changed by the environment. Over long periods of time, the process of ________weathering____ breaks down rock. When ________physical weathering____ occurs, the rock simply breaks into smaller pieces. During ________chemical weathering____, the rock weakens as the minerals in it are changed. After ________erosion____ removes the weathered rock. Gravity pulls loosened rock downhill in ________landslides____. Erosion and deposition shape shorelines. Ocean ________waves____ and currents move sediment along shorelines. They erode sand from some ________beaches____ and deposit it on others.

As ________glaciers____ move over the ground, they scoop out depressions and move the loose rock beneath them. Water, wind, and ice can drop eroded materials in a different place in a process called ________deposition____. This process also changes landforms.
Wrestling with the Big Muddy

Read the Reading in Science feature in your textbook.

**Problem and Solution**

Identify the main problem described in the reading. Then identify the solution to the problem and the steps taken to reach it. Write the information in the correct boxes in the graphic organizer below.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Step to Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Missouri River often flooded.</td>
<td>Engineers built dams on the river.</td>
</tr>
<tr>
<td></td>
<td>Engineers built levees on the river.</td>
</tr>
<tr>
<td></td>
<td>The Missouri’s flow is regulated so that the river does not flood as often.</td>
</tr>
</tbody>
</table>
Planning and Organizing

Read the “Write About It” questions carefully. Find the text within “Wrestling with the Big Muddy” that answers each question. Use the questions below to help organize your information.

List structures that now control the Missouri River.

a. dams

b. levees

List the problems the new structures cause.

a. Dams interfere with fish migration.

b. Dams interfere with soil fertilization.

Drafting Your Answers

Now, use the information above to help you write answers to the questions.

1. What did the government do to control the flow of the Missouri River?
   
   The government got engineers to build a series of dams and levees to regulate the flow of water.

2. What problems were caused by building dams along the river?
   
   The dams interfered with fish migration and soil fertilization.
Our Dynamic Earth

Choose the letter of the best answer.

1. Which of these is a physical feature on Earth’s surface?
   a. tsunami
   b. landform
   c. mantle
   d. hotspot

2. The crust and the top part of the mantle make up the
   a. atmosphere.
   b. hydrosphere.
   c. asthenosphere.
   d. lithosphere.

3. Earth’s surface layer is the
   a. mantle.
   b. crust.
   c. biosphere.
   d. asthenosphere.

4. What layer of Earth’s interior lies just below the crust?
   a. mantle
   b. inner core
   c. lithosphere
   d. outer core

5. The plate tectonics model states that Earth’s crust is composed of
   a. one solid piece of rock.
   b. both liquid and frozen water.
   c. several huge slabs of rock that fit together.
   d. hot, melted rock.

6. What is a fault?
   a. energy that an earthquake produces
   b. the opening in a volcano
   c. a large crack in Earth’s crust
   d. the boundary between two plates

7. Huge slabs of rock moving suddenly against each other in the Earth’s crust create
   a. earthquakes.
   b. abyssal plains.
   c. volcanos.
   d. a trench stretch.
8. A volcano is
   a. an opening in Earth’s crust through which magma flows.
   b. any mountain near a plate boundary.
   c. a group of faults near a hot spot.
   d. movement at a fault.

9. The low area between mountains is called a
   a. plateau.
   b. trench.
   c. valley.
   d. landform.

10. The wide, flat area of the ocean floor is known as the
    a. mantle.
    b. abyssal plain.
    c. trench stretch.
    d. aquatic plateau.

11. What is the term used for melted rock that reaches the Earth’s surface?
    a. lava
    b. mantle
    c. magma
    d. boundary rock

12. This device is used to detect and measure earthquake waves.
    a. wavometer
    b. richtometer
    c. barometer
    d. seismometer

13. This mass of large flowing ice can erode rock.
    a. glacier
    b. landslide
    c. iceberg
    d. delta

14. Underwater earthquakes of a great magnitude can create
    a. continental divides.
    b. trenches.
    c. tsunamis.
    d. aquatic drift.
# Protecting Earth’s Resources

Use your textbook to help you fill in the blanks.

<table>
<thead>
<tr>
<th>Name of Resource</th>
<th>Soil</th>
<th>Energy</th>
<th>Water</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Different Types of Resource</strong></td>
<td>Forest, desert, grassland</td>
<td>Atomic, solar, wind, hydroelectric</td>
<td>Salt and fresh</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Source of Resource</strong></td>
<td>Weathered rocks and minerals</td>
<td>The Sun, wind, water, atoms, biomass, fossil fuels</td>
<td>Glaciers, oceans, rivers, lakes</td>
<td>Atmosphere</td>
</tr>
<tr>
<td><strong>Uses for Resource</strong></td>
<td>Plants need soil to grow</td>
<td>Energy is used to power machines.</td>
<td>Animals and plants need water to live.</td>
<td>Animals breathe in oxygen from the air to stay alive.</td>
</tr>
<tr>
<td><strong>Threats to Resource</strong></td>
<td>Erosion</td>
<td>Overuse of non-renewable energy sources</td>
<td>Pollution and wasteful water use</td>
<td>Pollution from cars &amp; factories</td>
</tr>
<tr>
<td><strong>Ways to Protect Resource</strong></td>
<td>Terracing, wind breaks, crop rotation</td>
<td>Renewable energy sources</td>
<td>Follow laws that prevent water pollution. Conserve water.</td>
<td>Reduce use of cars; decrease factory emissions.</td>
</tr>
</tbody>
</table>
Minerals and Rocks

Use your textbook to help you fill in the blanks.

What are minerals?

1. A solid natural substance underground made from nonliving materials is a(n) _mineral_.

2. Minerals are made of one or more _elements_.

3. The color powder a mineral leaves when rubbed on a rough surface is its _streak_.

4. The way a mineral reflects light is its _luster_.

5. How well a mineral resists scratching is its _hardness_.

6. Scientists use the _Moh’s Hardness_ Scale to compare the hardness of minerals.

What are the shapes of a mineral?

7. The elements in minerals are in the form of _crystals_, which are solids whose shapes form patterns.

8. Important minerals such as copper are found in _ores_, which are combinations of many minerals.

What is the rock cycle?

9. Over time, rocks change from one type to another in the _rock cycle_.

10. Pressure can cement layers of weathered and eroded sediment into _sedimentary_ rock.
11. When magma and lava cool and harden, they become _____ igneous _____ rock.

12. If they become buried deep beneath Earth’s surface, sedimentary and igneous rocks can become _____ metamorphic _____ rock.

**What are igneous rocks?**

13. Igneous rocks that form inside Earth are called _____ intrusive _____, and have _____ large _____ crystals.

14. Igneous rocks that form from lava that cools on Earth’s surface are _____ extrusive _____, and have _____ small/tiny _____ crystals.

**What are metamorphic rocks?**

15. When metamorphic rocks form, the shape and _____ size _____ of crystals can change, or the crystals can change position to form _____ layers _____.

**Critical Thinking**

16. What are the different ways that rocks are produced, and what are the different properties of minerals?

Properties of minerals include color, streak, luster, hardness, cleavage, fracture, and crystal shape. Minerals form three types of rocks. Igneous rocks form from cooled and hardened lava or magma; Sedimentary rocks form from compacted and cemented layers of sediment; Metamorphic rock forms when heat and pressure change existing rock into other types.
Minerals and Rocks

Who am I? What am I?

Choose a word from the word box below that answers each question.

a. crystal  
b. hardness  
c. igneous rock  
d. luster  
e. metamorphic rock  
f. mineral  
g. rock cycle  
h. sedimentary rock

1. ______ b I am the measure of how well a mineral resists scratching. What am I?

2. ______ e I am a type of rock that forms when sedimentary and igneous rocks change under heat and pressure. Who am I?

3. ______ f I am a solid natural material made from nonliving substances in the ground. What am I?

4. ______ a I am a solid whose shape forms a pattern. What am I?

5. ______ h I am the type of rock that forms from layers of sediment. Who am I?

6. ______ d I am the way a mineral reflects light from its surface. What am I?

7. ______ c I am the type of rock that forms from magma or lava that cools and hardens. Who am I?

8. ______ g I am the change that occurs over time of one type of rock to another. What am I?
Minerals and Rocks

Fill in the blanks.

<table>
<thead>
<tr>
<th>cleavage</th>
<th>lava</th>
<th>metamorphic</th>
</tr>
</thead>
<tbody>
<tr>
<td>fractures</td>
<td>layers</td>
<td>minerals</td>
</tr>
<tr>
<td>igneous</td>
<td>luster</td>
<td>rock cycle</td>
</tr>
</tbody>
</table>

There are three categories of rocks. Rocks that form from cooled and hardened magma or lava are igneous rocks. Rocks that form from layers cemented together are sedimentary rocks. Heat and pressure deep inside Earth change igneous and sedimentary rocks into metamorphic rock. One rock can change into another type of rock in the rock cycle. All rocks are made from minerals that have many different properties. These properties include luster, or the way the rock reflects light, and its color. A mineral is said to have cleavage when it breaks along smooth surfaces. When it breaks along uneven surfaces, it fractures. The measure of how well a mineral resists scratching is its hardness.
Soil

Use your textbook to help you fill in the blanks.

What is soil?

1. Soil is a mixture of bits of _______ rocks _______ and once-living parts of plants and _______ animals _______.
2. The formation of soil starts with the _______ weathering _______ of rock.
3. Soil forms in layers that are called soil _______ horizons _______.
4. The soil in the A horizon is also called _______ topsoil _______ and is the soil in which most _______ plants _______ grow.
5. The A horizon also contains the decayed organic materials, or _______ humus _______, that makes soil fertile.
6. The B horizon, called the _______ subsoil _______, has lots of fine rock particles but little humus.
7. The C horizon, which rests on _______ bedrock _______, is mostly large pieces of weathered rock.
8. Soil in a forest has a thin _______ A _______ horizon, while soil in a(n) _______ desert _______ may not have this horizon at all.

How is soil used?

9. Soil in forests has a thin layer of _______ topsoil _______, and has little _______ humus _______.
10. Desert soil is sandy and does not hold much ________ humus. 

11. The soil of the prairies and other ________ grasslands in the central United States is rich in humus.

12. Grassland soil is good for ________ crops/farming. 

13. Plants hold nutrients that return to the soil when the plants die and ________ decay. 

14. Chemicals that kill insects and weeds can cause soil to become ________ polluted. 

How is soil conserved? 

15. Farmers can replace humus and nutrients in soil with ________ fertilizers. 

16. When farmers practice ________ crop rotation, they plant different crops on the same land in different years.

17. Farmers can conserve soil on hills when they use ________ contour plowing and ________ terracing. 

Critical Thinking

18. What composes soil? 

Soil is a mixture of pieces of weathered rock and bits of decayed plants and animals called humus.
Soil

Use the words below to complete the sentences.

<table>
<thead>
<tr>
<th>bedrock</th>
<th>horizon</th>
<th>pollution</th>
<th>topsoil</th>
</tr>
</thead>
<tbody>
<tr>
<td>conservation</td>
<td>humus</td>
<td>soil</td>
<td></td>
</tr>
</tbody>
</table>

1. The saving or protection of soil is ________ conservation ________.
2. The A horizon of soil, where most plants grow, is ________ topsoil ________.
3. A mixture of particles of rock and bits of once-living parts of plants and animals is ________ soil ________.
4. The part of soil made up of decayed materials is ________ humus ________.
5. The adding of harmful materials to soil, air, or water is ________ pollution ________.
6. A layer of soil is a soil ________ horizon ________.
7. Large pieces of rock, on which the soil’s C horizon rests, are called ________ bedrock ________. 
Soil

Fill in the blanks.

<table>
<thead>
<tr>
<th>bedrock</th>
<th>large</th>
<th>pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>desert</td>
<td>layers</td>
<td>subsoil</td>
</tr>
<tr>
<td>forest</td>
<td>plants</td>
<td>topsoil</td>
</tr>
</tbody>
</table>

Soil is a mixture of weathered rock and humus. It covers most of Earth’s surface. Soil is divided into several layers called soil horizons. There is unweathered bedrock beneath the soil. On top of this layer is a C horizon with pieces of rock that are large in size. Above this is the B horizon or the subsoil. In this layer, there are small/fine rock particles and humus. The A horizon is the topsoil. It contains the most humus and is good for the growth of plants. There are mainly three types of soil in the United States: forest soil, desert soil, and grassland/prairie soil. Soil is a resource that can be spoiled by pollution from chemicals. It can also be eroded by flowing water and wind.
Fossils and Energy

Use your textbook to help you fill in the blanks.

What are fossils?

1. The remnants or traces of organisms from long ago that are preserved in soil or rock are __________ fossils.

2. Many fossils formed when organisms died and were covered with layers of __________ sediment.

3. Over millions of years, sediment covered and compressed dead plants to form soft or __________ bituminous coal.

4. Sometimes increased heat and pressure turned soft coal into harder __________ anthracite coal.

5. Heat and pressure on buried ocean plants and animals helped to form __________ oil and __________ natural gas.

6. Coal, oil, and natural gas are __________ fossil fuels.

How old are fossil fuels?

7. Scientists can tell how old a fossil is by testing the age of the __________ rock around it.

8. The comparison that tells whether one fossil is older than another fossil is __________ relative age.

9. The law of superposition says that each layer of rock is __________ younger than the layer below it.
How can the Sun, wind, and water provide us with energy?

10. Sources of energy other than fossil fuels are called ________ energy sources.

11. Running or falling water spins generators to make electricity in a(n) ________ plant.

12. Solar energy is a(n) ________ resource that will not run out and does not pollute.

What are other sources of alternative energy?

13. Heat from deep inside Earth is ________ energy that can produce electricity and provide hot water.

14. Changes in the centers of ________ can release heat that produces nuclear power.

How can we conserve energy?

15. You use energy when you ride in a(n) ________ or use anything at home that runs on ________.

16. When you do not waste energy, you ________ it.

Critical Thinking

17. How did ancient organisms become fossil fuels?

__Coal is formed from ancient plants that were covered by sediment and compressed over millions of years. Oil and natural gas are formed when decayed plants and animals buried deep under the ocean are changed by heat, pressure, and the action of bacteria.__
Fossils and Energy

Fill in the blanks.

a. absolute age  

b. alternative energy  

c. era  

d. fossils  
e. fossil fuel  

f. nonrenewable  

g. relative age  

h. renewable

1. Any source of energy other than fossil fuels is ______b______.

2. The value that tells you whether a fossil is younger or older than another fossil is its ______g______.

3. A resource that can be used up faster than it is made is ______f______.

4. To find the ______a______ of a fossil, you must find the exact age of the rock that surrounds it.

5. The remnants or traces of ancient organisms that were preserved in soil or rock are ______d______.

6. Resources that can be replaced faster than they are used are ______h______.

7. A material formed from the decay of ancient organisms that is used to produce energy is a(n) ______e______.

8. A unit of time that describes the age of Earth in millions of years is a(n) ______c______.
The remains of ancient organisms that are preserved in rock are fossils. Our most common fuels are the fossil fuels coal, oil, and natural gas. These fossil fuels are nonrenewable resources. We also use alternative energy sources, which are energy sources that are not fossil fuels. Renewable energy sources include wind, falling water, and the Sun. These forms of energy do not produce pollution that dirties the air and water. Another energy source is geothermal energy, which comes from heat inside Earth. People also burn materials such as wood, a type of biomass. Changes in the nucleus of atoms release energy that runs nuclear power plants. To save energy, people do things to conserve it.
So You Want to Be a Fossil Hunter

Write About It
Select a fossil and write a description of it. Use sensory words and specific details in your description.

Getting Ideas
What fossil will you describe? Write its name in the center circle of the web below. Write details that describe the fossil in the outer circles. You can add circles to the web if you like.

Planning and Organizing
Jorge wants to describe a fossil of a dinosaur footprint. Here are some sentences that he wrote. Write Yes if the sentence describes the fossil. Write No if it does not.

1. The huge footprint was 2 $\frac{1}{2}$ feet across.  _____ Yes

2. It showed that the dinosaur had three long bony toes.  _____ Yes

3. I got scared when I looked at the footprint.  _____ No
Drafting
Write a sentence to begin your description. Tell what fossil you will describe. Tell an important idea about this fossil.

Students’ sentences will vary.

Now write your description. Use a separate piece of paper. Start with the sentence you just wrote. Then write your description. Use words that appeal to the senses. Use details that will help your readers picture the fossil.

Revising and Proofreading
Help Jorge improve his description. Add sensory words in the blanks. Choose a word from the box or pick your own.

The fossil footprint in the cold __________ gray __________ stone reveals secrets of this creature that lived millions of years ago. The footprint had made a __________ deep __________ impression in the earth. This suggested that the dinosaur was very big and heavy. It showed long __________ spiky __________ shapes at the end of the toes. Maybe this is where its __________ sharp __________ claws dug into the earth. The heel of the foot was __________ narrow __________, not wide.

Now revise and proofread your writing. Ask yourself:

- Did I include enough details to help readers picture the fossil?
- Did I use sensory words to bring my description to life?
- Did I correct all mistakes?
Air and Water

Use your textbook to help you fill in the blanks.

What are sources of fresh water?

1. About three-fourths of Earth’s surface is covered with water, with most of it in oceans.

2. Salt enters much of Earth’s water as rain and ocean waves wash over dirt and rocks.

3. Running water includes sources such as streams and rivers.

4. Standing water includes sources such as lakes and reservoirs that fill holes in the ground.

5. Water beneath Earth’s surface is groundwater.

6. Groundwater collects underground in layers of rock or soil called aquifers.

How do we use water?

7. Water can pick up substances that pollute or contaminate it as it falls through the sky or runs along the ground.

8. Wastes from mines and factories can also pollute water.

How do we clean, conserve, and protect water?

9. The following steps clean drinking water in water treatment plants: coagulation, sedimentation, filtration, and disinfection.
10. People can reduce their use of water through _______ conservation _______.

How do we use and pollute air?

