Study Guide

Lesson Main Idea Worksheets
Lesson Science Vocabulary Worksheets
Lesson Support Vocabulary Worksheets
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To the Teacher

Use this Study Guide with each lesson of Houghton Mifflin Science, California Edition. This Study Guide provides a variety of activities that help students check their understanding of each lesson’s main idea and practice using the lesson’s vocabulary.

Main Idea

Main Idea pages provide reinforcement for the core lesson content. A main idea statement is followed by three or four sentences that tell the details of the lesson’s main idea. These details outline the main idea providing scaffolding for students as they complete the interactive activities and strengthen their understanding of key lesson content. These activities may also be used to review and prepare for tests.

Science Vocabulary

The Science Vocabulary page of each lesson reinforces key science vocabulary words while helping students access lesson content. The key science vocabulary words are listed on the first Learn by Reading page of each lesson in the student’s textbook. All of the key vocabulary words in a lesson are covered in interactive activities designed to offer meaningful practice using these science words.

Support Vocabulary

The words found on the Support Vocabulary page have high general utility across the curriculum. These words are important to understanding the content of the lesson, but are not defined in the text. A glossary appears on the page for reference as students complete the activities. The Support Vocabulary page gives all students a way to work with everyday words that provide meaning for science concepts.

Homework activities allow students an opportunity to demonstrate their understanding of the important concepts and key science vocabulary in each chapter.

Vocabulary Skill practice addresses the Vocabulary Skill presented in the Vocabulary Preview of each chapter as well as other grade-level vocabulary skills.
What Are the Parts of a Cell?

Main Idea Cells are the basic building blocks of living things. Cells contain special structures to transport cell materials.

- All living things are made of cells. Cells are the basic unit of all living things. All cells come from other cells.
- All living things depend on cells to carry out the basic functions of life.
- Cells are made up of organelles that perform specific functions.

A. Use the words from the box to complete the diagram of a plant cell.

- cell membrane
- endoplasmic reticulum
- cell wall
- lysosome
- nucleus
- Golgi apparatus
- cytoplasm
- vacuole
What Are the Parts of a Cell?

B. Complete the sentences comparing the similarities and differences between plant and animal cells.

1. Plant cells make their own food, but animals take in their food by _______ ________ ________.

2. While the cells of both plants and animals are surrounded by a thin, flexible ________________, only plant cells have a ________________, a rigid outer layer for protection and support.

3. Both plant cells and animal cells store water, food, and waste in ________________; animal cells may have ________________ vacuoles, while plant cells often have __________ ________ vacuole.

4. ______ ________ help cells break down nutrients and old cell parts and are common in ________________ cells but rare in ______ ________ cells.

5. ______________ , containing pigments that absorb sunlight, are found in ________________ cells but not in ________________ cells.

C. Add a word to each group. Then write a sentence that describes the group.

lysosomes, vacuoles, ________________

______________________________ ____________________________

energy, support, ______ ________

______________________________ ____________________________

bacteria, yeast, __________ ________

______________________________ ____________________________
What Are the Parts of a Cell?

| Cell | Cytoplasm | Nucleus | Organelle |

Match the words from the box to each description. The words will be used more than once.

_________ the basic unit of a living organism

_____  _______ a small structure in cells that performs a specific function

_________ comes from another cell

_________ directs the activities of a cell

____  ___ _______ thick fluid between the nucleus and the cell membrane

_________ carries out the functions of life

____  ___ _______ surrounds lysosomes, vacuoles, and other cell parts

_________ stores DNA

_________ can make a copy of itself

____  ___ _______ a ribosome is one of these

Homework: A mnemonic is a device such as a pattern of letters, words, or ideas that assists in remembering something. For example: Chloroplasts are filled with chlorophyll. Create a mnemonic to help you remember the name and function of a cell part or an organelle.
What Are the Parts of a Cell?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>conclusion</td>
<td>decision or opinion reached by reasoning</td>
</tr>
<tr>
<td>function</td>
<td>proper work, normal action or use</td>
</tr>
<tr>
<td>membrane</td>
<td>a thin soft layer of tissue that lines or covers something</td>
</tr>
<tr>
<td>organism</td>
<td>a living thing formed of separate parts that work together to carry on the various processes of life</td>
</tr>
<tr>
<td>pigment</td>
<td>substance that occurs in and colors the tissues of a living thing</td>
</tr>
<tr>
<td>proteins</td>
<td>complex chemical compounds that make up the parts of cells and allow the cell to perform chemical reactions</td>
</tr>
</tbody>
</table>

Complete each sentence to tell about cells.

1. Cells are the building blocks of every living ____________.
2. Every organelle has a specific ____________.
3. The Golgi apparatus receives and processes ____________.
4. The ____________ chlorophyll gives plants their green color.
5. Food, water, and gases enter cells through the cell ____________.
6. In the late 1800s, scientists made a ____________ that cells come from other cells.

Vocabulary Skill: Word Parts

In the word *multicellular*, the prefix *multi-* means “many,” and the suffix *-ular* indicates the word is an adjective. Based on this information, write a definition for the word.

______________________________________________________________
How Do Cells Make and Use Energy?

Main Idea To get energy, plant and animal cells break down sugar, releasing water and carbon dioxide.

- All living things require energy to survive.
- Cells break down glucose and capture its energy in a process called cellular respiration.
- Cells need energy to move, make proteins, divide, and transport materials.

A. Complete the sentences to tell how cells use energy.

1. Plants get energy from food they make for themselves. Animals get energy from ________________

2. In order to acquire glucose, some animals eat plants. Other animals eat ________________

3. Energy for a flashlight is stored in a battery. Energy for a cell is stored in ________________

4. Animals are able to store glucose. However, animals cannot store ________________

5. When animals breathe in, they inhale oxygen, which is required for cellular respiration. When animals breathe out, they exhale ________________, which is ________________

6. Some proteins allow cells to control the chemical reactions inside. Other proteins provide ________________

7. In passive transport, materials move from areas of high concentration to areas of low concentration. In active transport, ________________
How Do Cells Make and Use Energy?