11. Particles produced by cars and trucks can create a yellow haze in the air called _______ smog _______.

12. Chemicals in old aerosol cans and old air conditioners can escape high into the atmosphere and destroy _______ ozone _______.

13. In some areas, pollution caused by smoke and gases from factories combines with rain to form _______ acid _______ rain.

How do we stop air pollution?

14. Many pollutants are now banned or disposed of before they get into the air because of the _______ Clean Air _______ Act.

15. For example, vehicles have devices that limit the amount of pollutants that come out of _______ exhaust _______ pipes.

Critical Thinking

16. Why are water and air important resources?

Most of the organisms that live on land (including people) cannot survive without fresh water. Water is used for drinking, to irrigate crops, and to fight fires. Air contains gases necessary for life. Plants take in carbon dioxide to make their food. Both plants and animals use oxygen to produce energy.
Air and Water

Match the correct letter with the description and fill in the blank with the correct answer.

<table>
<thead>
<tr>
<th>a. aquifer</th>
<th>d. reservoir</th>
<th>g. running water</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. groundwater</td>
<td>e. smog</td>
<td></td>
</tr>
<tr>
<td>c. ozone hole</td>
<td>f. oceans</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. ______  Salty water bodies containing most of Earth’s water
2. ______  A thin spot in the layer of ozone
3. ______  A lake made by people that is used to store water
4. ______  An underground layer of rock or soil that can absorb water
5. ______  Water that is beneath Earth’s surface
6. ______  A type of air pollution caused by particles from cars and factories
7. ______  The type of water that comes from rivers and streams
Two of Earth’s most important resources are water and air. Most of Earth’s water is the salt water in oceans. However, people and most other living things need fresh water to survive. Most of the fresh water people use comes from running water, standing water, and groundwater. We get running water from streams and rivers. Standing water comes from lakes and reservoirs. We get groundwater from underground layers of rock and soil called aquifers that absorb water. Living things also need gases, such as oxygen, carbon dioxide, and nitrogen, from the atmosphere. Plants use carbon dioxide to make food. Bacteria in soil use nitrogen to make chemicals that plants need. People can make water and air unusable when they release pollution.
Getting the Salt Out

Read the following passage. Underline any sentence that identifies a problem. Circle any passages that mention possible solutions to those problems.

Why does California have water shortages when it is next to the Pacific Ocean? People cannot drink ocean water because of the salts in it.

The island of Santa Catalina lies off the coast of Southern California. It is completely surrounded by the Pacific Ocean. However, people use water from the ocean all the time—to water crops, to take showers, and even to drink. How can they use the salty ocean water? The water is converted from salty to fresh at the Santa Catalina desalination plant. Desalination means “to remove salts.”

At the desalination plant, ocean water is taken from an ocean water well. Once it is moved into the plant, salt and other impurities are removed from the water. The fresh water that is produced can now be used by people.

The Santa Catalina plant is one of the few desalination plants in the United States that produces water for public use. Desalination is an expensive process that uses a lot of energy. Despite its cost, there are desalination plant projects all over the world, including places like Saudi Arabia and Japan. Desalination is generally used when a community has so little access to fresh water that they are willing to pay a high price to get it. Scientists continue to research cheaper and more effective ways to produce fresh water from ocean water.

Problem and Solution

- Identify the problem by looking for a conflict or an issue that needs to be resolved.
- Think about how the conflict or issue could be resolved.
Problem and Solution

Fill in the problem-and-solution graphic organizer below. Use the underlined passages from the reading to help you.

Problem

People cannot drink or use ocean water because of the _____________ salt it contains.

Steps to Solution

Communities can build _____________ desalination plants that turn _____________ salty ocean water into _____________ fresh water.

Solution

Fresh water from _____________ desalination plants can be used for _____________ drinking, for _____________ washing, and for _____________ watering crops.

Write About It

Problem and Solution

1. What is in ocean water that prevents the people of Santa Catalina Island from drinking and using it directly from the ocean? _____________ salt


Answer the following questions. Use clues from the graphic organizer to help you.

1. What is in ocean water that prevents the people of Santa Catalina Island from drinking and using it directly from the ocean? _____________ salt

Protecting Earth’s Resources

Choose the letter of the best answer.

1. A solid natural material in the ground made from nonliving substances is a(n)
   a. rock.
   b. aquifer.
   c. mineral.
   d. horizon.

2. Which type of rock is formed from layers of sediment?
   a. igneous
   b. magma
   c. sedimentary
   d. granite

3. Igneous rocks form from
   a. lava and magma.
   b. fossils.
   c. layers of sediment.
   d. humus.

4. Which of these causes the formation of metamorphic rock?
   a. an increase in water content
   b. very high temperatures
   c. the growth of crystals
   d. the splitting of atoms

5. A mixture of pieces of rock and bits of once-living parts of plants and animals is
   a. humus.
   b. rock.
   c. pollution.
   d. soil.

6. Which part of soil is formed from decayed materials?
   a. rock
   b. minerals
   c. humus
   d. topsoil

7. Soil in the A horizon is called
   a. topsoil.
   b. bedrock.
   c. humus.
   d. subsoil.
Choose the letter of the best answer.

8. Harmful chemicals added to air, water, or soil are
   a. luster.
   b. pollution.
   c. runoff.
   d. smog.

9. The remnants, or traces, of ancient organisms preserved in soil or rock are known as
   a. fossils.
   b. minerals.
   c. horizons.
   d. fuels.

10. Which of these is a nonrenewable energy resource?
    a. wind
    b. falling water
    c. oil
    d. biomass

11. Which of these is an alternative energy resource?
    a. coal
    b. natural gas
    c. the sun
    d. oil

12. Which of these statements is true of a nonrenewable energy resource?
    a. Its supply will never run out.
    b. It is used up faster than it is made.
    c. It cannot be burned as fuel.
    d. It can be replaced faster than it is used.

13. An underground layer of rock or soil that can absorb water is a(n)
    a. aquifer.
    b. reservoir.
    c. soil horizon.
    d. well.

14. Which of these is a source of drinking water for people?
    a. ocean
    b. ozone holes
    c. groundwater
    d. pools of magma

15. A yellow haze in the air caused by particles from cars and factories is
    a. oxygen.
    b. acid rain.
    c. carbon dioxide.
    d. smog.
Strong Storms
Read the Literature feature in your textbook.

Write About It

Response to Literature  This article describes the damage caused by severe rainstorms in Los Angeles. Research the damage severe rainstorms can cause. Write a report about the effects of severe rainstorms. Include facts and details from this article and your own research.

Paragraphs should have a clear topic sentence that directly identifies the effects of severe rainstorms. The sentences that follow the topic sentence should support the topic sentence by describing the damage severe rainstorms can cause. Supporting sentences should include researched facts and details about the effects of severe rainstorms as well as facts and details from the article. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will stay on topic, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from one idea to the next.
Weather Patterns

Complete the concept map about relationships within ecosystems.

Weather

The average weather in a given region is called **climate**.

Weather is predicted by measuring **variables** and making **maps**.

The variables that contribute to weather are air pressure, **temperature**, cloud cover, **precipitation**, and wind speed.

**Types of Cloud Cover**

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cirrus</strong></td>
<td>Clouds composed of ice crystals high in the sky.</td>
</tr>
<tr>
<td>clouds</td>
<td></td>
</tr>
<tr>
<td><strong>Cumulus</strong></td>
<td>Puffy clouds at middle altitudes.</td>
</tr>
<tr>
<td>clouds</td>
<td></td>
</tr>
<tr>
<td><strong>Stratus</strong></td>
<td>Layered clouds at low altitudes.</td>
</tr>
<tr>
<td>clouds</td>
<td></td>
</tr>
<tr>
<td><strong>Fog</strong></td>
<td>A cloud close to the ground.</td>
</tr>
</tbody>
</table>

**Types of Precipitation**

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rain</strong></td>
<td>Liquid precipitation</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sleet</strong></td>
<td>Raindrops that fall through a layer of cold air and freeze</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Snow</strong></td>
<td>Water vapor that turns directly into ice crystals</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hail</strong></td>
<td>Raindrops that freeze and then are moved up by wind.</td>
</tr>
</tbody>
</table>
The Atmosphere and Weather

Use your textbook to help you fill in the blanks.

How does the Sun warm Earth?

1. Sunlight strikes Earth with the most vertical angle at ___________ equator _________.

2. An area near the ___________ poles _________.

What are the layers of the atmosphere?

3. When energy from the Sun hits the Earth, 50 percent is absorbed by ___________ Earth’s surface ________, and 20 percent is absorbed or reflected by ___________ the atmosphere _________.

4. Particles of gas in the air pressing on Earth’s surface create a force called ___________ air pressure _________.

What changes air pressure?

5. Atmospheric pressure decreases as altitude ___________ increases _________.

6. As humidity increases, air pressure ___________ decreases _________.

What are global winds?

7. Winds that blow between 30°North and 30°South latitudes are called the ___________ trade winds _________.

8. Air pressure near the equator is ___________ lower _________. than air pressure near the poles, a fact that causes air to move from the ___________ poles _________. toward the ___________ equator _________.

9. Winds that blow south from the North Pole curve to the right because of the Coriolis effect.

What are local winds?

10. During the day, the Sun heats land more quickly than it heats water, so an ( ) sea breeze blows; during the night, water cools more slowly than land does, so an ( ) land breeze blows.

11. In the morning, valley breezes blow ( ) upward; in the afternoon, mountain breezes blow ( ) downward.

How do we measure air pressure and wind?

12. Air pressure is measured with an ( ) barometer; wind speed is measured with an ( ) anemometer; wind direction is measured with an ( ) wind sock or weather vane.

Critical Thinking

13. How does Earth's shape affect global temperatures and wind patterns?

Because Earth is curved, the equator receives the most direct rays from the Sun, and the poles receive the most slanted rays from the Sun. Therefore, temperatures at the poles are much lower than those at the equator. The presence of lower temperatures at the poles means that the air pressure at the poles is higher than the air pressure at the equator, so winds move from the poles to the equator.
The Atmosphere and Weather

Who am I? What am I?

Choose a word from the word box below that answers each question.

a. air pressure  

b. atmosphere  
c. global wind

d. humidity  
e. insolation  
f. troposphere  
g. weather

1. _____ d I make the air feel dry or sticky. I am the amount of water vapor in the air. What am I?

2. _____ f I am the layer of gases nearest Earth, where all weather takes place. What am I?

3. _____ g Look out your window. I am the current condition of the atmosphere. What am I?

4. _____ b I am the envelope of air surrounding Earth. What am I?

5. _____ c You can count on me to blow steadily in predictable directions over very long distances. Who am I?

6. _____ e I am the solar energy that reaches your planet. What am I?

7. _____ a I am the weight of air pressing against you. What am I?
The condition of the atmosphere at any time and place is called weather. Weather occurs in the troposphere, the layer of the atmosphere closest to Earth. Global weather patterns are largely due to Earth's shape and the angle at which sunlight strikes Earth in different places. The equator receives more direct rays from the Sun, whereas the poles receive very low angles of sunlight. Therefore, the temperature at the equator is always higher than that at the poles.

The uneven heating of Earth causes differences in air pressure. Warm air is less dense and has a lower air pressure than does cold air. Air always flows from areas of high air pressure to areas of low air pressure. Differences in air pressure cause global winds that blow in predictable directions over long distances.
Clouds and Precipitation

Use your textbook to help you fill in the blanks.

How do clouds form?

1. As water vapor rises, it becomes colder and **condenses** on particles of dust to form **clouds**.

2. Clouds composed of ice crystals high in the sky are called **cirrus clouds**.

3. Puffy clouds at middle altitudes are called **cumulus clouds**.

4. Layered clouds at low altitudes are called **stratus clouds**.

5. A cloud close to the ground is called **fog**.

How does precipitation form?

6. Raindrops that fall through a layer of cold air can freeze to form **sleet**.

7. At low temperatures, water vapor turns directly into solid crystals called **snow**.

8. Rainfall is measured with an instrument called a(n) **rain gauge**.

What are air masses and fronts?

9. When a cold, dry, air mass meets a warm, moist, air mass, the cold air pushes the warm air **upward**, producing **stormy** weather.
10. On a weather map, blue triangles on a line represent a(n) \underline{cold front} ; red half-circles on a line represent a(n) \underline{warm front}.

11. Almost all weather fronts in North America are pushed from west to east by the \underline{jet stream}.

What are highs and lows?

12. Areas on a weather map that have the same air pressure are connected with lines called \underline{isobars}.

13. Low pressure systems bring \underline{warm and stormy} weather; high pressure systems bring \underline{dry and cool} weather.

What do weather maps tell you?

14. To make weather maps, meteorologists collect and analyze data such as \underline{temperature}, \underline{wind speed}, and air pressure.

Critical Thinking

15. How and why do clouds form along a front?

\underline{Clouds form when warm, moist air rises and cools. Water vapor condenses on particles of dust to form clouds. This happens along a front because the front is the place where cool air pushes warm air upward.}
Clouds and Precipitation

Choose a word from the word box below to finish the puzzle.

<table>
<thead>
<tr>
<th>cumulus</th>
<th>high</th>
</tr>
</thead>
<tbody>
<tr>
<td>front</td>
<td>isobar</td>
</tr>
</tbody>
</table>

Across

4. Cloud that is low and layered
6. Connects all places that have the same air pressure
7. Pressure system that brings cool, clear weather
8. Scientist who studies the atmosphere

Down

1. Puffy cloud
2. Meeting place between two air masses
3. Rain, sleet, hail, or snow
5. Large region of air that has a similar temperature and humidity throughout

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Clouds and Precipitation

Fill in the blanks.

<table>
<thead>
<tr>
<th>air mass</th>
<th>fog</th>
<th>snow</th>
<th>warm front</th>
</tr>
</thead>
<tbody>
<tr>
<td>cumulus</td>
<td>front</td>
<td>stratus</td>
<td>weather</td>
</tr>
</tbody>
</table>

The formation of precipitation begins when water vapor condenses on dust particles, forming _______ clouds. Clouds form in different places and have different shapes—_______ forms close to the ground, layered _______ clouds form at low altitudes, and puffy _______ clouds form at middle altitudes. Water droplets grow larger until they become heavy enough to fall as rain, _______, or _______.

A large region of air that has similar temperatures and humidity throughout is called a(n) _______ air mass. As air masses move, they cause changes in the _______ weather. A place where two different air masses meet is called a(n) _______ front. Warm air moving toward cold air is called a(n) _______ warm front. Cold air moving toward warm air is called a cold front.
Severe Storms

Use your textbook to help you fill in the blanks.

What are thunderstorms?

1. Updrafts of warm, moist air result in tall clouds called **thunderheads**.

2. During a thunderstorm, particles of rain and ice rub against one another as they rush upward and downward, creating **static electricity**.

3. The discharge of static electricity in thunderclouds is seen as **lightning**.

4. Lightning suddenly raises the temperature of the air, causing the air to expand violently, and producing a sound known as **thunder**.

What are winter storms?

5. Winter storms often form when a(n) **continental polar** air mass meets a(n) **maritime tropical** air mass.

6. Blizzards are snowstorms with **35** mile per hour winds and **$\frac{1}{4}$** of a mile visibility.

What are tornados?

7. Tornados begin to form when warm air moves upward in a thunderhead, creating a(n) **low pressure** area that draws more air inward and upward.
8. Air moving into the low pressure closure begins to spin, creating a(n) ______ funnel cloud ______ , which becomes a(n) ______ tornado ______ when it reaches the ground.

What are hurricanes?

9. A tropical storm has ______ rotating ______ winds with a(n) ______ low ______ pressure area at its center.

10. When wind speeds reach more than 73 miles per hour, a tropical storm becomes a(n) ______ hurricane ______.

11. The three types of cyclones are ______ tropical storms ______, ______ hurricanes ______, and ______ tornados ______.

How are storms tracked?

12. Weather stations around the world use instruments such as ______ weather vanes ______, ______ barometers ______, and rain gauges to measure local weather conditions.

13. Weather balloons collect data on ______ air pressure ______, ______ temperature ______, and ______ humidity ______ at higher altitudes.

Critical Thinking

14. Explain why severe storms occur along fronts.

A front is the point at which two different air masses meet. When a cold, dry, air mass meets a warm, moist, air mass, the cold air pushes the warm air upward, causing water vapor to condense and form clouds and precipitation—snow or ice in winter, and heavy rain in summer.
Severe Storms

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. blizzard</th>
<th>e. storm surge</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. cyclone</td>
<td>f. thunderstorm</td>
</tr>
<tr>
<td>c. ground blizzard</td>
<td>g. tornado</td>
</tr>
<tr>
<td>d. hurricane</td>
<td>h. whiteout</td>
</tr>
</tbody>
</table>

1. ______ c  blizzard that occurs when snow is no longer falling
2. ______ f  rainstorm with thunder and lightning
3. ______ a  snowstorm with winds of 35 miles per hour and visibility of a 1/4 mile
4. ______ d  tropical storm with wind speeds reaching more than 73 miles per hour
5. ______ h  zero visibility caused by heavy snowfall combined with strong updrafts and downdrafts
6. ______ e  bulge of water in the ocean, caused by hurricane winds
7. ______ b  any storm with a low pressure closure that causes the formation of a circular pattern of winds
8. ______ g  rotating funnel-shaped cloud with winds that blow up to 299 miles per hour
Severe Storms

Fill in the blanks.

<table>
<thead>
<tr>
<th>center</th>
<th>lightning</th>
<th>thunderheads</th>
<th>tropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>front</td>
<td>polar</td>
<td>thunderstorm</td>
<td>tropical storm</td>
</tr>
<tr>
<td>hurricane</td>
<td>thunder</td>
<td>tornado</td>
<td></td>
</tr>
</tbody>
</table>

Storms come in many forms. A severe storm that includes __________ and __________ is called a(n) __________. Warm, moist air is pushed up by cold air along a(n) __________, and __________ form. Sometimes a thunderstorm can turn into a twister, or __________. A thunderstorm can also become a(n) __________, with rotating winds and a low pressure area at its __________. Such a storm can turn into a(n) __________.

Winter storms often form when a continental __________ air mass meets a maritime __________ air mass. A winter storm can drop many forms of precipitation.
Living Through a Mudslide

Write About It
Write a personal narrative about a storm, mudslide, or other severe weather condition that you have experienced. Use a clear sequence of events to tell what happened and what you did.

Getting Ideas
Choose a severe weather condition you have experienced. Write its name in the center circle. Then put on your thinking cap. Write words and details that tell about this weather condition in the outer circles.
Students’ answers will vary. Sample answer appears below.

Planning and Organizing
Here are some sentences that Kevin wrote to tell about his experience during a hurricane. Number the sentences from 1-4, by 1 being the sentence that comes first.

2. Next, the winds picked up, knocked over garbage cans, and tossed the trash like balls in the air.

1. First, the sky grew dark as a wall of clouds marched in.

3. Then, the waves built, growing higher and higher, until they crashed over the railings along Shore Road.

4. Finally, Mom and Dad moved us all to the shelter before the full force of the storm hit.
Drafting

Write a sentence to begin your personal narrative. Introduce yourself by using the pronoun “I.” Name the weather condition and tell how it made you feel.

Students’ sentences will vary. Sample sentence: I have never been as frightened as when I heard the weather announcement, “Hurricane approaching!”

Now write your personal narrative. Use a separate piece of paper. Begin with the sentence you wrote above. Tell about the events in time order. Use time-order words to make the sequence easy to follow.

Revising and Proofreading

Here is part of Kevin’s personal narrative. He made five mistakes in grammar. Find the mistakes and correct them. Cross out the error. Write the correction above it.

It started out as a beautiful day in late September. The sun was shining bright and the temperature were mild. My friends and I had it would be a great day for a bike ride along Shore Road. Was we ever wrong! My sister heard the announcement first and calls me into her room.

Now revise and proofread your writing. Ask yourself:

- Did I use the pronoun “I” to identify myself?
- Did I tell the events in sequence?
- Did I correct all mistakes in grammar, spelling, punctuation, and capitalization?
What is climate?

1. Two variables that are important in determining climate are ______ temperature ______ and ______ rainfall ______.

2. The global variable that has the strongest effect on climate is ______ latitude ______.

3. Areas between 0° and 23.5° latitudes (whether north or south) receive the ______ most ______ insolation from the Sun.

4. The tropical climate zone has high ______ temperatures ______ and high ______ precipitation ______ during at least part of the year.

5. The temperate climate zone has ______ warm ______ summers and ______ cool or cold ______ winters.

6. The polar climate zone has ______ short, warm ______ summers and ______ long, cold ______ winters.

7. Greenhouse gases include ______ water vapor ______, ______ carbon dioxide ______, and ______ ozone ______.

8. Burning ______ fossil fuels ______ increases the amount of greenhouse gases in the atmosphere, a factor in ______ global warming ______.
What affects climate?

9. The temperature of an inland city is usually _______ warmer _______ in summer and _______ cooler _______ in winter than the temperature of a coastal city.

10. At a given latitude, the higher the altitude, the _______ cooler _______ the climate.

11. The climate on the _______ windward _______ side of a mountain is wetter and cooler than the climate on the _______ leeward _______ side.

What is El Niño?

12. A cold current along the coast of Peru causes air pressure to be _______ higher _______ in the eastern Pacific than it is in the western Pacific.

13. El Niño brings _______ heavy rains and storms _______ to the coasts of North and South America; La Niña brings _______ dryer weather _______ to these coastal areas.

Critical Thinking

14. Location A is near the equator on the windward side of a mountain. Location B is at 30°N latitude on the east side of the Atlantic Ocean. Describe the climate in each location. Explain your answers.

Location A has a tropical climate because it is near the equator and because it receives plenty of precipitation as a result of being on the windward side of the mountain. Location B has a temperate climate because although it lies at 30°N latitude, the Gulf Stream keeps temperatures warmer than other locations at the same latitude.
Climate

Choose a word from the word box below to complete the puzzle.

<table>
<thead>
<tr>
<th>climate</th>
<th>Gulfstream</th>
<th>polar</th>
<th>tropical</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENSO</td>
<td>La Niña</td>
<td>temperate</td>
<td>windward</td>
</tr>
</tbody>
</table>

Across
2. Climate that is warm year-round and rainy at least part of the year
3. Average weather of a place
5. Climate with short, warm summers and long, cold winters
7. Wetter side of a mountain
8. Comings and goings of El Niño

Down
1. Ocean current that warms Europe
4. Climate with warm summers and cold winters
6. The dryer weather that occurs when the current along the Peruvian coast sinks
The type of weather that exists in a place over the long term is its climate. The two most important variables that determine climate are __temperature__ and __precipitation__. It is possible to predict the climate of an area if you know its __latitude__. Areas near the equator have __tropical__ climates and the highest temperatures. They also have heavy precipitation during at least part of the year. Areas between 23.5° and 66.5° latitudes (whether north or south) have __temperate__ climates. Other factors that affect climate are distance from a(n) __body of water__, __ocean currents__, and __altitude__. All of these factors can give you a general idea of the climate of an area.
Museum Mail Call

Read the following letters from the Reading in Science passage in your textbook. Underline the sentences or phrases that describe the features of each area.

June 13
Dear Museum Scientists,

_Hola!_ (That’s “hello” in Spanish) It’s the _dry season_ here in Palmdale right now and it’s _muy caliente_—very hot! We haven’t had rain in weeks.

It’s usually hot and dry here from May to November. We don’t have a lot of water, so it has to be piped in from other areas. Restaurants only serve water to people who ask for it.

Some people plant cactuses and shrubs around their homes. I planted jalapeño peppers with _mi hermana_, my sister. _We water the plants in the evening._ That way the hot sun won’t dry up all of the water.

Carlos

June 23
Dear Museum Scientists,

The _gio mua_, or monsoons, have brought wet weather to our land. Everything here is soaked! Our _monsoon season lasts from May to October_. Many inches of rain can fall during heavy storms. But the storms only last for about an hour each day. It’s very hot, so we don’t mind getting wet.

Our farm is near the Mekong River. Water floods our rice fields and helps the rice grow. It’s hard work walking through the swampy ground. We carry the rice with _quang ganh_. These are baskets that we balance at the end of a pole.

People here are used to a lot of water. We build our houses on stilts so the water won’t get in. Some years, there is more water than we expect!

Vang
**Compare and Contrast**

Fill in the Venn diagram below with the facts that you underlined in each of the letters on the previous page.

- **Mekong River**
  - Monsoon season from May to October
  - Storms last for an hour each day
  - Swampy ground
  - Sometimes more rain than expected

- **Palmdale**
  - Dry season from May to October
  - Does not rain
  - Water piped in from other areas
  - Water plants in the evening

- **Both**
  - Very hot

**Write About It**

**Compare and Contrast**

How does the weather in Palmdale compare with the weather near the Mekong River? What activity do both Carlos and Vang do?

**Compare and Contrast**

Answer the following questions, using the information you have about both Palmdale and the Mekong River.

1. How does the weather in Palmdale compare with the weather near the Mekong River?

   During the summer, weather in Palmdale is hot and dry, and weather near the Mekong River is hot and wet.

2. What activity do both Carlos and Vang do?

   Both Carlos and Vang garden, but Carlos grows peppers and Vang grows rice.
Weather Patterns

Choose the letter of the best answer.

1. The layer of gases closest to Earth, where all weather takes place, is called the
   a. thermosphere.
   b. troposphere.
   c. stratosphere.
   d. exosphere.

2. Which of the following causes an increase in air pressure?
   a. increase in altitude
   b. increase in volume
   c. increase in humidity
   d. decrease in temperature

3. Global winds occur because
   a. air pressure near the poles is lower than air pressure near the equator.
   b. sunlight heats areas near the equator more than it heats areas near the poles.
   c. sunlight warms the air over land faster than it warms the air over water.
   d. sunlight warms the air over mountains faster than it warms the air in valleys.

4. Air pressure is measured with a(n)
   a. anemometer.
   b. wind sock.
   c. thermometer.
   d. barometer.

5. Because of the Coriolis Effect, winds that blow south from the North Pole
   a. curve to the right.
   b. curve to the left.
   c. speed up.
   d. slow down.

6. A cloud close to the ground is called
   a. a cumulus cloud.
   b. a stratus cloud.
   c. fog.
   d. a cirrus cloud.
7. Which of the following best describes how snow forms?
   a. Water vapor freezes directly into a solid.
   b. Water droplets freeze and then fall as precipitation.
   c. Water droplets collide with bits of ice and freeze.
   d. Water droplets fall through a layer of cold air close to the ground.

8. An air mass that forms over northern Canada will be
   a. cold and humid.
   b. cold and dry.
   c. warm and humid.
   d. warm and dry.

9. Which of the following best describes how the weather will change when a cold front moves into an area?
   a. The weather will become drier.
   b. The weather will become clear and cool.
   c. The weather will become stormy, but when the front passes, the weather will become cool and dry.
   d. The weather will become stormy and warmer.

10. Which of the following is a cyclone?
    a. thunderstorm
    b. blizzard
    c. ice storm
    d. hurricane

11. When do storm surges occur?
    a. during a blizzard
    b. during a hurricane
    c. during a thunderstorm
    d. during a tornado

12. A storm that has an eye and rotating winds that reach 73 miles per hour is called a
    a. tropical storm.
    b. cyclone.
    c. tornado.
    d. hurricane.

13. A sudden discharge of static electricity during a thunderstorm is called
    a. thunder.
    b. lightning.
    c. a low pressure closure.
    d. a downdraft.
The Universe

Complete the concept map with information you learned about the universe.

The _________ is a huge space that holds energy and matter.

Most of the matter is in groupings of stars, dust, and gas called

_______galaxies_______, which can be spiral, _________elliptical_______, or irregular.

The spiral _________galaxy_______ that you live in is called the

_______Milky Way_______.

This galaxy includes the _________solar system_______, which has the Sun at its center.

The solar system has eight _________planets_______ that orbit the Sun. These include Mercury, _________Venus_______, Earth, Mars, _________Jupiter_______, Saturn, Uranus, and Neptune. Many of these have natural satellites called _________moons_______.

The solar system also has rocky asteroids and icy _________comets_______ that orbit the Sun.
Earth and Sun

Use your textbook to help you fill in the blanks.

What is gravity?

1. The force of attraction between any two objects is gravity.

2. The strength of gravity increases as the mass of objects increases and decreases as the distance between objects increases.

3. The Sun’s gravitational pull on Earth is greater than its pull on a planet much farther away, such as Neptune.

4. A path that one object takes as it moves around another object is its orbit.

5. Earth and the other planets move in orbits around the Sun.

6. Moving objects have the tendency to keep moving in a straight line; this is called inertia.

7. Because of the effects of gravity and inertia, Earth moves in a nearly circular orbit shaped like a(n) ellipse.

What causes the seasons?

8. Every year, Earth makes one complete trip, or revolution, around the Sun.

9. As Earth revolves around the Sun, sunlight strikes different parts of Earth at different angles.
10. Sunlight strikes Earth differently at different times of year because Earth’s axis is ________ tilted ________.

11. The changes in the angle of sunlight on Earth’s surface cause the ________ seasons ________.

12. When the Northern Hemisphere is tilted away from the Sun, the season there is ________ winter ________.

13. When it is winter in the Northern Hemisphere, it is ________ summer ________ in the Southern Hemisphere.

14. The heat energy of sunlight is more concentrated in the summer because the hemisphere having summer is tilted ________ toward ________ the Sun.

What causes day and night?

15. As Earth revolves around the Sun, it also ________ rotates ________ on its axis.

16. At any time, half of Earth faces the Sun and has ________ day ________ , while the other half faces away and has ________ night ________.

Critical Thinking

17. If Earth’s axis were not tilted, could any area have both a hot summer and a cold winter?

   No. Each latitude of Earth would receive the same amount of sunlight and energy from the Sun all year.
Earth and Sun

Who am I? What am I?

Choose a word from the word box below that answers each question.

| a. | ellipse          | d. | orbit         |
| b. | gravity          | e. | revolution    |
| c. | inertia          | f. | rotation      |

1. ____c____  I am the tendency of a moving object to keep moving in a straight line. What am I?

2. _____f_____  I am the spinning of Earth around its axis. I cause day and night. Who am I?

3. _____d_____  I am the path that one object, such as a planet, takes as it moves around another object. What am I?

4. _____e_____  I am one complete trip around the Sun. For Earth, one of me is a year. Who am I?

5. _____b_____  I am the force of attraction, or pull, between two objects. I increase as the mass of the objects increases. What am I?

6. _____a_____  I am the shape of a planet’s orbit. Who am I?
Earth and Sun

Fill in the blanks.

<table>
<thead>
<tr>
<th>axis</th>
<th>night</th>
<th>summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>concentrated</td>
<td>revolution</td>
<td>winter</td>
</tr>
<tr>
<td>day</td>
<td>seasons</td>
<td></td>
</tr>
</tbody>
</table>

Earth moves in two main ways. Each year, it makes one \underline{revolutions} around the Sun. At the same time, Earth also spins on its \underline{axis}. As it spins, half of Earth faces the Sun and has \underline{day}, while the other half faces away from the Sun and has \underline{night}. Earth’s tilt on its \underline{axis} causes \underline{seasons}.

The hemisphere of Earth tilted toward the Sun has \underline{summer}. Temperatures are warmer at this time of year because the Sun’s heat strikes at a direct angle and is \underline{concentrated}. The hemisphere tilted away from the Sun has \underline{winter}. The seasons in the Northern Hemisphere and Southern Hemisphere are always opposite.
Earth and Moon

Use your textbook to help you fill in the blanks.

How does the Moon appear?

1. Although the Moon has no water, vast plains called maria, a Latin word meaning “seas,” cover large parts of its surface.

2. Rocks striking the Moon over billions of years have formed many craters.

3. The Moon shines with light that comes from the Sun and reflects off the Moon’s surface.

4. The appearance and shape of the Moon as you see it from Earth is called a(n) ______ phase.

What causes eclipses?

5. A darkening or hiding of the Sun, a planet, or a moon by another object in space is a(n) ______ eclipse.

6. A solar eclipse happens when the ______ Moon casts a shadow on part of Earth, and people there see the Moon move across the face of the Sun.

7. A solar eclipse occurs only during the ______ new moon ______ phase.

8. A lunar eclipse happens when the Moon moves into and is hidden by the shadow of ______ Earth ______.
9. During an eclipse, the area where the Sun is completely blocked is the _______ umbra______, and the area where light is not completely blocked is the _______ penumbra______.

What causes the tides?

10. The rise and fall of the ocean’s surface because of the gravity of the Moon and Sun is the _______ tide_______.

11. A bulge of water occurs on the side of Earth facing the _______ Moon_______ and on the opposite side of the planet.

12. There are high tides at the bulges of water and _______ low tides_______ halfway between the bulges.

13. When the Sun and Moon align at full moon and pull on Earth together, the higher high tides and lower low tides are called _______ spring tides_______.

14. When the Sun and Moon pull at a right angle and their pulls partly cancel each other, more moderate tides called _______ neap tides_______ occur.

Critical Thinking

15. What would be different on Earth if the Moon did not exist?

Possible answers: Nights would be darker because no light would reflect from the Moon; no eclipses would occur; tides would be much less noticeable because the oceans would be affected only by the much weaker pull of the Sun.
Earth and Moon

Use the words below to help you complete the sentences.

<table>
<thead>
<tr>
<th>lunar eclipse</th>
<th>phase</th>
<th>solar eclipse</th>
</tr>
</thead>
<tbody>
<tr>
<td>maria</td>
<td>rill</td>
<td>tide</td>
</tr>
</tbody>
</table>

1. A groove in the Moon’s surface is often called a ________ rill ________.

2. The periodic rise and fall of the ocean’s surface is the ________ tide ________.

3. The appearance and shape of the Moon as you see it from Earth is called a ________ phase ________.

4. When the Moon moves into Earth’s shadow, a ________ lunar eclipse ________ occurs.

5. A vast plain on the Moon’s surface is a ________ maria ________.

6. When the Moon passes directly between the Sun and Earth, a ________ solar eclipse ________ happens.
Earth and Moon

Fill in the blanks.

<table>
<thead>
<tr>
<th>low</th>
<th>month</th>
<th>rotates</th>
<th>tides</th>
</tr>
</thead>
<tbody>
<tr>
<td>lunar eclipse</td>
<td>phase</td>
<td>solar eclipse</td>
<td></td>
</tr>
</tbody>
</table>

The Sun lights half of the Moon at all times, but people on Earth see different amounts of the Moon’s lit half at different times of the _______ month _______. The shape of the Moon as you see it from Earth at a particular time is called its _______ phase _______. The Moon sometimes passes directly between the Sun and Earth, causing a _______ solar eclipse _______. When Earth’s shadow falls on the Moon, a _______ lunar eclipse _______ occurs.

The gravity of the Moon and the Sun pull on the surface of Earth’s oceans, forming bulges that we know as _______ tides _______. As Earth _______ rotates _______, the tides move around the planet. Most places have two high tides and two _______ low _______ tides during a single day.

The Moon is a rocky body with no atmosphere.
What Would Happen if Gravity Went Away?

Read the Writing in Science feature in your textbook.

Write About It

Explanatory Writing  You know that gravity keeps everything on Earth from floating off into space. Look at the picture on page 326 of your textbook. Explain what would change if gravity suddenly stopped working.

Planning and Organizing

Explanatory writing requires you to organize your ideas in chronological or time order. When Luis planned to make a mobile to represent the solar system, he needed to list the steps in sequence. Here are some steps that he wrote, number them from 1 to 5 with 1 being the first step.