B. Complete the diagram to describe cellular respiration.

1. Glucose and _______ and _______ enter a cell.

2. A chemical _______________ occurs.

3. Water, _______________, and _______ and _______ are produced.

C. Rewrite each sentence about energy to make it true.

1. Two factors that determine how much energy an animal needs are whether it has fur and how much it sleeps each day.
   
   ________________________________
   ________________________________

2. Plants require less energy than animals because they are much smaller than most animals.
   
   ________________________________
   ________________________________

3. Plants use energy to carry out cellular respiration.
   
   ________________________________
   ________________________________
How Do Cells Make and Use Energy?

Match the words from the box to each description. The words may be used more than once.

- Cellular respiration: cells break down glucose in this process
- Diffusion: works to keep water inside cells
- Osmosis: the process that spreads substances through a gas or liquid
- Cellular respiration: serves to change glucose and oxygen into carbon dioxide gas and water
- Diffusion: spreads materials into and out of cells
- Osmosis: takes place across a membrane that lets water pass, but keeps out many things that are dissolved in the water

**Homework:** Draw a cartoon illustrating the concepts of active transport and passive transport. For example, the cartoon could be of people crowding onto a subway car (active transport) and people exiting a subway car (passive transport). Be sure to label your drawing.
How Do Cells Make and Use Energy?

Glossary

<table>
<thead>
<tr>
<th>Division</th>
<th>condition of being separated into equal parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propeller</td>
<td>a wheel with curved blades</td>
</tr>
<tr>
<td>Reactions</td>
<td>processes in which substances act on each other</td>
</tr>
<tr>
<td>Structure</td>
<td>the arrangement of parts and elements</td>
</tr>
<tr>
<td>Transport</td>
<td>process of carrying from one place to another</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the paragraph about why cells need energy.

Cells need energy to perform important life functions. First, all cells make and use proteins. Some proteins allow cells to control chemical ______________. Other proteins provide ______________ and support for organisms. Cells also need energy to create movement. For example, some single-celled organisms use a structure that acts as a ______________. Cell ______________, which allows an organism to grow, also requires energy. Finally, the ______________ of materials across a cell membrane requires energy.

Vocabulary Skill: Word Parts

The word transport consists of the prefix trans-, which means “across,” and the root port, which means “to carry.” Write your own definition of transport based on this information.
How Are Cells Organized?

Main Idea  Cells join together to perform basic life functions in multicellular organisms.

- Tissues are made up of specialized cells of the same type.
- Organs are made up of tissues that perform specific functions.
- Organisms are made up of organ systems that perform specific functions.

A. Complete the chart to tell about the specialization of cells.

<table>
<thead>
<tr>
<th>Type of Cell</th>
<th>Characteristics</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>skin</td>
<td>flat, arranged close together</td>
<td>form a protective layer around the body</td>
</tr>
<tr>
<td>nerve</td>
<td>long with many branches</td>
<td>deliver electrical impulses over long distances</td>
</tr>
<tr>
<td>muscle</td>
<td>larger than other cells, can contract and relax</td>
<td>cause movement</td>
</tr>
</tbody>
</table>

B. Complete each sentence to tell about organ systems.

1. The __________ breaks down food into _______________ that cells can absorb.

2. The __________ brings oxygen to the body and _______________.

3. The circulatory system brings _______________ and _______________ to body cells and removes _______________.
# How Are Cells Organized?

C. Add the descriptions to the chart to tell how cells are organized.

<table>
<thead>
<tr>
<th>Description</th>
<th>Chart Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>the basic building blocks of living things</td>
<td></td>
</tr>
<tr>
<td>a living thing made up of a combination of organ systems</td>
<td></td>
</tr>
<tr>
<td>a group of related organs that work together</td>
<td></td>
</tr>
<tr>
<td>a group of related tissues that perform a specialized function</td>
<td></td>
</tr>
<tr>
<td>a large group of similar specialized cells</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cells:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissues:</td>
<td></td>
</tr>
<tr>
<td>Organs:</td>
<td></td>
</tr>
<tr>
<td>Organ Systems:</td>
<td></td>
</tr>
<tr>
<td>Organism:</td>
<td></td>
</tr>
</tbody>
</table>
How Are Cells Organized?

A. Use the words from the box to complete the diagram about cellular organization.

organ  organ system  tissue

B. List four examples of cell organization in each of the following categories.

<table>
<thead>
<tr>
<th>Tissues</th>
<th>Organs</th>
<th>Organ Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Homework: Choose an organ system that you would like to learn more about. Use the library or the Internet to research your choice, and then write a summary of what you learned.
How Are Cells Organized?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>absorb</td>
<td>to take in and make part of itself</td>
</tr>
<tr>
<td>complex</td>
<td>made up of a number of parts</td>
</tr>
<tr>
<td>contract</td>
<td>to draw together, make shorter</td>
</tr>
<tr>
<td>expel</td>
<td>to force or drive out</td>
</tr>
<tr>
<td>relax</td>
<td>to loosen up, become less stiff</td>
</tr>
<tr>
<td>simple</td>
<td>made up of one part</td>
</tr>
<tr>
<td>specialize</td>
<td>to perform a specific function</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences to tell about cellular organization.

1. Single-cell organisms have a ________ structure compared to the ________ structure of a multicellular organism.

2. Cells ________ in their functions.

3. Arm muscles ________ to pick up an object and ________ to put it down.

4. Cells ________ nutrients and ________ wastes.

Vocabulary Skill: Antonyms

Antonyms are words that have opposite meanings. Identify the pair of antonyms in the box.
How Do Plants Produce Food?

**Main Idea** Plants use energy from the Sun to make food. They combine carbon dioxide and water to make sugar, and release oxygen in the process.

- During photosynthesis, plants make their own food using energy from the Sun.
- Photosynthesis occurs in the chloroplasts of the leaves of plants. Chlorophyll is the pigment in chloroplasts that absorbs light.
- Plants remove carbon dioxide from the air and add oxygen and water vapor.

**A. Complete the diagram to tell about the process of photosynthesis.**

- **________________** takes place in organelles called chloroplasts located in a plant's leaves.
- Inside the chloroplasts, a pigment called **________________** absorbs light.
- During photosynthesis, the Sun's energy is used to split **________________** molecules into hydrogen and oxygen.
- The hydrogen then joins with carbon from carbon dioxide to form **________________**.
- The plant releases **________________** gas and water vapor into the atmosphere.
How Do Plants Produce Food?

B. Rewrite each statement about photosynthesis to make it true.

1. Photosynthesis occurs in the roots of plants.

2. Carbon dioxide enters a leaf through its veins.

3. Chloroplasts use the energy of sunlight and oxygen to make glucose.

4. Photosynthesis produces carbon dioxide and glucose.

C. Complete the diagram to tell about the effects of human activities on the cycles of carbon and oxygen.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>People are burning fossil fuels at a very fast rate.</td>
<td>Fewer trees are available to remove carbon and release oxygen.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How Do Plants Produce Food?

chlorophyll  grana  stomata
chloroplast  photosynthesis

Complete the diagram with words from the box to tell about the process of photosynthesis.

A __________ contains _________.

Chlorophyll can be found in the ________ of chloroplasts.

During ________ plants make their own food.

Oxygen is released through the ________ of leaves.

Vocabulary Skill: Prefixes

The prefix chloro- indicates the color green. What part of a tree is responsible for making its leaves green?

__________________________
How Do Plants Produce Food?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>blade</td>
<td>the flat, wide part of a leaf</td>
</tr>
<tr>
<td>compound</td>
<td>having more than one part</td>
</tr>
<tr>
<td>epidermis</td>
<td>a skinlike layer of cells in plants</td>
</tr>
<tr>
<td>simple</td>
<td>not divided into parts, single</td>
</tr>
<tr>
<td>veins</td>
<td>vessels forming the framework of a leaf</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences about the structure of leaves.

1. The broad, flat portion of the leaf is called the _____________.

2. A ____________ leaf has a blade that is one piece.

3. A ____________ leaf has a blade that is divided into parts.

4. The outer layer of a leaf is called the _____________.

5. ____________ carry materials in and out of the leaf, connecting the leaf’s cells to the rest of the plant.

Homework: Draw a diagram of the process of photosynthesis. Be sure to show what is needed for the process to occur and what results. Then write a paragraph that explains the process shown in your diagram.
How Do Plants Move Materials?

Main Idea Plants have specialized tissues and use natural forces to transport water, minerals, and nutrients.

- In nonvascular plants, materials move from cell to cell through diffusion.

- In vascular plants, specialized tissues transport materials.

- Water moves up in vascular plants through the xylem because of cohesion, root pressure, and transpiration. Gravity moves sugar down through the phloem.

A. Write **vascular** by each example or characteristic of a vascular plant. Write **nonvascular** by each example or characteristic of a nonvascular plant.

  ____________      sunflower
  ____________      mosses
  ____________      absorb water and minerals through roots
  ____________      grow well with little light
  ____________      redwood
  ____________      roots, stems, and leaves
  ____________      liverworts
  ____________      veins
  ____________      no leaves, stems, or roots
  ____________      materials move from cell to cell
How Do Plants Move Materials?

B. Use these terms to label the diagram of a vascular plant: \textit{phloem, xylem, and vascular cambium.}

C. Put a check by each statement that is true about the movement of water and nutrients through a vascular plant.

- Water moves up in plants because of three factors: root pressure, cohesion, and transpiration.
- Root pressure is strong enough to push water through a plant on its own.
- Water molecules cling to each other as a result of a force called cohesion.
- Adhesion forces water to go down.
- Water is pulled upward by transpiration.
- Gravity pulls sugar from the leaves down to nourish the plant.
- About 99% of the water that enters the roots is transpired by the leaves.
How Do Plants Move Materials?

A. Match each word from the box with its description.

_______ ________ conducts water and minerals from roots to stems and leaves
_______ ________ conducts sugar from leaves to the rest of the plant
_______ ________ evaporation of water through the surface of leaves
_______ ________ has specialized tissues that transport materials throughout it
_______ ________ lacks structures that transport sugar, water, and other materials between plant parts

B. Complete the diagram to compare and contrast vascular plants and nonvascular plants.

Plants use natural forces to transport water, minerals, and nutrients.

- Plants can be very small or very large
- Plants have roots, stems, and leaves
- Plants contain important tissues: _________ and _________
- Plants move water up by root pressure, cohesion, and _________

- Plants is almost always small
- Plants lacks true leaves, stems, and roots
- Plants lacks ways to deliver water to distant parts
- Plants Gases, water, and minerals move only by diffusion.

nonvascular plant transpiration xylem
phloem vascular plant
How Do Plants Move Materials?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>adhesion</td>
<td>condition of holding to, sticking to</td>
</tr>
<tr>
<td>cohesion</td>
<td>attraction between molecules of the same kind</td>
</tr>
<tr>
<td>gravity</td>
<td>the natural force that causes objects to tend to move to the center of the Earth</td>
</tr>
<tr>
<td>nutrient</td>
<td>any substance that a living thing needs for energy, growth, and repair of tissues</td>
</tr>
<tr>
<td>tissues</td>
<td>a group of cells that are similar in form and function</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences about the flow of materials through a vascular plant.

1. Sugar produced in the leaves of a plant being pulled down through the plant is an example of _____ ________ at work.

2. Water molecules being attracted to other water molecules is an example of _____________.

3. Glucose is an example of a _____________.

4. Water molecules clinging to molecules of other substances is an example of _____________.

5. Vascular _____________ conduct water, minerals, and sugar between different parts of the plant.

Homework: Write a brief explanation of the process of transpiration. Use sequence words to help clarify the steps in the process.
What Are the Respiratory and Circulatory Systems?