1. 3. Next, cut out the circles. Punch a hole at the top.
2. 5. Then, thread the string through the hole in each circle. Attach it to a coat hanger. Finally, paste a cutout of the Sun onto the coat hanger.
3. 1. First, look at the sizes of the planets in comparison to each other.
4. 4. After that, use string to represent how far each planet is from the Sun.
5. 2. Then, use a compass to draw circles on cardboard to represent each planet. Make sure each circle represents the relative size of each planet. Color each planet and write its name.
Now write the first draft of your composition. Begin with a paragraph that establishes your topic and briefly describes the important ideas. Then describe the events that occur in chronological order. End with a short summary of the events and how they relate to your topic.

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Now revise and proofread your instructions. Ask yourself:

► Have I explained the topic and described the important ideas?

► Have I described the events in time order?

► Have I provided clear descriptions of the events?

► Have I corrected all grammar errors?

► Have I corrected all errors in spelling, punctuation, and capitalization?
The Solar System

Use your textbook to help you fill in the blanks.

How do we observe objects in space?

1. An optical telescope uses lenses or mirrors to make distant objects seem larger and nearer.

2. The orbiting Hubble Space Telescope “sees” objects more clearly than Earth-based telescopes because Earth’s atmosphere does not change Hubble’s view.

3. Radio telescopes are giant dishes on Earth’s surface that gather radio waves from objects in space.

What are planets?

4. The solar system includes eight planets that orbit the Sun.

5. The planet closest to the Sun is Mercury, and the planet farthest away from the Sun is Neptune.

6. Mercury, Venus, Earth, and Mars are terrestrial planets with surfaces made of rock.

7. Jupiter, Saturn, Uranus, and Neptune are jovian planets with surfaces made of gases.

How do the planets compare?

8. The most noticeable feature about Saturn is its large set of rings that are made of ice and rock.
9. Venus has an atmosphere made mostly of carbon dioxide, which holds in heat and gives this planet the hottest surface in the solar system.

10. The solar system's highest mountains and largest canyon system are on the surface of the planet Mars.

How do the moons compare?

11. A natural object that orbits a planet is a moon.

12. The solar system's moons are natural satellites, but artificial satellites orbit Earth to gather weather data and help people communicate.

13. Objects from space can strike moons or planets to create bowl-shaped holes called craters.

What are asteroids, comets, and meteors?

14. Most of the solar system's asteroids orbit the Sun in a belt between Mars and Jupiter.

15. A comet is a mixture of ices, dust, and rock that moves around the Sun.

How do we explore the solar system?

16. The only place in the solar system that humans have visited is Earth's Moon.

Critical Thinking

17. Why is it not possible to land a spacecraft on Jupiter or Saturn? Jupiter and Saturn have no landing surfaces because both are made of gases.
The Solar System

Match the correct letter with the description and fill in the crossword puzzle.

a. asteroid  d. moon  g. telescope
b. comet  e. planet

c. meteor  f. satellite

Across
1. ___ g ___ an instrument that makes distant objects seem larger and nearer

2. ___ e ___ a large object that orbits a star but does not give off its own light

4. ___ a ___ a rock that revolves around the Sun in a belt between Mars and Jupiter

6. ___ f ___ an object in space that orbits another object

7. ___ b ___ an object made of ice, dust, and rock that orbits the Sun

Down
2. ___ e ___ a large object that orbits a star but does not give off its own light

3. ___ d ___ a natural object that orbits a planet

5. ___ c ___ a meteoroid that enters Earth's atmosphere
The major objects of the solar system are eight planets that orbit the Sun and their moons. Earth is one of the terrestrial planets, which have rocky surfaces. The jovian planets, such as Jupiter and Saturn, have surfaces made of gases. Earth has one moon, some planets (such as Mercury and Venus) have none, and other planets (such as Jupiter and Saturn) have dozens.

Other objects in the solar system include the asteroids that orbit the Sun between Mars and Jupiter. Balls of ice, dust, and rock in elongated elliptical orbits around the Sun are comets. These bodies originate in the Oort Cloud, of which the Kuiper Belt is a part. When far away from the Sun, comets remain frozen, but they form a glowing tail of gas and dust as they get close to the Sun. Astronomers study the solar system with many types of telescopes.
**Voyager Discoveries**

**Read the following passage.**

In 1977, NASA launched the Voyager Interstellar Mission to explore Jupiter, Saturn, Uranus, Neptune, and their moons. The trip had to be very precisely planned. Speeds and distances had to be accurately calculated. The two *Voyager* spacecraft had to be close enough to each planet to collect data and to get a pull from that planet’s gravity in order to be propelled toward their next destination. At the same time, the spacecraft had to be far enough away from the planets that they would not go into orbit around them. All of NASA’s careful planning worked. The *Voyager* Mission has provided scientists with new and closer looks at our farthest neighbors.

**Voyager Spacecraft Travel**

**Jupiter—1979:**
Images show Jupiter’s rings. Volcanic activity is observed on Io, one of Jupiter’s moons.

**Saturn—1980-91:**
Scientists get a close look at Saturn’s rings. They contain structures that look like spokes, or braids. Scientists observed that Titan, one of Saturn’s moons, has a thin atmosphere and active, geyser-like landforms.

**Uranus—1986:**
Scientists discover the dark rings around Uranus. They also see ten new moons, bringing Uranus’s total to 15 moons. *Voyager* sends back detailed images and data on the planet, its moons, and dark rings.

**Neptune—1989:**
Large storms are seen on the planet. One of these storms is Neptune’s Great Dark Spot. Neptune was originally thought to be too cold to support this kind of weather.
After observing these planets, the *Voyager* spacecraft keep traveling. They are the first human-made objects to go beyond the heliosphere. The heliosphere is the region of space reached by the energy of our Sun. It extends far beyond the most distant planets in the Solar System.

**Write About It**

**Cause and Effect**

- Look for the reason why something happens to find a cause.
- An effect is what happens as a result of a cause.

1. What would cause the *Voyager* spacecraft to be propelled toward their next destination?

   The pull from the planet’s gravity they are visiting would propel them to their next destination.

2. What was an effect of the *Voyager* mission?

   Answer may discuss that the Voyager mission provided scientists with new and closer looks at Jupiter, Saturn, Uranus, and Neptune.
Stars and the Universe

Use your textbook to help you fill in the blanks.

How do stars form?

1. Stars form from a huge cloud of gases and dust called a(n) _______ nebula _______.

2. When the cloud contracts and powerful reactions start to turn hydrogen atoms into helium atoms to produce energy, a(n) _______ protostar _______ forms.

3. After billions of years, the hydrogen fuel of a star begins to run out and the star expands to become a _______ red giant _______.

What happens to larger stars?

4. A star that begins life with much more hydrogen than a medium-size star such as our Sun ends its life as an exploding star called a(n) _______ supernova _______.

5. Very massive stars end their lives as _______ black holes _______, which are objects with gravity so powerful that even light cannot escape from them.

6. Stars are classified by their size, _______ color _______, and temperature.

7. The Sun is a medium-size _______ yellow _______ star with a surface temperature of about 6000°C.

8. By studying the motion of distant stars, scientists have discovered about 160 __________ planets outside our solar system.
What are constellations?

9. Patterns of stars in the sky are ___________ constellations ________.

10. Most stars are so far from Earth that astronomers use huge measuring units, such as the ___________ light-year ________, to describe the distance.

What are star systems?

11. Huge, far-off families of stars that look like hazy patches of faint light in the night sky are ___________ galaxies ________.

12. There are spiral galaxies, ___________ elliptical ________ galaxies, and irregular galaxies.

13. When two stars are near each other and rotate around each other, they form a(n) ___________ binary ________ star.

How did the universe form?

14. The theory that the universe started from a single point and then exploded outward is the ___________ big bang ________ theory.

15. According to this theory, the universe continues to ___________ expand ________.

Critical Thinking

16. Will the Sun always shine?

No. Like other stars, the Sun was born, ages, and will die. In about 5 billion years, the Sun will be near the end of its life and will become a white dwarf.
## Stars and the Universe

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. big bang theory</th>
<th>d. galaxies</th>
<th>g. star</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. black hole</td>
<td>e. light-year</td>
<td>h. supernova</td>
</tr>
<tr>
<td>c. constellation</td>
<td>f. nebula</td>
<td>i. white dwarf</td>
</tr>
</tbody>
</table>

1. An exploding star is a \(\text{h}\).
2. Huge, very far-off families of stars are \(\text{d}\).
3. An object in space that produces its own energy, including heat and light, is a \(\text{g}\).
4. The idea that the universe began with a big bang and has been expanding since that time is the \(\text{a}\).
5. The distance that light travels in one year is a \(\text{e}\).
6. An object that is so dense and has so much gravity that not even light can escape it is a \(\text{b}\).
7. A huge cloud of gases from which stars form is a \(\text{f}\).
8. A group of stars that forms a pattern is a \(\text{c}\).
9. A small, very dense star is a \(\text{i}\).
Stars and the Universe

Fill in the blanks.

<table>
<thead>
<tr>
<th>elliptical</th>
<th>helium</th>
<th>spiral</th>
<th>white dwarf</th>
</tr>
</thead>
<tbody>
<tr>
<td>galaxies</td>
<td>nebulas</td>
<td>Sun</td>
<td>10 billion</td>
</tr>
</tbody>
</table>

Scientists use the big bang theory to explain how the universe began and why it is expanding. The universe contains many families of stars called galaxies. Those shaped like pinwheels are spiral galaxies. There are also elliptical galaxies and irregular galaxies. The star closest to Earth, after the Sun, is Proxima Centauri.

Like living things, stars have life cycles. Stars are born from clouds of gas called nebulas. When gravity causes nebulas to contract enough, temperature rises and reactions that change hydrogen into helium start. When the helium is also gone, the star shrinks and cools to become a white dwarf. The life cycle of a medium-size star, such as our Sun, is about 10 billion years. Our Sun is about 5 billion years old.
Chapter 8 • The Universe
Reading and Writing

Name ___________________________ Date ____________

The Universe

Choose the letter of the best answer.

1. Gravity is the
   a. measure of mass.
   b. force of attraction between objects.
   c. size of an object.
   d. long distance between stars.

2. What is an orbit?
   a. the speed of a planet moving around the Sun
   b. the order of planets in distance from the Sun
   c. the path a planet takes as it moves around the Sun
   d. the tilt of Earth on its axis

3. Inertia is the tendency of a moving object to
   a. keep moving after it hits something.
   b. keep moving in a straight line.
   c. keep moving faster and faster.
   d. rise upward against gravity.

4. What is Earth’s revolution?
   a. its spinning motion on its axis
   b. its gravitational pull on the Moon
   c. its changing of seasons
   d. its movement in orbit around the Sun

5. Which of these is a lunar phase?
   a. penumbra
   b. new moon
   c. lunar eclipse
   d. neap moon

6. What happens during new moon when the Moon passes directly between the Sun and Earth?
   a. a solar eclipse
   b. a quarter moon
   c. a lunar eclipse
   d. a new season

7. A lunar eclipse happens only during
   a. new moon.
   b. crescent moon.
   c. quarter moon.
   d. full moon.
8. What causes tides?
   a. earthquakes beneath the ocean
   b. the gravity of the Moon and Sun
   c. Earth’s inertia in space
   d. high winds on the ocean’s surface

9. A natural object that orbits a planet is a(n)
   a. asteroid.
   b. comet.
   c. moon.
   d. star.

10. In the solar system, most asteroids are
    a. beyond Neptune.
    b. orbiting Saturn.
    c. between Mars and Jupiter.
    d. next to the Sun.

11. The source of the solar system’s comets is the
    a. asteroid belt.
    b. Oort Cloud.
    c. Sun.
    d. Moon.

12. What does a telescope do?
    a. makes objects in space appear larger and nearer
    b. brings objects closer to Earth
    c. makes Earth seem brighter
    d. allows us to see black holes

13. Stars form from a cloud of gas called a
    a. galaxy.
    b. nebula.
    c. universe.
    d. neutron star.

14. What object is so dense and has such strong gravity that no light can escape it?
    a. black hole
    b. neutron star
    c. white dwarf
    d. red giant

15. What is the name of the theory that explains the way the universe began?
    a. The Gravitational Microlensing Theory
    b. The Stellar Life Cycle Theory
    c. The Big Bang Theory
    d. The Expanding Universe Theory
Green and Clean: Plants as Pollution Control

Read the Literature feature in your textbook.

Write About It

Response to Literature  This article describes how plants are used to help clean polluted soil. Research additional information about cleaning up waste. Write a report about the cleaning process. Include facts and details from this article and from your research.

Paragraphs should have a clear topic sentence that directly identifies another process for cleaning up pollution. The sentences that follow the topic sentence should support the topic sentence by describing the steps of the clean-up process, the pollution that it removes, and whether the clean-up process is cost- and time-efficient. Supporting sentences should include researched facts and details about the pollution clean-up process as well as facts and details from the article. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will stay on topic, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from one idea to the next.
Comparing Kinds of Matter

Matter

Has Certain Properties:

Density
Buoyancy
Mass
Weight
Volume

Is Made of:

Atoms

Contains Different Types of Elements:

Metal
Nonmetal
Metalloid
Properties of Matter

How can you describe matter?

1. The amount of matter in an object is its ___mass___.

2. The mass of an object is measured in ___grams___ or kilograms.

3. A measure of how strongly gravity pulls on an object is the object's ___weight___.

4. The greater the ___mass___ of an object, the greater its weight.

5. Weight is measured in ___Newtons___.

6. The amount of space an object takes up is its ___volume___.

7. To measure liquid volume in ___milliliters___, scientists use tools such as beakers or graduated cylinders.

8. The volume of solids is measured in ___cubic centimeters___.

9. Anything that has mass and volume is ___matter___.

What is density?

10. The amount of mass for each milliliter of a substance is that substance's ___density___.

11. To calculate density, divide an object's ___mass___ by its ___volume___.

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12. Buoyancy depends on \[ \text{density} \], which depends on mass and volume.

13. Changing the mass or volume of an object changes its density and \[ \text{buoyancy} \].

14. If an object covers a large enough area of the water’s surface, it can float on the water because of the \[ \text{surface tension} \] of water particles.

What forms can matter have?

15. Matter can exist as a solid, a(n) \[ \text{liquid} \], or a gas.

16. A solid has a definite \[ \text{shape} \] and volume.

17. A liquid has a definite \[ \text{volume} \], but it takes the shape of the container holding it.

18. A gas does not have a definite volume or a definite \[ \text{shape} \].

Critical Thinking

19. How can matter be described?

Possible answer: Matter can be described by its many properties, including its state, mass, density, and weight.
Properties of Matter

Fill in the crossword puzzle from the clues below.

Across
4. The amount of space that matter takes up
5. The metric unit used to measure weight
6. Anything that has mass and volume
7. The amount of mass for each milliliter of a substance

Down
1. The property of water that helps certain objects float
2. An object’s resistance to sinking
3. How strongly gravity pulls on an object
6. The amount of matter in an object
We describe matter in a number of ways. Matter can exist as a(n) _____________ , a liquid, or a(n) _____________ . Scientists use these and other _____________ to identify matter.

The amount of matter in an object is the object’s _____________ , a property that is _____________ . However, the _____________ of an object changes as the force of gravity changes. The amount of space that an object takes up is its _____________ . Scientists also measure the amount of matter for each milliliter of a substance, or its _____________ . An object’s resistance to sinking is _____________ . When an object is placed on a fluid, the object and the fluid _______ push _______ against each other. If the fluid is denser, the object will _______ float _______ . If the object is denser, the object will _______ sink _______ . Matter is anything that has mass and volume.
Elements
Use your textbook to help you fill in the blanks.

What is matter made of?

1. A substance that cannot be broken down chemically into simpler substances is a(n) ________ element.

2. One important property of an element is its ________ state at room temperature.

3. Another important property of an element is the way that it ________ combines with other elements.

4. Today we know that a(n) ________ atom is the smallest unit of an element that has that element's properties.

What are atoms and molecules made of?

5. The center of an atom is its ________ nucleus.

6. An atom's nucleus contains particles called protons that have a positive charge and particles called ________ neutrons that have no charge.

7. Negatively charged particles called ________ electrons move around the nucleus.

8. Because an atom has the same number of ________ protons and electrons, the atom has no overall charge.

9. The number of protons in an atom is that atom's ________ atomic number.
10. An atom’s protons and neutrons have about the same mass, which is one \underline{atomic mass} unit, or a.m.u.

11. The mass of all particles of an atom added together is its \underline{atomic weight}.

12. Two or more atoms joined into a single particle form a(n) \underline{molecule}.

13. Molecules have properties that are different than the \underline{elements} that form them.

How are elements grouped?

14. Dmitri Mendeleev created the \underline{periodic table} of elements.

15. The table’s columns group elements according to their \underline{properties}.

What are the most common elements?

16. In space, the most common elements are \underline{hydrogen} and helium.

17. On Earth, elements such as \underline{hydrogen} and any of these: oxygen, silicon, aluminum, nitrogen, iron, and calcium are among the most common.

Critical Thinking

18. What is matter made of?

All matter is composed of the 112 known elements, either by themselves or in combination with other elements.
Elements

Read each clue. Write the answer in the blanks using the words below.

atom  element  molecule  nucleus
electron  metal  neutron  proton

1. The smallest unit of an element that retains that element’s properties is a(n) _______ atom _______.

2. The particle in an atom that has a negative charge is a(n) _______ electron _______.

3. A substance that chemical reactions cannot break down into something simpler is a(n) _______ element _______.

4. An element that has properties such as shine, conductivity, and flexibility is a(n) _______ metal _______.

5. Two or more atoms that are joined into one particle are a(n) _______ molecule _______.

6. In the nucleus of an atom, a particle that has no electrical charge is a(n) _______ neutron _______.

7. The center of an atom is its _______ nucleus _______.

8. In the nucleus of an atom, a particle that has a positive electrical charge is a(n) _______ proton _______.
Elements

Fill in the blanks.