Main Idea The respiratory system brings oxygen into the body and removes wastes. The circulatory system carries oxygen to the cells and carries away wastes.

- The respiratory system brings oxygen to the blood and removes carbon dioxide from the blood.
- The circulatory system brings oxygen and nutrients to cells and takes away carbon dioxide and other wastes.
- The heart is the central organ of the circulatory system.

A. Complete the diagram to tell how the respiratory system delivers oxygen to the blood.

1. When you inhale, you take oxygen-filled air into your _________ or ________.
2. The air moves into a sturdy tube called the ________, which leads down your chest toward the ________.
3. The trachea divides into two main tubes called ________.
4. Inside the lungs each bronchus divides into smaller and smaller tubes, leading to grapelike sacs called ________.
5. Each of these tiny structures borders a ________.
What Are the Respiratory and Circulatory Systems?

B. Complete the diagram to show how blood circulates through the body.

Blood picks up oxygen in the _________.

Blood travels from the lungs to the _________.

Blood travels through ____________ to all other parts of the body.

The heart pumps the blood back into the _________ where it releases the carbon dioxide.

The blood flows into ________ which carry it back to the heart.

Oxygen, sugars, and minerals in the blood pass from capillaries into the _________.

Carbon dioxide and other wastes pass from the body cells into _________.

C. Complete the sentences to tell about the human heart and its functions.

1. The ____________ is at the center of the circulatory system.

2. The four chambers of the heart are the ____________, the ____________, the ____________, and the ____________.

3. The atria receive blood from the ____________.

4. The ____________ pump blood to the body.
What Are the Respiratory and Circulatory Systems?

Use the words from the box to complete the sentences about the circulatory and respiratory systems. Some words may be used more than once.

1. Nutrients pass through the wall of a _________ into the body cells.

2. A(n) _________ is a blood vessel that carries blood away from the heart.

3. The _________ brings oxygen and nutrients to the body’s cells and removes carbon dioxide and other wastes from the cells.

4. The _________ is the organ that pumps blood through the circulatory system.

5. The lungs are the central organ of the _________________.

6. Blood picks up oxygen in the _________.

7. A(n) _________ is a blood vessel that carries blood to the heart.

Vocabulary Skill:
Word Origins

The word *circulatory* comes from the Latin word *circulus*, which means “circle or ring.” Explain how the meaning of *circulus* relates to the circulatory system.

______________________________
What Are the Respiratory and Circulatory Systems?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alveoli</td>
<td>tiny air sacs in the lungs</td>
</tr>
<tr>
<td>bronchi</td>
<td>two tubes leading from the trachea into the lungs</td>
</tr>
<tr>
<td>hemoglobin</td>
<td>a substance in red blood cells used to carry oxygen and carbon dioxide</td>
</tr>
<tr>
<td>plasma</td>
<td>the liquid part of the blood</td>
</tr>
<tr>
<td>platelets</td>
<td>small pieces of cells that help the blood clot</td>
</tr>
<tr>
<td>trachea</td>
<td>a sturdy tube that leads down the chest to the bronchi</td>
</tr>
</tbody>
</table>

Write the word from the box that matches each clue.

__________  found in red blood cells
__________  leads to the bronchi
__________  carries air into the lungs
__________  help the body heal wounds
__________  carries blood cells
__________  bordered by a capillary

Homework: Draw a diagram that shows how blood is carried into the heart and out of the heart. Label the diagram.
What Is the Digestive System?

**Main Idea** To function properly, living things need nutrients found in foods. The digestive system breaks down food to release these nutrients.

- The digestive system breaks down food into nutrients the body can use. Starches break down into sugars in the mouth.
- The stomach mixes and stores food. It further breaks down food into a soupy mix.
- Digestion finishes in the small intestine and nutrients are absorbed into the blood. Water and minerals are absorbed from the large intestine.

A. Complete the outline about the digestive system.

I. You must take in food.
   A. Food provides the body with ________.
   B. The body uses ________ of nutrients for ________.

II. Your body releases nutrients from food in a process called ________.
   A. The ________ is a group of organs that breaks food down into ________ that the body can use.
   B. These small particles enter the ________.

III. You should eat a ________ diet.
   A. A balanced diet is made from a variety of ________.
   B. ________ helps your digestive system work properly.
   C. You should avoid eating too many ________.

IV. You should eat ________ every day.
   A. Your body can store certain ________.
   B. Many ________, however, cannot be stored.
What Is the Digestive System?

B. Complete the chart to tell about nutrients.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Uses</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>main source of energy for the body</td>
<td>pasta, potatoes, rice and other grains</td>
</tr>
<tr>
<td>Proteins</td>
<td>used to replace, repair, and grow new cells and tissues</td>
<td>fish, beef, chicken, beans</td>
</tr>
<tr>
<td>Vitamins and minerals</td>
<td>help in various ways, including helping nerves work</td>
<td>fruits, vegetables, fortified milk</td>
</tr>
<tr>
<td>Fats</td>
<td>provide energy and keep skin healthy</td>
<td>butter, oil, ice cream</td>
</tr>
</tbody>
</table>

C. Use the numbers 1 through 9 to put the stages of digestion in order.

1. Chewed food moves into the esophagus.
2. Undigested food and other substances pass to the large intestine.
3. Food enters the small intestine where most digestion takes place.
4. Digestion begins in the mouth.
5. Nutrients from the digested food pass from villi into the blood.
6. Water and minerals from food are absorbed into the blood.
7. Chewing grinds food into smaller pieces, and saliva moistens the food and begins to break it down.
8. The stomach squeezes the food and mixes it with digestive fluids.
9. Remaining undigested food passes as solid waste.
What Is the Digestive System?

Use the words in the box to complete the paragraph about digestion. Some words may be used more than once.