Every substance on Earth is made of one or more elements. Dmitri Mendeleev created the periodic table in the 1860s. It groups elements according to their properties. One important property of an element is its state at room temperature. Another is the way that it combines or mixes chemically with other elements. A third property is the element’s classification as a(n) metal, a(n) nonmetal, or a(n) metalloid.

Each element is composed of tiny particles called atoms, the smallest units that retain the element’s properties. All atoms have the same parts. The center of an atom is its nucleus. The nucleus contains protons and neutrons. Atoms also contain electrons, which move around the nucleus. Protons and neutrons have a much larger mass than electrons do.
Element Discovery

When Mendeleev shuffled his element cards to create the periodic table in 1869, he suspected he wasn’t playing with a full deck. Many of the elements had already been discovered, but he believed others would come later.

1766 Hydrogen—The most abundant atom in nature is discovered by Henry Cavendish. In 1766, Cavendish is experimenting with materials in his lab when he isolates a gas that is flammable. He realizes that this gas might be a new element and calls it flammable air. The element later gets its name from the Greek words meaning “water forming,” when another scientist discovers that water is made of hydrogen and oxygen.

1772–74 Oxygen—Scientists Joseph Priestley and Carl Wilhelm Scheele independently discover that when they heat certain compounds, a new kind of “air” or gas is given off. The new gas makes substances burn five times faster than ordinary air. The new gas is named oxygen from the Greek words meaning “acid former.” That’s because when oxygen combines with other elements, the compounds are usually acidic.

1868–1895 Helium—Joseph Lockyer discovers helium in 1868 by studying the Sun’s spectrum with a spectroscope during a solar eclipse. He finds color lines that no element at the time was known to produce. He infers the lines must be due to a new element found only in the Sun. The element is named helium, after Helios, the Greek god of the Sun. In 1895, helium is finally found on Earth in uranium minerals.

1940 Plutonium—Scientists in Berkeley, California, create a new element by bombarding uranium with particles of deuterium, a special form of hydrogen. They name the element after the recently discovered planetary body Pluto.
1952 Einsteinium—A team of scientists find this element while studying the radioactive debris created when a hydrogen bomb explodes. They name it in honor of scientist Albert Einstein. Only a small amount of einsteinium has ever been produced, and it exists only for a fraction of a second before it transforms itself into other elements.

The periodic table isn’t finished. Elements are still being added to it. In the past 75 years, 26 new elements have been added to the table. That’s about one element every three years! If you found a new element, what would you name it?

Write About It
Classify

1. Which elements were discovered as gases?
2. Which elements have names that describe their properties? How are the other elements named?

Hydrogen, Helium, and Oxygen. Hydrogen and Oxygen are both named for their properties. Hydrogen was discovered to be part of water and was named from words meaning “water-former.” Oxygen was named for words that mean “acid former” because oxygen containing compounds are usually acidic. Other elements are named for famous people and mythological figures.
Metals, Nonmetals, and Metalloids

Use your textbook to help you fill in the blanks.

What are metals?
1. Metals share certain properties, such as __________ shiny surfaces.
2. Metals conduct __________ heat and __________ electricity well.
3. Metals are also easy to shape because they have __________ malleability.
4. The property of __________ ductility allows a metal to be pulled into thin wires.
5. Almost all metals occur naturally in the __________ solid state, but they vary in __________ hardness.
6. When left out of doors, many metals will __________ corrode as they combine with nonmetals around them.

How do we use metals?
7. Metals such as steel are useful because they are both __________ strong and flexible.
8. Reactive metals such as cadmium and nickel are used to make electricity in __________ batteries.

What elements are nonmetals and metalloids?
9. Nonmetals are not good __________ conductors of electricity.
10. Instead of bending, nonmetals usually __________ break or __________ crumble.
11. Elements with properties that are between metals and nonmetals are ______ metalloids ______.

12. Solid metalloids look like metals, but they do not have _____________ shiny surfaces.

13. Because they do not bend well, metalloids are not _____________ malleable or ductile.

14. Metalloids are called _____________ semiconductors because they do not conduct electricity as well as metals but conduct it better than nonmetals.

15. Nonmetals are excellent _____________ insulators of electricity and heat.

16. Semiconductor metalloids such as _____________ silicon are used to make computer chips.

Critical Thinking

17. Describe the properties of metals, nonmetals, and metalloids.

Metals are excellent conductors, have malleability and ductility, and have shiny surfaces when polished. Nonmetals are not good conductors, break or crumble rather than bend, and have dull rather than shiny surfaces. Metalloids may look like metals, but they do not have shiny surfaces. They are semiconductors that conduct electricity better than nonmetals but not as well as metals. They are also not as malleable or as ductile as metals.
Metals, Nonmetals, and Metalloids

Who am I? What am I?

Choose a word from the word box above that answers each question.

<table>
<thead>
<tr>
<th>a. corrosion</th>
<th>d. metal</th>
<th>g. nonmetal</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. ductility</td>
<td>e. metalloid</td>
<td>h. semiconductor</td>
</tr>
<tr>
<td>c. malleability</td>
<td>f. noble gas</td>
<td></td>
</tr>
</tbody>
</table>

1. ______ d I am a shiny solid that conducts electricity very well. What am I?

2. ______ f I am very particular. I am an element that does not like to mix with others. What am I?

3. ______ e Look for me in the middle of columns in the periodic table. I am located between the metals and the nonmetals. Who am I?

4. ______ b I am a property of metals. Because of me, people can make copper into thin wires. What am I?

5. ______ g I am a poor conductor of electricity. Try to bend or flatten me, and I will break or crumble instead. Who am I?

6. ______ a I happen when metals are left out of doors and combine with nonmetals. I create rust in iron. Who am I?

7. ______ c I am the property that lets you bend and shape a metal. What am I?

8. ______ h I am a metalloid used in computer chips. I conduct electricity better than a nonmetal, but not as well as a metal. Who am I?
 Metals, Nonmetals, and Metalloids

Fill in the blanks.

<table>
<thead>
<tr>
<th>break</th>
<th>electricity</th>
<th>metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ductile</td>
<td>insulators</td>
<td>nonmetals</td>
</tr>
<tr>
<td>dull</td>
<td>malleable</td>
<td>opposite</td>
</tr>
</tbody>
</table>

Scientists classify an element as a metal, a nonmetal, or a metalloid on the basis of the element's properties. Most **metals** can be polished until their surfaces are shiny. They conduct **electricity** and heat well. When bent and pulled, metals are both **malleable** and **ductile**.

Nonmetals have properties that are the **opposite** of those of metals. The surface of a nonmetal is **dull** rather than shiny. Nonmetals are good **insulators** rather than conductors. Instead of bending, nonmetals **break** or crumble. Metalloids have some properties like those of metals and some that are more like those of **nonmetals**. Metalloids are semiconductors—materials that conduct electricity better than nonmetals do, but not as well as metals.
Comparing Kinds of Matter

Choose the letter of the best answer.

1. A material that cannot be broken down into simpler chemical substances is a(n)
   a. element.
   b. metal.
   c. chemical.
   d. molecule.

2. What is the smallest particle of an element?
   a. molecule
   b. proton
   c. atom
   d. metalloid

3. The positively charged particles in an atom are called
   a. neutrons.
   b. electrons.
   c. protons.
   d. molecules.

4. Which particles share the nucleus of an atom with the protons?
   a. neutrons
   b. protons

5. Which particles in an atom are negatively charged?
   a. protons
   b. neutrons
   c. molecules
   d. electrons

6. Two or more atoms can join to form a(n)
   a. element.
   b. neutron.
   c. molecule.
   d. superatom.

7. The amount of matter in an object is its
   a. weight.
   b. mass.
   c. volume.
   d. density.
Choose the letter of the best answer.

8. The strength of gravity on an object determines that object’s
   a. mass.
   b. volume.
   c. weight.  
   d. electrical charge.

9. The amount of space being taken up by matter is known as its
   a. volume.
   b. weight.
   c. mass.
   d. density.

10. Anything that has mass and volume is
    a. metallic.
    b. matter.
    c. gaseous.
    d. atomic.

11. The amount of mass for each milliliter of a substance determines the substance’s
    a. weight.
    b. buoyancy.
    c. density.  
    d. volume.

12. An object’s resistance to sinking is called
    a. weight.
    b. buoyancy.  
    c. volume.
    d. surface tension.

13. The property that allows matter to be bent, flattened, or hammered without breaking is
    a. malleability.
    b. surface tension.
    c. ductility.
    d. buoyancy.

14. What happens to a metal that is left exposed to the environment and combines chemically with a nonmetal?
    a. It shrinks.
    b. It becomes a metalloid.
    c. It corrodes.
    d. It becomes a nonmetal.
Physical and Chemical Changes

Use your textbook to help you fill in the blanks.

A physical change may involve a change in shape, size, or _______ state of matter. The three states of matter are ________ , ________ , and ________ .

<table>
<thead>
<tr>
<th>Name of Process</th>
<th>Speed of Process</th>
<th>Initial Phase</th>
<th>Final Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporation</td>
<td>Slow</td>
<td>Liquid</td>
<td>Gas</td>
</tr>
<tr>
<td>Boiling</td>
<td>Fast</td>
<td>Liquid</td>
<td>Gas</td>
</tr>
<tr>
<td>Sublimation</td>
<td>Fast</td>
<td>Solid</td>
<td>Gas</td>
</tr>
<tr>
<td>Melting</td>
<td>Slow/Fast</td>
<td>Solid</td>
<td>Liquid</td>
</tr>
<tr>
<td>Condensation</td>
<td>Slow/Fast</td>
<td>Gas</td>
<td>Liquid</td>
</tr>
</tbody>
</table>
Changes of State

Use your textbook to help you fill in the blanks.

How can matter change state?

1. Altering the form or organization of an object without changing the type of matter within it is called a(n) _____________.

2. The three states of matter are ________________, liquid, and ________________.

3. The state of matter of an object is a(n) ____________ property.

4. The average vibration of molecules in an object is measured by _____________.

5. When a solid gains heat energy, its molecules begin vibrating too quickly to stay together, so the solid becomes a(n) _____________.

6. When gases lose heat, they ________________ into liquids.

7. A liquid loses heat and ________________ into a solid.

8. When a solid changes directly into a gas, it _________________.

9. Most liquids become ________________ when they change to a solid.
When does matter change state?

10. When a substance melts or boils, it absorbs _____ heat energy _____.

11. The temperature at which a substance changes from a solid to a liquid is its _____ melting point _____.

12. The temperature at which a substance changes from a liquid to a gas is its _____ boiling point _____.

13. The temperature at which a substance changes from a liquid to a solid is its _____ freezing point _____.

14. Nonmetals are weakly attracted to one another, so they have _____ low ____ melting and boiling points.

15. The slow change from a liquid to a gas at temperatures below the boiling point is called _____ evaporation _____.

What are expansion and contraction?

16. An increase in an object’s volume when it is heated is called _____ thermal expansion _____; a decrease in its volume when it is cooled is called _____ thermal contraction _____.

Critical Thinking

17. How does water change when heat is added or removed?

   When liquid water is heated to 100°C, it boils and changes into a gas. If the gas is cooled, it condenses and becomes a liquid. If the liquid is cooled to 0°C, it freezes and becomes a solid. If ice is heated, it melts to become water or sublimes to become a gas. Liquid water expands when heated and when it turns into ice.
Changes of State

Choose words from the word box below to finish the crossword puzzle.

boiling  freezing  sublimation
contraction  melting

Across
2. A change from a solid to a gas.
4. The temperature at which water changes from a solid to a liquid is the melting point.
5. A decrease in an object’s volume because of a change in temperature is thermal contraction.

Down
1. The temperature at which water changes from a liquid to a solid is its freezing point.
3. The temperature at which water changes from a liquid to a gas is the boiling point.
Changes of State

Fill in the blanks.

<table>
<thead>
<tr>
<th>boiling point</th>
<th>heat energy</th>
<th>solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>freezing point</td>
<td>liquid</td>
<td>sublimation</td>
</tr>
<tr>
<td>gas</td>
<td>melting point</td>
<td>temperature</td>
</tr>
</tbody>
</table>

All substances have three common forms called physical states. These states are _____________, liquid, and _____________. The physical state of matter is changed when _____________ is added or taken away. A measure of the average heat energy that a substance has (the average vibration of its molecules) is its _____________. When a solid is heated to its _____________, its molecules start moving faster, and the solid changes into a(n) _____________. When the liquid is heated to its _____________, its molecules move even faster, and the liquid turns into a gas. The melting point of water is 0°C, and its boiling point is 100°C. Sometimes a solid changes directly into a gas without passing through the liquid state, a process called _____________. When a liquid is cooled to its _____________, it becomes a solid. When a gas is cooled, it condenses and becomes a liquid.
Mixtures

Use your textbook to help you fill in the blanks.

What are mixtures?

1. A physical combination of substances that remain the same is a(n) ______ mixture.

2. Mixtures can be ______ separated into their original substances.

3. Mixtures with different parts that can be plainly seen with the naked eye are called ______ heterogeneous ______ mixtures.

4. Mixtures that look smooth to the naked eye but speckled under a microscope are called ______ suspensions ______.

5. Over time, one or more parts of a suspension can ______ settle out ______.

6. A heterogeneous mixture with parts that do not settle out is called a(n) ______ colloid ______.

What are solutions?

7. A mixture that looks the same everywhere, even under a microscope, is called a(n) ______ solution ______.

8. The part of a solution that is dissolved is the ______ solute ______.

9. The part of a solution that dissolves the other substance is called the ______ solvent ______.
LESSON Outline

10. A solution of two or more solids is a(n) ___________ alloy.

11. Because it can dissolve many things, water is called
the ___________ universal solvent.

How can you take mixtures apart?

12. To separate one part of a mixture from another, you can use
a(n) ___________ physical property.

13. When two liquids in a mixture have different boiling points,
they can be separated by ___________ distillation.

14. Because liquids travel at different speeds through an
absorbent paper, they can be separated by ___________ chromatography.

How are mixtures used?

15. Cheese, gelatin, marshmallows, and paint are all examples of
useful ___________ colloids.

16. Copper is alloyed with zinc to make ___________ brass.

Critical Thinking

17. Suppose you were to mix together salt, water, and mud.
Identify type of mixture you have made. Describe how you
could separate the parts of the mixture from one another.

The mixture is a heterogeneous suspension because it is not
the same throughout. The specks of mud could be seen with a
microscope, and the mud would eventually settle. The mixture
could be poured through a filter, or it could be allowed to settle to
separate out the mud. Then, the water could be boiled away, leaving
behind the dissolved salt.
Mixtures

Who am I? What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th>a. alloy</th>
<th>b. colloid</th>
<th>c. distillation</th>
<th>d. mixture</th>
<th>e. solubility</th>
<th>f. solute</th>
<th>g. solution</th>
<th>h. solvent</th>
</tr>
</thead>
</table>

1. ______ b I am smoke, cheese, and foam. I am a mixture that does not settle. Who am I?

2. ______ h I am the water in sugar water. Who am I?

3. ______ f I am the sugar in sugar water. Who am I?

4. ______ a I am steel and I am brass. Who am I?

5. ______ e I am the maximum amount of solute that can go into a solvent. What am I?

6. ______ c Using evaporation and condensation, I can separate the liquids in a mixture. What am I?

7. ______ d I am a combination of two or more materials, but none of my parts are chemically combined. What am I?

8. ______ g I can be made with solids, liquids, and gases. All my parts blend so that I look the same everywhere, even under a microscope. Who am I?
Mixtures

Fill in the blanks.

<table>
<thead>
<tr>
<th>alloys</th>
<th>distillation</th>
<th>liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>boiling points</td>
<td>heterogeneous</td>
<td>solids</td>
</tr>
<tr>
<td>condensing</td>
<td>homogeneous</td>
<td>suspensions</td>
</tr>
</tbody>
</table>

Several substances that are physically mixed together but not chemically combined are called mixtures. Mixtures can include various combinations of solids, liquids, and gases.

Liquids in a mixture may have different **boiling points**. Boiling and **condensing** the liquids, a process called **distillation**, can be used to separate them.

There are two kinds of mixtures: those that are the same throughout (**homogeneous**) and those that are not (**heterogeneous**). Homogeneous mixtures, such as sugar water, are called solutions. Gases form solutions more easily than **liquids** do, and liquids form solutions more easily than **solids** do. Solutions of two or more solids are called **alloys**.

The different parts of some heterogeneous mixtures can clearly be seen by the naked eye. These are called **suspensions**. Some suspensions settle to the bottom.
Compounds and Chemical Changes

Use your textbook to help you fill in the blanks.

What are compounds?

1. A combination of two or more elements is called a(n) ___________ compound.

2. A compound has different properties than do the ___________ elements that formed it.

3. Rust is a combination of iron and ___________ oxygen.

4. The chemical name for rust is ___________ iron oxide.

5. The chemical formula for rust is ___________ Fe₂O₃.

What are chemical changes?

6. Changing one substance into another is a(n) ___________ chemical change.

7. When atoms break their old links and form new links with other atoms, a(n) ___________ chemical reaction has occurred.

8. Chemists keep track of which substances are used and created in a chemical reaction by writing ___________ chemical equations.

9. Chemicals on the left side of a chemical equation are called ___________ reactants; chemicals on the right side are called ___________ products.

10. In every chemical reaction, the total mass of the reactants always equals the total mass of the products. This fact is known as the ___________ law of conservation of mass.
How can you spot a chemical change?

11. A color change on metal that is caused by a chemical change is called _______ tarnish _______.

12. Bubbles form when baking soda and vinegar are mixed, indicating that a _______ chemical change _______ has taken place.

13. A solid that forms when two solutions are mixed is called a(n) _______ precipitate _______.

14. If a chemical reaction produces heat and light, then reversing the reaction should _______ absorb energy _______.

How can you use chemical changes?

15. Plants use a chemical reaction called _______ photosynthesis _______ to produce sugars from sunlight, water, and carbon dioxide.