The ___________ is a group of organs that breaks down food into small pieces the body can use. Food moves from the mouth to the stomach through the _______ __ _______. The _______________ is a muscular organ that stores and helps digest food. When food leaves the stomach, it enters the _______________ where more digestion takes place. Nutrients from the digested food pass through villi in the _______________ into the blood and to every cell in the body. Undigested food and other substances pass to the ____ _____________.

Vocabulary Skill: Word Origins

The word digestive comes from the Latin word digestus, meaning “to divide or distribute.” Write an explanation of the term digestive system using this information.

_________________________ ______________________________

_________________________ ______________________________
What Is the Digestive System?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>acid</td>
<td>a corrosive chemical substance</td>
</tr>
<tr>
<td>carbohydrates</td>
<td>organic compounds that release energy when broken down by an organism</td>
</tr>
<tr>
<td>enzymes</td>
<td>substances produced by an organism that bring about specific biochemical reactions</td>
</tr>
<tr>
<td>glands</td>
<td>organs that secrete particular chemical substances</td>
</tr>
<tr>
<td>nutrients</td>
<td>substances that provide nourishment essential for growth and the maintenance of life</td>
</tr>
</tbody>
</table>

Use the words from the box to complete each sentence about the digestive system.

1. Digestion helps to release ________________ from food that the body can use.

2. People get most of the energy their bodies need from eating ________________.

3. Saliva is produced by ________________ that are located at the back and bottom of the mouth.

4. The ________________ in saliva break down the starch in foods like bread and potatoes.

5. Digestive fluids in the stomach contain a(n) ________________ that breaks down food.

**Homework:** Create a timeline to show how long it takes food to move through the digestive system. Begin your timeline with food entering the mouth.
What Is the Excretory System?

**Main Idea** All living things produce wastes. In humans, the excretory system removes wastes and helps maintain water levels.

- Kidneys filter wastes from blood and produce urine.
- People with kidney problems can often be helped with dialysis or a kidney transplant.
- Plants and animals use different methods of removing wastes.

A. Complete the diagram to tell about the excretory system.

**Causes**

- The body produces a lot of _______.
- The body produces carbon dioxide.
- Blood carries wastes that contain ____________.
- Blood then contains ____________.
- When urea and water are filtered by the kidneys, ____________ results.
- The ____________ in the bladder causes it to increase in size.

**Effects**

- The ____________ removes it.
- The ____________ remove it.
- The ____________ converts nitrogen waste into ____________.
- The ____________ filter out the urea from blood.
- The ____________ carry urine to the ____________.
- Sensors detect its size and _______ _______ that it needs to be emptied.
What Is the Excretory System?

B. Rewrite each statement about excretory system problems to make it true.

1. If the excretory system works poorly or stops working, vitamins and minerals will gradually build up in the body.

If the excretory system works poorly or stops working, wastes and poisons will gradually build up in the body.

2. Kidney disease can only occur in adults.

Kidney disease can occur in children and adults.

3. Drinking lots of water and eating a healthy diet are two important steps to keeping your ureters healthy.

Drinking lots of water and eating a healthy diet are two important steps to keeping your kidneys healthy.

C. Put the steps in order to describe dialysis.

1. Waste and extra fluid are removed from the blood.
2. Blood is filtered in a machine.
3. Filtered blood is returned to the body.
4. Blood containing wastes is removed from the body.

D. Match each term with its waste removal system. Use each term only once.

- camels
- mammals
- plants
- earthworms
- plant cells
- snakes

- diffuse wastes directly to the outside
- change nitrogen wastes into uric acid
- make urea which they flush out with water
- make urine saltier than sea water
- often store wastes in a central vacuole
- may also keep wastes in unwanted parts
What Is the Excretory System?

A. Use the words from the box to complete each sentence.

1. The job of the _______ is to remove wastes and to maintain water balance.

2. The _______ is a bean-shaped organ located near the middle of the back.

3. The _______ is a muscular bag that holds urine.

B. Write a word from the box next to each phrase that describes it. Some words may be used more than once.

__________ sensors detect its size and signal the brain when it needs to be emptied.

__________ filters urea from the blood

__________ helps the body maintain the right water balance

__________ involves different processes and organs spread throughout the body

__________ surrounded by a layer of fat for protection

__________ connected to kidneys by ureters

Homework: Write two or three sentences that explain how the kidneys and bladder work together in the excretory system.
What Is the Excretory System?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>dialysis</td>
<td>process of cleansing the blood artificially</td>
</tr>
<tr>
<td>filter</td>
<td>straining out substances from a liquid or gas by slow passage through tissues, cloth, paper, sand, or charcoal</td>
</tr>
<tr>
<td>urea</td>
<td>substance present in the urine of mammals</td>
</tr>
<tr>
<td>urine</td>
<td>the liquid waste product that is produced by the kidneys</td>
</tr>
<tr>
<td>wastes</td>
<td>materials that the body cannot use</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the paragraph about the excretory system. Some words may be used more than once.

The excretory system removes _____________ from the body.

As key organs of the excretory system, the kidneys _____________ the blood and produce _____________. The urine of all mammals contains _____________. If a person’s kidneys are not working, ____________ can be removed from the blood by _____________.

In this process, a machine is used to _____________ out _____________ and other fluids.

Vocabulary Skills: Word Origins

The word dial comes from a Latin word meaning “day.” The face of a sundial was called “the wheel of day” and people started using the word for other marked circles. How does the origin of dialysis relate to its meaning?

__________________________________________

__________________________________________
Where Is Earth’s Water?

Main Idea Most of Earth’s water is salt water contained in the oceans.

- Oceans and seas make up 97 percent of Earth’s water.
- Earth’s fresh water is located in rivers, lakes, underground, and as ice in glaciers.
- Distillation and reverse osmosis are processes used to remove salt from salt water.

A. Complete the diagram to tell about salt water oceans and seas.

As water from runoff moves across the land, it dissolves __________ in ______________.

The runoff carries salts and other minerals into ______________.

Eventually, the rivers empty into ______________, bringing the salts and other minerals with them.

Over time—millions of years—the deposits accumulate, making the water ______________.

B. Complete the diagram to tell why fresh water is a valuable resource.

Fresh Water: A Valuable Resource

Much of the fresh water supply is ____________

It is ____________ over Earth’s surface.

__________ can damage the water supply.
Where Is Earth’s Water?

C. Complete each sentence in the diagram to identify sources of Earth’s fresh water.

A(n) _______________ is a body of water that flows downhill in a channel.

A(n) _______________ is a small river.

are bodies of water surrounded by land.

About two-thirds of Earth’s fresh water is “locked away” as ice in _______________.

D. Complete the chart to tell about the process of desalination.

<table>
<thead>
<tr>
<th>Processes</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Distillation:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Reverse osmosis:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The desalination plants are</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The plants produce brine, which can</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Where Is Earth’s Water?

Match each word from the box to the statement that describes it. Each word will be used more than once.

- ___________ water that collects in spaces and cracks in rocks and soil underground
- ___________ the main source of salt in oceans and seas
- __ ___________ one of the two main sources of fresh water
- ___________ the removal of salt from salt water to make fresh water
- ___________ rainwater that flows over land without sinking into the soil
- ___________ provides less than one percent of the world’s fresh water
- ___________ carries salts and other minerals into streams and rivers
- ___________ makes up about 94 percent of Earth’s usable fresh water supply
- ___________ an expensive process that produces brine

Homework: Explain the difference between surface water and groundwater in a few sentences.
Where Is Earth’s Water?

Glossary

- **condense** changes from a gas or vapor to a liquid
- **distillation** the process of boiling a liquid and condensing and collecting the vapor to purify the liquid
- **evaporates** changes from a liquid to a gas or vapor
- **membrane** a thin sheet or skin
- **molecules** groups of two or more atoms joined together in a chemical bond
- **osmosis** the movement of a solvent through a membrane separating two solutions of different concentrations

The Process of __________

Ocean water is collected and heated.

The hot water __________ and becomes water vapor, leaving the solid salts behind.

In a separate chamber, the water vapor is cooled and __________ back into liquid fresh water.

The Process of Reverse __________

Salt water is pumped at high pressure through a thin membrane.

Holes in the membrane let water __________ pass through, but trap dissolved salts.

Fresh water is produced.

Vocabulary Skill: Multiple-Meaning Words

The word *condense* has more than one meaning. Write two meanings this word can have. Use a dictionary to help you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
How Do Communities Get Water?

Main Idea Communities get fresh water from both underground sources and surface sources.

• Rivers provide drinking water.
• Dams create reservoirs that collect and store water for drinking and irrigation.
• Groundwater from wells and springs supply drinking water.
• Drinking water is processed in purification plants.

A. Complete each sentence to identify the sources and systems that provide Californians with fresh water.

Only about 35% of the ____________ and ____________ that falls in California becomes ____________ that supplies rivers and lakes.

create reservoirs.

Reservoirs also provide water for irrigation, the supplying of ____________ to farm fields.

A(n) ____________ is a place that collects and stores water.

A(n) ____________ is a system of channels, pipes, and tunnels that carries water a long distance.
How Do Communities Get Water?

B. Complete the sentences to tell about groundwater.

1. The source of most groundwater is ________________ that sinks into the ________________.

2. Water at the surface seeps downward until it reaches a layer of ________________ or ________________.

3. Water cannot ________________ this layer, so it fills in the spaces in soil and rock ________________.

4. When all the ________________ are filled with ________________, the ground is said to be ________________.

C. Complete the diagram to compare and contrast wells and springs.

[Diagram with Venn diagram comparing wells and springs]
How Do Communities Get Water?

Use a word from the box to complete each sentence about the water supply.

1. A(n) ________ is a region of land that drains into a river.

2. ________ is the supplying of fresh water to farm fields.

3. A(n) ________ is a natural flow of water from underground.

4. A(n) ________ is a system of channels, pipes, and tunnels that carries water a long distance.

5. A(n) ________ is a place that collects and stores water.

6. An underground layer of rock or soil through which water moves easily is a(n) ________.

7. The surface of a layer of saturated ground is the ________.

8. A(n) ________ is a hole dug or drilled into an underground area saturated with water.

**Homework:** Write a short paragraph explaining why aqueducts are necessary in parts of California.
How Do Communities Get Water?

Glossary

- **groundwater**: water beneath the surface of the earth
- **precipitation**: water, such as rain, snow, or sleet that falls to the surface of Earth
- **purification**: the act of cleansing or purifying water
- **wetland**: a lowland area that is saturated with water

Use words from the box to complete the diagrams.

- Water passes through a screen to remove objects.
- Sand and gravel filter out unwanted materials.
- Chlorine and other chemicals kill disease-causing organisms.
- Aquifer.
- Water Table.

Vocabulary Skill: Multiple-Meaning Words

The word **root** has more than one meaning. Write two meanings this word can have.

- ________
- ________
How Can Fresh Water Be Used Wisely?

**Main Idea** Water should be conserved in order to make fresh water supplies last longer.

- California’s growing population and crops need huge amounts of fresh water.
- About 1,300 dams and reservoirs, six major aqueduct systems, and other structures shift water from wetter areas to drier areas.
- Californians can conserve water by recycling and by decreasing their use of water.

**A. Complete the cause-and-effect diagram about California’s water needs.**

**Causes**

- California has the __________ population of any state.
- The state’s people and farm fields are not close to its major water ____________.
- Californians’ water needs have begun to grow ____________ than their supply.

**Effects**

- The state faces big challenges in providing enough ____________ to everyone.
- A large system of canals, pipes, aqueducts, dams, pumps, and reservoirs serve to ____________ water.
- New steps are being taken so that ____________ has the water they need.
How Can Fresh Water Be Used Wisely?