16. Plants and animals use a chemical reaction called _______ respiration _______ to burn sugars for energy.

17. Chemical reactions are used to produce a variety of products, such as _______ plastics _______.

Critical Thinking

18. Write the equation for the chemical change that produces water from two hydrogen molecules and one oxygen molecule. Label the reactants and the products. (Hint: Remember to take into account the conservation of mass.)

\[ 2H_2 + O_2 \rightarrow 2H_2O \] The reactants are on the left and the products are on the right.
Compounds and Chemical Changes

Use the words in the word box to fill in the blanks.

<table>
<thead>
<tr>
<th>chemical</th>
<th>photosynthesis</th>
<th>reactants</th>
</tr>
</thead>
<tbody>
<tr>
<td>compound</td>
<td>precipitate</td>
<td>tarnish</td>
</tr>
<tr>
<td>equations</td>
<td>products</td>
<td></td>
</tr>
</tbody>
</table>

1. The ____________ are on the left side of a chemical equation.
2. The ____________ are on the right side of a chemical equation.
3. The chemical reaction that plants use to produce sugar is known as ________.
4. A solid that is a product of a chemical reaction is called a(n) ________.
5. Atoms break their old links and form new links during a(n) ________ change.
6. Chemists keep track of chemical reactions by using chemical ________.
7. A color change in metal caused by a chemical change is called ________.
8. A chemical combination of two or more elements is a(n) ________.
A chemical change results in one or more products that are different from the reactants. Atoms break their links and form new links with other atoms to form new compounds.

Chemists describe what goes on in a chemical change by writing chemical equations. The substances to the left of the arrow in a chemical equation are the reactants; the substances to the right of the arrow are the products. The compounds in a chemical equation are written as chemical formulas. A chemical formula tells which elements are in a compound and how many atoms there are of each. For example, the chemical formula for water is \( \text{H}_2\text{O} \), and the chemical formula for carbon dioxide is \( \text{CO}_2 \). The chemical equation for photosynthesis is \( 6\text{H}_2\text{O} + 6\text{CO}_2 \xrightarrow{\text{☼}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \). The numbers of atoms of each element are the same on each side of the equation.
The Case of the Mystery Compounds

Write About It

Do research and write a report about how scientists can test water for pollutants and dangerous chemical compounds. Which chemical reactions do they use to perform the test? Give the steps of the process in order.

Getting Ideas

As you do research on how scientists test water, fill out the chart below. Write the steps in order.

<table>
<thead>
<tr>
<th>First</th>
<th>Students’ answers will vary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next</td>
<td></td>
</tr>
<tr>
<td>Last</td>
<td></td>
</tr>
</tbody>
</table>

Planning and Organizing

Organize the steps that Sean wrote about testing water for chlorine.

1. Chlorine will turn the litmus paper red, then white. ______
2. Place a sample of the water in a test tube. ______
3. Dip blue litmus paper in the water. ______
Drafting
Write a sentence to begin your report. Tell an important idea about testing water for pollutants and dangerous chemical compounds.
Students’ sentences will vary.

Now write your report. Use a separate piece of paper. Begin with the sentence you wrote above. Then tell the steps scientists follow to test water. Be sure to include important facts and details about chemical reactions.

Revising and Proofreading
Here are some sentences Sean wrote. They are very wordy. Read each pair. Combine each pair into one sentence by cutting out unnecessary words. Write the new sentence on the line.

1. Make sure the test tube you use is clean. It must be sterile.
   Make sure the test tube you use is sterile.

2. The chemical reaction may produce changes in color. It may produce changes in smell.
   The chemical reaction may produce changes in color and smell.

3. Test the sample quickly. Do the test within two hours.
   Test the sample within two hours.

Now revise and proofread your writing. Ask yourself:
- Did I tell the steps of testing water in order?
- Did I explain the chemical processes involved?
- Did I correct all errors?
Acids, Bases, and Salts

Use your textbook to help you fill in the blanks.

What are acids and bases?

1. A substance that tastes ____________ sour, turns blue litmus to red, and reacts with metals to make hydrogen gas is a(n) ____________ acid ____________.

2. When acids dissolve in water, they release ____________ hydrogen ions or H⁺ ions.

3. An atom or a molecule that has lost or gained one or more electrons is a(n) ____________ ion ____________.

4. The chemical formula of an acid often begins with ____________ H ____________.

5. Our stomachs produce ____________ HCl ____________, which helps digest food.

6. A substance that tastes ____________ bitter ____________, is slippery to the touch, turns red litmus to blue, and dissolves fats is a(n) ____________ base ____________.

7. When bases dissolve in water, they release ____________ hydroxide ions or OH⁻ ions ____________, which have a(n) ____________ negative ____________ charge.

8. Sodium hydroxide (NaOH), also called ____________ lye or caustic soda ____________, is used to make textiles, detergents, and some plastics.

9. Bases react with fat to make ____________ soap ____________.
Lesson 4

Outline

How can indicators identify acids and bases?

10. A dye that reacts chemically with acids and bases to produce one color in acids and another color in bases is called an acid-base indicator.

11. A low number on the pH scale indicates strong acidity; a high number indicates strong alkalinity.

12. The number of hydronium ions is equal to the number of hydroxide ions in neutral solutions.

13. Mixing an acid with a base produces a salt and water.

14. Acids and bases combine to form pH neutral solutions, a process called neutralization.

15. A compound that has positive and negative ions in a regular pattern or crystal is a salt.

16. Acids, bases, and salts dissolve in water to form an electrolyte.

Critical Thinking

17. Compare and contrast acids and bases. Tell what happens when they are mixed together.

An acid forms hydrogen ions in water, so it has a low pH. It tastes sour, stings at the touch, and turns litmus red. A base forms hydroxide ions in water, so it has a high pH. It tastes bitter, feels slippery, and turns litmus red. When mixed together, an acid and base can neutralize each other and form salt and water.
Acids, Bases, and Salts

Who am I? What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th></th>
<th>aci</th>
<th>alka</th>
<th>elect</th>
<th>neu</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>acid</td>
<td>d. base</td>
<td>f. ion</td>
<td>h. pH</td>
</tr>
<tr>
<td>b</td>
<td>acidity</td>
<td>c. alkalinity</td>
<td>e. electrolyte</td>
<td>g. neutralization</td>
</tr>
</tbody>
</table>

1. ______ e I can dissolve in water to form ions, which allows me to conduct electricity. Who am I?
2. ______ f I have lost or gained electrons, which gives me a positive or negative charge. Who am I?
3. ______ b I represent the strength of an acid. What am I?
4. ______ a I taste sour and turn blue litmus red. In water I produce H⁺ ions. Who am I?
5. ______ h I can tell you how acidic or basic a substance is. What am I?
6. ______ c I am the strength of a base. What am I?
7. ______ d I taste bitter and feel soapy. In water I produce OH⁻ ions. Who am I?
8. ______ g I can occur when acids and bases are mixed together. What am I?
Acids, Bases, and Salts

Fill in the blanks.

<table>
<thead>
<tr>
<th>acid-base indicator</th>
<th>bitter</th>
<th>pH scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>acidity</td>
<td>blue</td>
<td>neutralize</td>
</tr>
<tr>
<td>alkalinity</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>bases</td>
<td>low</td>
<td></td>
</tr>
</tbody>
</table>

Compounds that give off hydrogen ions (H\(^+\)) when dissolved in water are called acids. They taste sour, sting to the touch, and turn red an **acid-base indicator** called litmus.

Compounds that give off hydroxide ions (OH\(^-\)) when dissolved in water are called **bases**. They usually taste **bitter**, feel soapy, and turn litmus **blue**. The **pH scale** measures the strength of an acid (known as **acidity**) and the strength of a base (known as **alkalinity**). Highly acidic solutions have a(n) **low** pH; very alkaline solutions have a(n) **high** pH. When acids and bases are mixed together, they produce a salt and water. Acids and bases **neutralize** each other. The process in which an acid and a base combine to form a pH-neutral solution is called neutralization.
Meet Christina Elson

Read the Reading in Science feature in your textbook.

Infer

Fill in the Infer graphic organizer below. Use the clues and what you know to draw conclusions about Aztec artifacts.

<table>
<thead>
<tr>
<th>Clues</th>
<th>What I Know</th>
<th>What I Infer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large pots have been found with salt crystal residue in them.</td>
<td>Aztecs had to boil salty water to get salt crystals.</td>
<td>Aztecs used large pots to boil salty water and obtain salt crystals.</td>
</tr>
<tr>
<td>In one Aztec town, thousands of fragments of clay pots were found.</td>
<td>Salt was sold and transported in this Aztec town.</td>
<td>Salt may have been transported in clay pots in this town.</td>
</tr>
<tr>
<td>Salt helps pigment “cling” to cloth.</td>
<td>Cloth was dyed with pigment in a hot, watery dye bath.</td>
<td>Aztecs added salt to dye baths to make colored dyes cling to cloth.</td>
</tr>
</tbody>
</table>
Write About It

Infer

1. How did the Aztecs change a mineral resource into a finished product?

2. What would happen to the colors in Aztec cloth when washed if salt were not part of the dye-bath?

What I Know

Fill in the blanks to complete each of the steps in the salt-making process. Use clues from the reading passage. Then answer the questions that follow.

a. Salt deposits are found in dried _______ lake beds _______.

b. Salty _______ soil _______ is collected by scraping and digging.

c. Then, _______ water _______ is filtered through the salty soil _______ and collected in large _______ pots _______.

d. Finally, the water in the large pots is _______ boiled _______; it _______ evaporates _______ , leaving behind salts.

1. How did the Aztecs change a mineral resource into a finished process?

   The Aztecs collected salty soil from dry lake beds and filtered water through it. Then, they boiled the water until it evaporated, leaving behind salt crystals that could be used in many different processes.

2. What would happen to the colors in Aztec cloth if salt were not part of the dye-bath?

   The colors would wash out when the Aztecs washed the material.
Physical and Chemical Changes

Choose the letter of the best answer.

1. Which of the following is a physical change?
   a. paper burning
   b. egg frying
   c. water boiling
   d. baking soda and vinegar fizzing

2. Snow changing to water vapor is an example of
   a. sublimation.
   b. boiling.
   c. melting.
   d. thermal contraction.

3. When most liquids freeze, they undergo
   a. thermal expansion.
   b. thermal contraction.
   c. condensation.
   d. sublimation.

4. When a gas loses heat, it
   a. evaporates.
   b. freezes.
   c. sublimes.
   d. condenses.

5. The temperature at which alcohol changes to a gas is its
   a. sublimation point.
   b. freezing point.
   c. boiling point.
   d. melting point.

6. Steel is an example of a(n)
   a. alloy.
   b. colloid.
   c. heterogeneous mixture.
   d. suspension.

7. Which of the following can form a solution most easily?
   a. two liquids
   b. two gases
   c. two solids
   d. a gas and a liquid

8. In a saltwater solution, the salt is a(n)
   a. alloy.
   b. colloid.
   c. solvent.
   d. solute.
9. Which of the following is an example of a colloid?
   a. gelatin  
   b. brass  
   c. sugar water  
   d. orange juice

10. Which of the following is a compound?
   a. brass  
   b. rust  
   c. iron  
   d. steel

11. In the chemical reaction called photosynthesis, which of the following is a reactant?
   a. sunlight  
   b. oxygen  
   c. carbon dioxide  
   d. sugar

12. Which of the following indicates that a chemical change has taken place?
   a. a change from a liquid to a gas  
   b. an increase in the volume of a substance  
   c. a change from a solid to a liquid  
   d. a change in the color of a substance

13. Which of the following is a property of bases?
   a. tastes bitter  
   b. tastes sour  
   c. stings the skin  
   d. reacts with metal to make hydrogen gas

14. Which of the following releases hydrogen ions when dissolved in water?
   a. sodium hydroxide  
   b. hydrochloric acid  
   c. sodium chloride  
   d. baking soda

15. What happens when an acid and a base are mixed?
   a. A gas is given off.  
   b. A precipitate forms.  
   c. A color change occurs.  
   d. Heat is given off.
The Great Jump in China
Read the Literature feature in your textbook.

Write About It

Response to Literature This article describes how an athlete used a ramp to jump over a large object. If you were a professional athlete, what other kinds of devices might you use? Write a fictional narrative describing your device and its uses.

Paragraphs should have a clear topic sentence that directly identifies the device a student would use as a professional athlete. The sentences that follow the topic sentence should support the topic sentence by describing the device and how the student would use it. Students should use a closing sentence that wraps up the main idea of the paragraph or restates the topic sentence. Good paragraphs will show creativity and originality, contain vivid words, include correct grammar and mechanics, and demonstrate a proper transition from one idea to the next.
Using Forces

Fill in the concept map below using the information you know about energy.

1. Motion is a change in an object’s __________ over time.

2. Speed is a measure of how fast an object’s position changes. A measurement of an object’s speed and its direction is __________.
   A change in an object’s velocity is __________.

3. A force is a push or a __________ exerted on an object.

4. Newton’s laws describe how forces affect __________. These laws include the __________, second, and __________.

5. A force multiplied by the distance over which the force is applied is __________. The ability to do work is __________.

6. Machines can make doing work easier by changing the __________ of a force or the __________ over which the force is applied.
Motion

Use your textbook to help you fill in the blanks.

What is motion?

1. The location of an object is its _______ position. A change in the position of an object over time is motion. Motion has two parts: _______ direction and _______ distance.

2. Distance can be measured in _______ meters, _______ kilometers, _______ feet, _______ , or _______ miles.

3. To measure direction, you can use a(n) _______ compass or protractor and units of _______ degrees.

4. You need a(n) _______ frame of reference from which to measure position or motion.

What is speed?

5. To calculate speed, divide the _______ distance traveled by the _______ time spent traveling.

6. Units of speed can be _______ meters per second or _______ miles per hour.

7. A car’s speedometer measures _______ instantaneous speed. The calculated speed over an entire trip is _______ average speed.

8. To state the velocity of an object, you need to know the object’s _______ speed and its _______ direction.
What is acceleration?

9. Any change in the velocity of an object is a(n) acceleration.

10. If the speed of a car traveling south is increasing 5 m/s, its acceleration is \(5 \text{ (m/s)/s south}\).

11. An acceleration can be a change in speed or a change in direction. Negative acceleration is called deceleration.

What is momentum?

12. An object’s mass multiplied by its velocity is its momentum.

13. An object with a mass of 1 kg and a velocity of 10 m/s has a momentum of \(10 \text{ kg m/s}\).

14. The more mass an object has, the greater its inertia.

Critical Thinking

15. Would it be more difficult to stop a truck carrying a heavy load or stop the same truck empty? Explain your answer, using the concepts of inertia and momentum.

The truck carrying a heavy load has more inertia than an empty truck. It would be harder to change its momentum.
Motion

Use the words in the word box to finish the puzzle.

acceleration  momentum  position  speed
inertia  motion  reference  velocity

Across
2. tendency of an object to resist a change in motion
4. measurement of an object’s speed and direction of motion
5. a “frame” from which you can measure position or motion
8. mass times velocity

Down
1. location of an object
3. change in velocity over time
6. the rate at which an object’s position is changing over time
7. any change in position
Motion

Fill in the blanks.

<table>
<thead>
<tr>
<th>acceleration</th>
<th>motion</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>momentum</td>
<td>speed</td>
<td>velocity</td>
</tr>
</tbody>
</table>

To describe how an object moves, you need a frame of reference, or a group of objects from which you can measure position. You can then measure the object’s motion, or change in position. By dividing the distance an object moved by the time it took to move that distance, you describe an object’s average speed. If you also measure the direction in which the object moved, you can describe its velocity. If you know an object’s instantaneous speed at the beginning and end of a time interval, you can describe the object’s acceleration over that time interval.

An object’s mass multiplied by its velocity is its momentum. The greater an object’s inertia or resistance to a change in its motion, the greater its momentum.
## The Position of the Earth and Sun

Read the Reading in Science feature in your textbook.

### Main Idea and Details

Use the table below to record the main idea and details described in the timeline portion of the reading passage in your textbook.

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Many throughout history have made discoveries that help us determine how the planets and stars move.</td>
<td>Aristotle developed a model showing the movement of stars and planets around Earth.</td>
</tr>
<tr>
<td></td>
<td>Ptolemy used Aristotle’s model and geometry to predict the way the Sun, moon, and planets would appear in the sky.</td>
</tr>
<tr>
<td></td>
<td>Copernicus first proposed that the Sun is at the center of the Solar System.</td>
</tr>
<tr>
<td></td>
<td>Galileo’s discovery of moons circling Jupiter supported Copernicus’s theory.</td>
</tr>
<tr>
<td></td>
<td>Einstein explained how gravity works, helping us understand the movement of planets and stars.</td>
</tr>
<tr>
<td></td>
<td>Margaret Geller worked on the first 3-D map of the universe.</td>
</tr>
</tbody>
</table>
Write About It

Main Idea and Details  Read the “Write About It” question. Use the text of “The Position of the Earth and Sun” feature to write your answers.

Identifying the Main Idea
The main idea is the central point of the passage. It tells you what the passage is about. Review the graphic organizer to find the main idea of the passage. Write that idea on the lines below.
People throughout history made discoveries that help us determine how the planets and stars move.

Identifying Supporting Details
Details are important parts of the passage that support the main idea. Look for the supporting details within the list of scientists that follows the opening paragraphs. Give one detail from the article that supports the main idea. You can choose one supporting detail from your table.
Students may respond with any of the details listed in the table on the opposite page.
Forces and Motion

Use your textbook to help you fill in the blanks.

What are forces?
1. Units of force are the _______ Newton and the _______ pound.
2. An arrow can be used to represent the _______ strength and _______ direction of a force.
3. Three types of force act on an airplane: _______ thrust, lift, and _______ drag.

What are gravity and friction?
4. The force that pulls all objects together is called _______ gravity.
5. The amount of friction depends on two factors: the roughness of the _______ surfaces of the objects and how much force is required to _______ push______ the two objects together.
6. After an object begins moving, friction between it and the surface over which it slides is called _______ sliding _______ friction.

What is Newton’s first law?
7. According to the law of inertia, an object at rest tends to _______ stay at rest , and an object in motion tends to _______ stay in motion , unless acted upon by an _______ unbalanced force .
What is Newton’s second law?

8. According to Newton’s second law, an object’s acceleration increases as the amount of unbalanced force on it increases; an object’s acceleration decreases as the object’s mass increases.

What is Newton’s third law?

9. When one object pushes on a second object, the second object pushes back on the first object with the same strength.

10. According to Newton’s third law, for every action there is an opposite but equal reaction.

Critical Thinking

11. Suppose that you are walking down the street. Describe the forces acting on you, and use Newton’s laws of motion to describe your motion.

Gravity pulls you downward, and there is friction between your feet and the pavement. Newton’s first law: When you start to walk, you accelerate because there is an unbalanced force pushing you forward. Second law: When more force is applied, you accelerate. Third law: Your feet push down on the street, and the street pushes up on you. When your feet push backward against the street, the street pushes you forward.
# Forces and Motion

## What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th>a. action force</th>
<th>d. friction</th>
<th>g. unbalanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. balanced</td>
<td>e. inertia</td>
<td></td>
</tr>
<tr>
<td>c. force</td>
<td>f. reaction force</td>
<td></td>
</tr>
</tbody>
</table>

1. ______ c I am the word that scientists use for a push or a pull. What am I?

2. ______ d I am the force that sometimes makes sliding difficult. What am I?

3. ______ b I am a force whose effect is offset by other forces, so I won’t change your motion. What type of force am I?

4. ______ g I am a force whose effect is not offset, so I change your motion in some way. What type of force am I?

5. ______ a I am the first force in a pair. Whatever I push pushes back on whatever caused me. What am I?

6. ______ f I am the second force in a pair. If something gets pushed, I push back. What am I?

7. ______ e I am the tendency of an object in motion to stay in motion.
Forces and Motion

Fill in the blanks.

<table>
<thead>
<tr>
<th>accelerate</th>
<th>force</th>
<th>gravity</th>
<th>mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>distance</td>
<td>gravitation</td>
<td>inertia</td>
<td>unbalanced</td>
</tr>
</tbody>
</table>

The motion of any object can be explained using the laws that Newton discovered more than 300 years ago. His universal law of gravitation states that objects with more mass have more force of gravity between them. Objects that are separated by more distance have less force of gravity between them.

According to Newton's first law, also called the law of inertia, an object at rest tends to stay at rest, and an object in motion tends to stay in motion, unless acted upon by a(n) unbalanced force. The second law can be summed up with the equation $F = ma$. This equation means that an object accelerates more as the size of the unbalanced force on it increases and that more massive objects accelerate less for a given force. Newton’s third law states that for every action force there is an equal and opposite reaction force.
Work and Energy

Use your textbook to help you fill in the blanks.

What is work?

1. Work done on an object changes the amount of energy that the object has.

2. Work is equal to the force used multiplied by the distance over which the force was applied.

3. The units of work are newton-meters, or joules.

4. Work occurs when unbalanced forces cause an object to accelerate.

5. Total work is the sum of positive work and negative work.

6. When you move an object, friction often performs negative work on it.

What is energy?

7. Energy is measured in units called joules.

8. A stretched spring has potential energy.
   A moving object has kinetic energy.

9. Doing positive work on an object increases its energy.

10. Throwing a ball increases its kinetic energy; lifting a ball increases its potential energy.
11. Chemical energy, nuclear energy, and magnetic energy are different forms of _____ potential _____ energy.

12. Heat, electricity, sound, and light are different forms of _____ kinetic _____ energy.

How can energy change?

13. Energy cannot be _____ created _____ or _____ destroyed _____; it can only _____ change form _____.

14. Whenever energy is used to do work, energy _____ changes form _____.

15. Kinetic energy is often changed into heat energy by _____ friction _____.

Critical Thinking

16. Trace the energy changes that occur in a toaster, in a radio, and in a windmill used to generate electricity.

Energy is never created or destroyed, but it does change form. In a toaster, electrical energy is changed into heat and light. In a radio, electrical energy is changed into the kinetic energy of the vibrating speaker, sound energy, and a little heat. In the windmill, kinetic energy of moving air turns the blades, which spin a generator that turns energy of motion into electrical energy.
Work and Energy

Use the words in the word box to finish the puzzle.

chemical  joules  sound

conservation  kinetic  potential
electricity

Down
1. Energy that is stored in the position of an object is called potential energy.
2. Units of work are joules.
3. The energy of a moving object is kinetic energy.
4. The kinetic energy of electrons is called electricity.
5. The kinetic energy of particles as they move in waves is sound.

Across
6. The law of conservation of energy states that energy cannot be created or destroyed; it can only change form.
Work and Energy

Fill in the blanks.

| destroyed | friction | positive | sound |
| electrical | kinetic | potential | work |

Work is defined as an unbalanced force acting on an object through a certain distance. The total work done on an object is the sum of the ________ work and the negative work done on it. The force of ________ usually does negative work on a moving object. Energy is defined as the ability to do ________ .

If you lift a ball, you give it ________ energy. If you drop the ball, its potential energy is converted into ________ energy. Different forms of potential energy include chemical, nuclear, magnetic, and ________ energy. Different forms of kinetic energy include electricity, ________, and light. The law of conservation of energy states that energy cannot be created or ________ . Energy can only change forms.
Simple Machines

Use your textbook to help you fill in the blanks.

What are simple machines?

1. A simple machine can change the ___________ , ___________ , or ___________ of a force that you apply.

2. When you apply a force to a machine’s ___________ arm, the machine applies an output force to the load through its ___________ arm.

3. The ratio of a machine’s output force to the effort applied is called its ___________ .

What are levers?

4. A lever can either multiply an ___________ or multiply ___________.

5. A crowbar is a ___________ lever—the effort arm and the ___________ are on opposite sides of the ___________ .

6. A wheelbarrow is a ___________ lever—the effort force is ___________ than the output force, and both are in the same ___________.

7. A fishing rod is a ___________ lever—its output force is ___________ than the effort force, but output distance of the tip of the rod is greater than the effort distance of your hand.
Which machines are like levers?

8. A wheel and axle is a type of lever in which the axle acts like the _______ fulcrum____ and the wheel acts like the _______ arms____ of the lever.

9. A wheel and axle with a free-moving cord is called a __________ pulley ________.

What are inclined planes?

10. An inclined plane that is used to separate two objects is called a(n) _______ wedge _______. An inclined plane wrapped around a cylinder is a(n) _______ screw ________.

11. The farther apart the threads of a screw, the _______ faster _______ the screw moves when turned, but the _______ more _______ effort it takes to turn it.

What are compound machines?

12. Any machine that combines two or more simple machines is a _______ compound machine ________.

13. The more work that a machine does for a given input of energy, the more _______ efficient _______ it is.

14. Efficiency is often expressed as a(n) _______ fraction or percentage ________.

Critical Thinking

15. What types of simple machines are in a wheelbarrow?

The entire wheelbarrow is a second-class lever. The wheel and axle is also a lever. The screws holding it together are inclined planes wrapped around cylinders.
Simple Machines

What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th>compound machine</th>
<th>fulcrum</th>
<th>simple machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>efficiency</td>
<td>load</td>
<td></td>
</tr>
<tr>
<td>effort</td>
<td></td>
<td>screw</td>
</tr>
</tbody>
</table>

1. **compound machine** I am a bicycle, car, or anything else made up of two or more simple machines. What am I?

2. **effort** I am the push on a lever or the pull on a pulley. I am any force that you apply to a machine. What am I?

3. **simple machine** I take one force and change it into another force. I can change the direction, strength, or distance of a force. What am I?

4. **fulcrum** When the effort arm goes down, the resistance arm goes up, but I don’t move. I am the pivot point on a lever. What am I?

5. **load** When you push down on a lever, I am the object moved by the resistance arm. What am I?

6. **efficiency** I can tell you how much you can gain by using a machine. I am the ratio of your input energy to the machine’s output work. What am I?

7. **screw** I am an inclined plane wrapped around a cylinder. What am I?
Simple Machines

Fill in the blanks.

<table>
<thead>
<tr>
<th>farther</th>
<th>less</th>
<th>longer</th>
<th>simple machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>fulcrum</td>
<td>load</td>
<td>resistance</td>
<td>strength</td>
</tr>
</tbody>
</table>

Simple machines make work easier by changing the distance, direction, or amount of the effort force that you apply. Using an inclined plane, you can raise an object with less effort than if you lifted it directly upward. The longer the inclined plane, the less effort needed to lift a load. A pulley can change the direction or strength of the force applied to lift a load. A lever has an effort arm, resistance arm, and fulcrum, or pivot point. When you apply a force on the effort arm, the resistance arm applies a force on the load. If the effort arm is longer than the resistance arm, you use less force to lift a load, but the effort arm moves farther.

Compound machines combine two or more simple machines. The more work a machine does for a given input of energy, the more efficient the machine is.
A Humane Mousetrap

Write About It
Do some online research about bird feeders that keep squirrels from stealing the birdseed. Write an explanation of how this kind of bird feeder works by using simple machines. Provide steps for making this device. (You can invent your own.)

Getting Ideas
Do some online research on birdfeeders. Then fill in the sequence chart below. Jot down steps for making a birdfeeder that keeps squirrels from stealing the birdseed.

Planning and Organizing
When organizing explanatory writing, it is often best to write the details as they happened. Write the detail that happened first. Then the detail that happened second. Then the detail that happened last. When writing your explanation, make sure you write your steps in the order they happen.
Drafting

Write a sentence to begin your explanation. Tell what your birdfeeder does. In other words, tell how it is squirrel-proof.

Students’ sentences will vary. Sample answer: This birdfeeder keeps squirrels from reaching the birdseed.

Now write your explanation. Use a separate piece of paper. Begin with the sentence you just wrote. Tell how the birdfeeder works. Then tell the steps for making it. Write these steps in time order.

Revising and Proofreading

Here is part of Alicia’s explanation. Combine each pair of sentences. Use the word in parentheses.

1. Squirrels slide down the pole. It is slippery. (because)
   Squirrels slide down the pole because it is slippery.

2. Squirrels can’t jump onto the top of the feeder. It is too high up. (since)
   Squirrels can’t jump onto the top of the feeder since it is too high up.

3. Birds can get at the seeds. There are holes in the mesh. (because)
   Birds can get at the seeds because there are holes in the mesh.

4. Do not put this feeder under a tree. A squirrel might jump down onto it. (since)
   Do not put this feeder under a tree since a squirrel might jump down onto it.

Now revise and proofread your writing. Ask yourself:

- Did I clearly and accurately explain how the birdfeeder works?
- Did I write the steps for making it in order?
- Did I correct all mistakes?
Using Forces

Choose the letter of the best answer.

1. How fast an object’s position is changing over time is the object’s
   a. velocity.
   b. acceleration.
   c. speed.
   d. mass.

2. Momentum is calculated by multiplying an object’s mass by its
   a. mass.
   b. velocity.
   c. work.
   d. inertia.

3. The force of gravity between two objects
   a. increases with mass and decreases with distance.
   b. increases with distance and decreases with mass.
   c. decreases with mass and increases with distance.
   d. increases with mass and increases with distance.

4. Friction between objects produces
   a. gravity.
   b. load.
   c. inertia.
   d. heat.

5. Newton’s second law of motion states that force is equal to mass times
   a. speed.
   b. energy.
   c. velocity.
   d. acceleration.

6. Placing a dish on a higher shelf increases the dish’s
   a. inertia.
   b. kinetic energy.
   c. weight.
   d. potential energy.
Choose the letter of the best answer.

7. Work is done when
   a. you push against a wall.
   b. you lift a book.
   c. you stand on the floor.
   d. you hold a box.

8. When you do positive work on an object, you
   a. decrease the object’s energy.
   b. keep the object’s energy the same.
   c. increase the object’s energy.
   d. may increase or decrease the object’s energy.

9. The unit that is used to measure force is the
   a. meter.
   b. kilogram.
   c. Newton.
   d. joule.

10. The force that you apply to a simple machine is called the
    a. effort.
    b. work.
    c. load.
    d. output.

11. If a machine is 50 percent efficient, how much energy must you apply to lift a 100-Newton weight a distance of 10 meters?
    a. 2000 joules
    b. 1000 joules
    c. 500 joules
    d. 100 joules

12. Which of the following is an example of an inclined plane?
    a. pulley
    b. ramp
    c. gear
    d. wheel and axle

13. Which of these is a compound machine?
    a. wedge
    b. screw
    c. pair of scissors
    d. wheel and axle
# Using Energy

Fill in the concept map below, using information you know about energy.

<table>
<thead>
<tr>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat</strong></td>
<td>Heat is energy that flows because of a difference in temperature. The energy that flows away from your hand when you hold a cold drink.</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>Sound is energy that moves in the form of a wave that is a series of compressions and rarefactions. The energy from a whistle is an example of sound that has a high pitch.</td>
</tr>
<tr>
<td><strong>Light</strong></td>
<td>Light is a wave made from electric and magnetic energy. Light is also a particle. The light from a rainbow is an example of light that is spread out into a spectrum.</td>
</tr>
<tr>
<td><strong>Electricity</strong></td>
<td>Electricity is energy in the form of moving electrons. One example of electricity is the movement of electrons that occurs when you touch a door knob.</td>
</tr>
<tr>
<td><strong>Magnetism</strong></td>
<td>Magnetism is the ability of one object to push or pull on another object that has the same magnetic property. Magnetism is shown when two magnets either attract or repel each other.</td>
</tr>
</tbody>
</table>
Heat

Use your textbook to help you fill in the blanks.

What is heat?

1. Heat is energy that moves from an object with a(n) ____________ temperature to an object with a(n) ____________ temperature.

2. Heat continues to flow from one object to another object until both have the same ____________ temperature.

3. Heat is the ____________ amount of thermal energy that an object releases.

How does heat travel?

4. Conduction can occur between objects that are ____________ touching.

5. As hot and cool portions of a liquid or gas move, ____________ convection currents form.

6. The heat that you can feel radiating away from hot objects as electromagnetic rays is called ____________ infrared rays.

What is thermal conductivity?

7. Convection currents move heat more slowly than do ____________ electromagnetic rays but more quickly than conduction.

8. Heat traveling by conduction moves at the speed at which molecules can ____________ bump one another and change how fast nearby molecules are vibrating.
9. A material that conducts heat poorly is a good ______ thermal insulator____.

10. Thermal conductivity increases as ______ density ______ increases, so ______ solids ______ are the best conductors of heat and ______ gases ______ are the worst conductors.

11. Objects with a low heat capacity change temperature ______ quickly ______ when heated and give off ______ less ______ heat as they cool.

When is heat waste?

12. Heat energy caused by friction is usually a waste product that results when energy ______ changes form ______ or ______ performs work ______.

Critical Thinking

13. Describe how heat is used in a kitchen. What appliances produce heat, and how do they produce it? What objects are used as insulators, and what objects are used as conductors?

Stoves produce heat by burning fossil fuel or by sending electricity ______ through heating coils. Crock pots and toasters also use heating coils to produce heat. Pots and pans are metal, so they conduct heat well. Pot holders and pot handles are insulators.
Heat

Who am I? What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th>a. conduction</th>
<th>d. heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. conductivity</td>
<td>e. radiation</td>
</tr>
<tr>
<td>c. convection</td>
<td>f. temperature</td>
</tr>
</tbody>
</table>

1. _____ e I can transfer heat through a vacuum because I am electromagnetic rays. Who am I?
2. _____ d I flow from a warmer object to a cooler object until both objects are the same temperature. What am I?
3. _____ a I move heat through a material from one atom or molecule to the next. Who am I?
4. _____ c I move heat as a liquid or a gas rises and sinks. Who am I?
5. _____ f I am a measurement of the average energy of molecules. What am I?
6. _____ b I can tell you how easily heat moves through a material. What am I?
Heat

Fill in the blanks.

- conduction
- convection
- faster
- gases
- liquids
- molecules
- temperature
- thermal conductors
- thermal insulators

Heat is energy that flows from an object at a higher temperature to an object at a lower temperature. The measure of the average kinetic energy of molecules is __________. When a warmer object touches a cooler object, heat moves by __________. The molecules of the warmer object vibrate __________. The two objects stay in place, but their __________ bump one another and energy passes from the warmer object to the cooler object.

Some materials, such as metals, are good __________. Other materials, such as gases, are good __________. Currents of matter spread heat through __________ and __________, a process called __________. The transfer of heat by electromagnetic rays is called radiation.
Use your textbook to help you fill in the blanks.

How is sound produced?

1. Regions of a material that have many molecules squeezed together are _______ compressions _______; regions that have fewer molecules spread apart are _______ rarefactions _______.

2. A series of compressions and rarefactions moving through a medium is a(n) _______ sound wave _______.

3. Sound waves vibrate the medium in the _______ same _______ direction that the energy moves.

How does sound travel?

4. Sound cannot travel through a(n) _______ vacuum _______, which is a region of space that contains no matter.

5. Sound travels faster through a(n) _______ solid _______ than it travels through a liquid or a(n) _______ gas _______.

6. When sound hits soft, thick, or uneven materials, much of the sound is _______ absorbed _______; when sound hits flat, firm surfaces, much of it is _______ reflected _______.

What is pitch?

7. The higher the frequency or pitch of a sound wave, the more _______ peaks _______ pass in a period of time.

8. To increase the pitch of a musical instrument, you need to _______ shorten _______ the part that vibrates.
9. If you move in the direction from which a sound wave is coming, you hear a higher pitch as a result of the ______ Doppler ______ effect.

What is volume?