B. Rewrite each statement about California’s water supply to make it true.

1. The 238-mile-long Los Angeles Aqueduct brings water from Los Angeles over the mountains to Owens Valley.

2. The Sacramento-San Joaquin River system supplies water to northern California.

3. The Colorado River Aqueduct carries river water from the Colorado to the city of Los Angeles.

4. “The 4.4 Plan” is an agreement between the states that share water from the Sacramento River and promotes laws and practices that increase water use.

C. Complete the diagram to tell about water conservation.

Water Conservation in California

- the careful use of water to help it
- irrigating wisely, such as using
- water reclamation, which is__________

Homework: Make a list of what you do to help conserve water.
How Can Fresh Water Be Used Wisely?

Match the words from the box with the phrases below.

1. ___________  the careful use of a natural resource

2. ___________  replacing old toilets with newer models that use less water

3. ___________  recycling waste water

4. ___________  taking shorter showers

5. ___________  between 50 and 75 percent of waste water from homes and offices could be reused to wash cars or to water lawns

6. ___________  turning off the water as we brush our teeth

Vocabulary Skill: Suffixes

Some nouns can be formed by adding the suffix -tion to the verb form. Explain how to form a noun from the word conserve.

__________________________________________

__________________________________________
**How Can Fresh Water Be Used Wisely?**

**Glossary**

- **encourage**: to stimulate; spur
- **irrigate**: to supply with water by means of streams or pipes
- **recycling**: extracting useful materials from waste
- **resource**: an available supply that can be drawn upon as needed
- **seeps**: passes slowly through small openings

**Use the words from the box to complete the sentences about water conservation.**

1. Conserving a ________ will help it last longer.

2. Most of California’s water is used to ________ farms and crops.

3. Much of the water used from irrigation canals evaporates, runs off the land, or ________ into soil.

4. The state of California has passed laws to ________ water conservation.

5. One law addresses water reclamation, the ________ of waste water.

**Vocabulary Skill: Prefixes**

The prefix *re-* means “once more” or “again” when added to a base word. How does knowing this prefix help you understand the meaning of *recycle*? Use an example to help you answer the question.

Write a sentence using the word *recycle* with the prefix *re-*: ________________________________

Write another sentence using the word *recycle* without the prefix: ________________________________

Write a sentence using the word *recycle* with another prefix: ________________________________

Write another sentence using the word *recycle* without any prefix: ________________________________
How Does Water Change State?

Main Idea On Earth, water exists in three states: liquid water, solid ice, and a gas called water vapor. Water changes from one state to another in processes that make up the water cycle.

• Earth’s fresh water is cleaned and renewed in the processes that make up the water cycle.
• Liquid water evaporates and changes to water vapor in the air. When cooled, it changes back to a liquid or a solid and falls to Earth as rain, sleet, snow, or hail.
• Groundwater collects in underground spaces between soil and rock. Runoff is water that flows over the ground, eroding the soil.

A. Put a check next to each statement that is true about water in the environment.

____ 1. The water cycle is a natural process that restores and cleans Earth’s water supply.
____ 2. Only 30 percent of the Earth’s surface is covered with water.
____ 3. Unwanted materials can pollute water on Earth’s surface.
____ 4. Most fresh water on Earth is found underground and in glaciers and ice caps.
____ 5. The water cycle adds pollution to Earth’s fresh water supply.
____ 6. Water exists in only two states: liquid water and water vapor.
____ 7. People use fresh water for drinking, cooking, and growing food.
____ 8. About 97 percent of the Earth’s water is salt water.
____ 9. In the water cycle, water moves from the Sun to Earth’s surface.
How Does Water Change State?

B. Use the diagram below to answer the questions about the water cycle.

1. What is shown as A?

2. What part of the water cycle is illustrated by B?

3. What is shown as C?

4. What part of the water cycle is illustrated by D?

5. What part of the water cycle is illustrated by E?

6. What are four types of precipitation?

C. Explain how groundwater and runoff are different.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
How Does Water Change State?

condensation  evaporation  groundwater
precipitation  transpiration  water vapor

Use the words from the box to complete the puzzle about the water cycle.

**Across**

1. any form of water that falls to Earth’s surface from clouds
2. water in the form of a gas
3. water that soaks into the ground and collects there

**Down**

4. a liquid changing to a gas
5. a process in which the leaves of plants release water vapor into the air
6. the change of state from a gas to a liquid
How Does Water Change State?

Glossary

<table>
<thead>
<tr>
<th>word</th>
<th>definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cycle</td>
<td>a series of events that happen one after another in the same order, over and over again</td>
</tr>
<tr>
<td>energy</td>
<td>the capacity for work or vigorous activity</td>
</tr>
<tr>
<td>process</td>
<td>a series of actions performed in making or doing something</td>
</tr>
<tr>
<td>renew</td>
<td>to make new or as if new again</td>
</tr>
<tr>
<td>restore</td>
<td>to bring back into existence or use</td>
</tr>
</tbody>
</table>

Use words from the box to complete the diagram about the Water Cycle.

a natural _______ that _______ and cleans Earth’s water supply

__________

Earth’s supply of usable fresh water

Water

requires _________ from the Sun to evaporate liquid water on Earth’s surface

Homework: Write a paragraph that explains how water changes from one state to another in the water cycle.
How Does Precipitation Form?

**Main Idea** Clouds form and release precipitation as rain, snow, sleet, and hail.

- As moist air rises, water vapor condenses and clouds can form.
- Luke Howard described four classes of clouds.
- Rain, sleet, snow, and hail are the major forms of precipitation.

**A. Number the events below to show the order in which they occur.**

1. The rising warm air gradually cools.
2. The Sun warms Earth’s surface.
3. The cold air sinks back to the ground.
4. The warm air rises further above Earth’s surface.
5. The air just above Earth’s surface warms, too.

**B. Complete the diagram about cloud formation.**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm air rises in a convection current.</td>
<td>The air carries ________________ with it.</td>
</tr>
<tr>
<td>The air cools.</td>
<td>The water vapor ________________ around tiny specks of dust or salt, forming tiny _________________.</td>
</tr>
<tr>
<td>The droplets remain suspended in the air.</td>
<td>_________________.</td>
</tr>
</tbody>
</table>
How Does Precipitation Form?