10. Amplitude of sound depends on how ______ dense ______ the air in compressions is compared to normal air.

11. Volume is measured in ______ decibels ______.

12. A 30 dB noise has ______ 100 times ______ more energy than a 10 dB noise, but a 30 dB noise sounds about ______ 4 times ______ as loud as a 10 dB noise.

13. To make a sound louder, you need to use more energy, which increases the amount of ______ air ______ displaced.

14. The volume of a sound decreases with ______ distance ______ because the same amount of sound energy is spread over a larger and larger area.

What is echolocation?

15. Bats make sound and listen to the ______ echo ______ to locate prey.

16. Sound navigation and ranging, or ______ sonar ______, is used to find the depth of a body of water and locate objects beneath water.

Critical Thinking

17. Why is the pitch of a train’s whistle higher as the train approaches and lower as it moves away?

Because the train is moving, the sound waves from the whistle are compressed in front of the train. The sound waves are expanded behind the train.
## Sound

Use the words in the word box to finish the sentences.

<table>
<thead>
<tr>
<th>absorption</th>
<th>frequency</th>
<th>reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>amplitude</td>
<td>medium</td>
<td>sound</td>
</tr>
<tr>
<td>echolocation</td>
<td>pitch</td>
<td>vacuum</td>
</tr>
</tbody>
</table>

1. **medium** Material through which sound travels
2. **reflection** The bouncing of a sound wave off a surface
3. **frequency** Number of wave peaks that pass each second
4. **amplitude** Height of a sound wave
5. **echolocation** Finding objects by using echoes
6. **pitch** How high or low a sound is
7. **sound** Space that contains few or no molecules
8. **absorption** Disappearance of a sound wave into a soft surface
9. **vacuum** A series of rarefactions and compressions traveling through a medium
As an object vibrates, it moves back and forth against the air around it. The air begins to vibrate, creating compressions where air molecules are pushed together and rarefactions where air molecules are farther apart. Compressions and rarefactions moving through a medium make a(n) sound wave. The number of compressions that pass each second is the sound wave's frequency. A higher frequency sound has a higher pitch.

When more energy is used to make sound, the sound has a higher amplitude. High-amplitude sounds are louder than sounds having low amplitude. When sound waves hit a flat, firm surface, much of their energy is reflected. When sound waves hit a soft or uneven surface, much of their energy is absorbed.
Light

Use your textbook to help you fill in the blanks.

What is light?

1. Light is vibrating _______electric________ and _______magnetic________ energy.

2. Light waves vibrate in directions _______perpendicular________ to the direction of their motion.

3. Light travels fastest in a _______vacuum________.

4. The wavelength of a wave times its frequency is the _______speed________ of the wave.

5. Light has properties of both _______waves________ and _______particles________.

6. Light rays bouncing off a surface at random angles is called _______scattering________.

How does light make shadows?

7. If most light goes through an object, the object is _______translucent________; if some light goes through, the object is _______translucent________; if no light goes through, the object is _______opaque________.

8. Objects that do not allow light to pass through cause _______shadows________.
How does light bounce and bend?

9. According to the law of reflection, the angle between an incoming light ray and a surface equals the angle between the reflected light ray and the surface.

10. When light enters a different medium, its speed changes and it undergoes refraction.

Why do we see colors?

11. White light is a mixture of many wavelengths or colors that can be separated by a prism to form a spectrum.

12. Opaque objects appear the color of the light they scatter, but transparent objects appear the color of light they let pass through.

Is all light visible?

13. Many forms of electromagnetic radiation cannot be seen with the human eye.

Critical Thinking

14. Why does mixing the primary colors of light produce white light, but mixing paints that have the primary colors produces black paint?

When you mix the primary colors of light, you see a mixture of the light, which appears white. When you mix the same colors of paint, you see whichever colors are reflected and not absorbed. If the three pigments are mixed, no colors are reflected.
Light

Use the words in the word box to fill in the blanks.

<table>
<thead>
<tr>
<th>electromagnetism</th>
<th>prism</th>
<th>translucent</th>
</tr>
</thead>
<tbody>
<tr>
<td>image</td>
<td>refraction</td>
<td>wavelength</td>
</tr>
<tr>
<td>photon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **spectrum** Band of colors in a rainbow

2. **photon** Tiny bundle of light

3. **image** Picture of a light source that light rays make when they reflect from a mirror or refract through a lens

4. **electromagnetism** The way in which electric and magnetic forces interact

5. **prism** Cut piece of glass with two opposite sides in the shape of a triangle

6. **wavelength** Distance between one peak and the next in a wave

7. **translucent** Material that allows only some light to pass through

8. **refraction** The bending of light waves as they pass from one substance to another
**Light**

Fill in the blanks.

<table>
<thead>
<tr>
<th>colors</th>
<th>red</th>
<th>straight lines</th>
<th>wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>opaque</td>
<td>refracts</td>
<td>vacuum</td>
<td></td>
</tr>
<tr>
<td>prism</td>
<td>spectrum</td>
<td>violet</td>
<td></td>
</tr>
</tbody>
</table>

A light wave is energy in the form of electric and magnetic fields. Light travels fastest through a(n) **vacuum** and travels slower in other mediums. The size of a light wave is measured as its **wavelength**, the distance from one peak to the next. We see different wavelengths as different **colors**. The shortest wavelength looks **violet**, and the longest wavelength looks **red**.

Light travels in **straight lines** until it strikes an object or another medium. When light enters another medium, it slows down and **refracts**, or bends. When white light travels through a(n) **prism**, a triangular piece of glass, it refracts and separates into the different colors of the **spectrum**. If light strikes an **opaque** object, most of it is absorbed but some scatters off the object.
How We Use Lasers

Write About It
Find out more about one of the uses of lasers. Write an expository essay giving important information about this use. Support your main idea with facts and details. Reach a conclusion at the end.

Getting Ideas
Brainstorm a list of uses of lasers. Choose one to write about. Then do some research. Use the chart below to record information that you find.

Students’ answers will vary. Sample answer:

- less risk of infection
- less blood loss during operation
- in many cases, less scarring

Lasers are useful in surgery because they cut down on infection, blood loss, and scarring

Planning and Organizing
Nick wanted to tell about the benefits of laser surgery. Here are four sentences he wrote. Write Yes if the sentence below belongs in his essay. Write No if it does not.

1. The laser seals the blood vessels when it cuts. Yes
2. When lasers are used, there is less blood lost during surgery. Yes
3. Scientists used lasers to measure the distance between earth and the moon. No
4. Lasers cut down on the risk of getting an infection from surgery. Yes
Drafting

Write a sentence to begin your essay. Tell your topic. This is the use of lasers you chose to write about. Tell your main idea about this topic. This sentence is your topic sentence.

Students’ sentences will vary. Sample sentence: Lasers have made surgery easier and safer.

Now write your essay. Use a separate piece of paper. Start with your topic sentence. Then include facts and details that back up your main idea. (Do not include facts and details that don’t support your main idea.) Reach a conclusion about your topic at the end.

Revising and Proofreading

Now revise and proofread your writing. Ask yourself:

► Did I clearly state my main idea about a use of lasers?
► Did I back up my main idea with facts and details?
► Did I reach a sound conclusion at the end?
► Did I correct all mistakes?
Electricity

Use your textbook to help you fill in the blanks.

What is static electricity?

1. When two objects rub against each other, electrons can move from one object to the other and cause a buildup of static electricity.

2. Electrons jumping through the air to an area that has a positive charge form a(n) spark.

3. Like charges move easily on a good conductor.

4. Objects can be protected from the buildup of static electricity by grounding them to the Earth.

How can electricity flow?

5. Circuits must have an unbroken path of conductors and a(n) voltage that causes the electrons to move along the path.

6. A device that can open or close a circuit is called a(n) switch.

7. Electrons in a circuit are pushed away from a battery’s negative pole and are pulled toward the battery’s positive pole.

8. Resistance is measured in ohms, and electric current is measured in amperes or amps.
9. A current of electrons moving through resistors loses energy that changes into _______ heat or light _______.

What kinds of circuits are there?

10. A circuit with only one conductive path is a(n) _______ series _______ circuit; a circuit with more than one conductive path is a(n) _______ parallel _______ circuit.

11. In a series circuit, resistance increases with each _______ resistor _______ added.

12. In a parallel circuit, paths with greater _______ resistance _______ have less electric current flowing through them.

How can you use electricity safely?

13. To protect against large currents, homes have _______ fuses or breakers _______.

14. Outlets in kitchens and bathrooms have _______ ground fault interrupters _______ that turn an outlet off if a short is detected.

15. Touching two _______ power lines _______ at the same time or touching one power line and _______ the ground _______ or some grounded object can be deadly.

Critical Thinking

16. When a home circuit breaker opens, the lights in some rooms go off but the lights in other rooms stay on. Explain why.

A house has several parallel circuits. Putting all of the appliances in a home on one circuit would overload the circuit. Only the appliances connected to the parallel circuit that opens are turned off.
Electricity

Matching

Match the correct letter with the description.

a. circuit  
b. electric current  
c. grounding  
d. resistor  
e. static electricity  
f. switch

1. _____ f device that opens or closes an electric circuit
2. _____ e a buildup of charged particles
3. _____ a an unbroken path of conductors through which electric current passes
4. _____ c a conductor sharing its excess charge with a much larger conductor
5. _____ d an object in an electric circuit that resists the flow of electrons
6. _____ b a flow of electricity through a conductor
Electricity

Fill in the blanks.

<table>
<thead>
<tr>
<th>circuit</th>
<th>negative</th>
<th>static electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>conductor</td>
<td>poles</td>
<td>switch</td>
</tr>
<tr>
<td>electric current</td>
<td>resistor</td>
<td></td>
</tr>
</tbody>
</table>

When objects rub against each other, electrons sometimes move from one object onto the other. The resulting buildup of charged particles is called static electricity. Electricity moves more easily through a wire. When a wire is hooked to the two oppositely charged poles of a battery, a(n) circuit is formed. Electrons move from the negative pole through the conductor to the positive pole. This flow of electrons is called a(n) electric current.

A device that opens or closes a circuit is called a(n) switch. Any device, such as a light bulb, that resists the flow of electrons is a(n) resistor. Circuits that have only one path for electrons are series circuits, and circuits that have more than one path are parallel circuits.
Building a Better Battery

Read the Reading in Science feature in your textbook. Try to draw conclusions from text clues.

**Draw Conclusions**

Fill in the Drawing Conclusions Chart using text clues you find in the article.

<table>
<thead>
<tr>
<th>Text Clues</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Batteries are devices that store chemical energy and make it available in electric form.</td>
<td>Batteries convert chemical energy to electrical energy.</td>
</tr>
<tr>
<td>2. All batteries have positive and negative electrodes and an electrolyte through which a(n) current can flow.</td>
<td>Electrodes are plates to which wires can be attached; the electrolyte is a solution through which electrons move.</td>
</tr>
<tr>
<td>3. A(n) lead-acid battery has two plates in a(n) sulfuric acid solution; most cars have them.</td>
<td>Lead plates are the electrodes of this type of battery, and sulfuric acid solution is the electrolyte; this type of battery recharges when the car runs.</td>
</tr>
<tr>
<td>4. Hybrid cars use nickel hydride batteries that recharge when the car slows down.</td>
<td>Nickel hydride batteries are used in hybrid cars, instead of lead-acid batteries.</td>
</tr>
</tbody>
</table>
Write About It

**Draw Conclusions** Explain what is used as an electrolyte in a voltaic pile. Explain what types of batteries are used in hybrid cars.

Planning and Organizing

**Answer these questions in more detail.**

Describe the components of a battery.

**Batteries consist of two electrodes, a positive and a negative, and an electrolyte.**

Explain what an electrolyte is.

**An electrolyte is a substance through which current can flow.**

Explain how a voltaic pile is constructed and what is used as the electrolyte.

**A voltaic pile is built with alternating copper and zinc discs, separated by cloth soaked in salt water.**

What kinds of batteries do cars have and why do they have them?

**Cars run on lead-acid batteries. They are used in cars because they are rechargeable.**

What type of batteries are used in hybrid cars? Why?

**Hybrid cars use nickel hydride batteries that are recharged when the car brakes.**
Magnetism

Use your textbook to help you fill in the blanks.

What is magnetism?

1. When a magnet is cut in half, each of the two pieces has
   a(n) __________ pole and a(n) __________ pole.

2. Like poles of a magnet __________ each other, and unlike poles __________ each other.

3. The Earth is a giant permanent __________ magnet.

4. Whenever an electric charge moves, it creates __________ forces.

5. The __________ closer together the lines of a magnetic field, the stronger the magnetic force.

What are electromagnets?

6. An electric current that produces a magnetic field is called a(n) __________.

7. A magnetic field goes in __________ around a straight wire when current is flowing through it.

8. Wrapping many loops of wire together __________ the magnetism of the coil.

9. You can increase the strength of an electromagnet in three ways: __________, place an iron rod inside the coils, or __________.
LESSON 10.

As the electric current rises and falls in the **voice coil** of a speaker, its magnetic field changes, causing a cone of paper or metal to vibrate.

11. In an electric motor, a coil acting as an electromagnet rotates between the poles of a(n) **permanent magnet**.

**How can magnets produce electricity?**

12. A generator creates an electric current by spinning a coil of wire between the poles of a powerful **magnet**.

13. The energy needed to spin the coils in an electric generator can come from **falling water** in a hydroelectric dam, **steam** in a coal-fired power plant, or from wind or tides.

**What is magnetic levitation?**

14. Two electromagnets can push against each other to **lift** an object.

15. Scientists have designed **maglev** trains that are held just above their tracks by electromagnets, greatly reducing the amount of energy lost to **friction**.

**Critical Thinking**

16. In what way is an electric generator the opposite of an electric motor?

   An electric generator gets input energy from falling water, steam, or some other source that turns the coils of the generator to produce electrical energy. In an electric motor, electricity is used to turn the coil of the motor and do work.
Magnetism

Who am I? What am I?

Choose a word from the word box below that answers each question.

<table>
<thead>
<tr>
<th>a. alternating current</th>
<th>d. magnetic field</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. electromagnet</td>
<td>e. magnetic levitation</td>
</tr>
<tr>
<td>c. generator</td>
<td>f. magnetism</td>
</tr>
</tbody>
</table>

1. _____ c _____ When my wire coils are spun between the poles of my powerful magnet, I produce electricity. Who am I?

2. _____ a _____ I move back and forth through a wire, changing directions many times per second. What am I?

3. _____ e _____ I use magnetic forces to lift objects. I can even lift an entire train! Who am I?

4. _____ b _____ I am magnetic when an electric current flows through me. Who am I?

5. _____ f _____ When you have me, you can push or pull on another object that also has me. What am I?

6. _____ d _____ I describe the strength and direction of a magnet’s force. If you sprinkle iron filings near a magnet, you can see me. What am I?
Magnetism

Fill in the blanks.

<table>
<thead>
<tr>
<th>electric current</th>
<th>magnetic field</th>
<th>poles</th>
</tr>
</thead>
<tbody>
<tr>
<td>electric motor</td>
<td>north</td>
<td>south</td>
</tr>
<tr>
<td>electromagnet</td>
<td>permanent magnet</td>
<td>spin</td>
</tr>
</tbody>
</table>

Permanent magnets are made of metals such as iron. They have two __________ poles, north and south, and a(n) __________ magnetic field around them. An iron core with a wire coil wrapped around it is called a(n) __________ electromagnet. When a(n) __________ electric current passes through the wire coil, a magnetic field with a(n) __________ north pole and a(n) __________ south pole is generated.

Electric motors and electric generators have an electromagnet between the poles of a very strong __________ permanent magnet. In a(n) __________ electric motor, current is sent through the wire coil. The poles of the electromagnet switch back and forth, causing it to __________ spin between poles of the permanent magnet. In an electric generator, energy from falling water or some other source is used to spin the wire coil past the poles of the permanent magnet, generating electricity in the wire coil.
Using Energy

Choose the letter of the best answer.

1. A measurement of the average kinetic energy of molecules is
   a. heat.
   b. temperature.
   c. thermal capacity.
   d. thermal conductivity.

2. The movement of heat through a material while the material stays in place is
   a. radiation.
   b. convection.
   c. conduction.
   d. conductivity.

3. The surface of the Earth is warmed mainly by
   a. convection.
   b. conduction.
   c. geothermal heat.
   d. radiation.

4. Which of the following is the best thermal insulator?
   a. wood
   b. air
   c. water
   d. metal

5. Through which of these does sound travel fastest?
   a. water
c. metal
   b. air
d. a vacuum

6. A loud sound has a higher ___ than a soft sound.
   a. frequency
   b. pitch
   c. wavelength
d. amplitude

7. Which statement about light is true?
   a. It has properties of both a particle and a wave.
   b. It travels slowest through a vacuum.
   c. It can travel only through matter.
   d. It always has the same amount of energy.

8. When white light travels through a prism, it forms a(n)
   a. image.
   b. spectrum.
c. shadow.
d. reflection.
9. When light hits an opaque object, we see the color that the object
   a. absorbs.
   b. transmits.
   c. scatters.
   d. refracts.

10. What happens as light moves from one transparent material into a different transparent material?
    a. It reflects.
    b. It refracts.
    c. It is absorbed.
    d. It is scattered.

11. Which color of visible light has the shortest wavelength?
    a. red
    b. violet
    c. yellow
    d. blue

12. Which of the following is a resistor?
    a. a light bulb
    b. a switch
    c. a battery
    d. a wire

13. What happens when one bulb in a series circuit burns out?
    a. The other bulbs get dimmer.
    b. The other bulbs go out.
    c. The other bulbs get brighter.
    d. The other bulbs stay the same.

14. Which statement about magnets is true?
    a. Like poles attract each other.
    b. Unlike poles attract each other.
    c. Unlike poles repel each other.
    d. Poles have no affect on each other.

15. A device that changes electrical energy into a spinning motion is a(n)
    a. electric motor.
    b. transformer.
    c. electromagnet.
    d. electric generator.