C. Complete the diagrams to identify the four major forms of precipitation.

- **sleet**
  - Drops fall through air that is **colder** than water's freezing point.
  - Type of flakes depends on temperature of cloud.
  - Made up of small flakes and pellets of ice.

- **snow**
  - Begins to form when drops of rain **freeze** inside a cloud with cold updraft winds.
  - Chunks grow **heavier** as coats of ice are added inside cloud.
  - Made up of round chunks of ice.

- **rain**
  - Can form when tiny cloud droplets **combine** liquid and pellets of ice.
  - Can begin as drops of **water**.

- **hail**
  - Produced when temperature in cloud is **low enough** to form ice crystals.
  - Made up of drops of **rain**.
How Does Precipitation Form?

Use the words from the box to complete each sentence about precipitation.

1. The temperature at which air becomes saturated is its ____________________.

2. ____________________ is the amount of water vapor in the air at any given time.

3. A ____________________ is a continuous loop of moving air or liquid that transfers energy.

4. If the air temperature drops below the ____________________, water condenses and clouds or fog form.

5. One reason that ____________________ changes is because the temperature changes.

6. When the ____________________ is 100 percent, the air is said to be saturated.

Vocabulary Skill:
Root Words

The word *humidity* comes from the Latin word *humere*, which means “to be moist.” Explain how knowing the meaning of the root helps you understand the meaning of *humidity*.

____________________________________________________

____________________________________________________
How Does Precipitation Form?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cirrus</td>
<td>a cloud composed of feathery white patches, bands, or streamers of ice crystals, found typically at high altitudes</td>
</tr>
<tr>
<td>cumulus</td>
<td>a dense, white, fluffy cloud that billows upward from a flat base</td>
</tr>
<tr>
<td>cumulonimbus</td>
<td>a very dense cloud with massive projections that billow upward to great heights, usually producing heavy rains, thunderstorms, or hailstorms</td>
</tr>
<tr>
<td>stratus</td>
<td>a low-lying grayish cloud that resembles a layer of fog</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the chart about the different types of clouds. Then answer the question that follows.

<table>
<thead>
<tr>
<th>Type of Cloud</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>These clouds form in layers and may cover large parts of the sky. Some may bring rain.</td>
</tr>
<tr>
<td>_______</td>
<td>These are puffy, white clouds with flat bottoms. They form in rising columns of warm air and generally mean the weather is fair.</td>
</tr>
<tr>
<td>_______</td>
<td>These high altitude clouds are thin and wispy, and made of ice crystals. They indicate that pleasant weather may change to rain.</td>
</tr>
<tr>
<td>_______</td>
<td>These clouds may bring heavy rain or thunderstorms. They may extend up through the troposphere.</td>
</tr>
</tbody>
</table>

Why do clouds stay in the sky?

Homework: Write a short paragraph describing the types of precipitation that fall in your city or town.
How Does the Ocean Affect Weather?

Main Idea Oceans have a major effect on Earth’s weather and climate.

- Earth’s oceans warm and cool more slowly than its lands because water has a relatively high specific heat capacity.
- Ocean currents move warm and cold water around the oceans, helping to even out Earth’s temperatures.
- Oceans help to moderate the climate of places near them, such as California.

A. Complete the summary about heating and cooling land and water.

The _________________ is the amount of energy it takes to raise the temperature of 1 gram of a material by 1°C. Land and water have different specific heat capacities. In general, land heats up _________________ and reaches _________________ temperatures than do bodies of water. Land areas also lose heat _________________ and drop to _________________ temperatures. As a result, it takes more _________________ and _________________ to heat ocean water than it does to heat nearby land.

B. Put a check next to each description of surface ocean currents that is true.

_____ move vertically within ocean
_____ can be warm or cold
_____ form because of differences in water temperature and salinity
_____ move in great circles
_____ driven by surface winds and the effects of Earth’s rotation
_____ help balance temperatures at Earth’s surface
How Does the Ocean Affect Weather?

C. Fill in the blanks to tell how oceans help to moderate the climate of places near them.

**Summer**
- Land is __________ away from ocean
- Coastland is __________

Ocean water holds summer heat longer than land.

**Winter**
- Land is __________ away from ocean
- Coastland is __________

Ocean water holds winter's coldness longer than land.
How Does the Ocean Affect Weather?

Rewrite each sentence to make the statement about the movement of ocean water true.

1. An ocean current is an area of cold water in the ocean.

2. Water that flows within a current has a wide range of temperatures and densities.

3. Ocean currents move cold water around Earth’s oceans. This helps cool the temperature of nearby land.

4. There are three types of ocean currents—shallow currents, salty currents, and wave currents.

Vocabulary Skill: Multiple-Meaning Words

The word current has more than one meaning. Write a sentence with the word current using the same meaning that is found in the lesson.

Write another sentence using a different meaning.

Sample response: We didn’t go swimming at the beach because the current was too strong.

Samantha needs to give me her current address.
How Does the Ocean Affect Weather?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy</td>
<td>the capacity for work or vigorous energy</td>
</tr>
<tr>
<td>land</td>
<td>any part of Earth’s surface that is not water</td>
</tr>
<tr>
<td>ocean</td>
<td>the whole body of salt water that covers nearly three-fourths of Earth’s surface</td>
</tr>
<tr>
<td>temperature</td>
<td>the degree of heat or cold</td>
</tr>
<tr>
<td>warm</td>
<td>somewhat hot; not cold</td>
</tr>
</tbody>
</table>

Use a word from the box to complete the paragraph about ocean effects on weather and climate.

How much ________________ does it take to raise the ________________ of 1 gram of water by 1°C? The term used to describe this amount is specific heat capacity. Water and ________________ have different specific heat capacities. In general, land heats up faster and cools faster than bodies of water do. For this reason, oceans hold the heat of summer long into winter. During winter, the ________________ warms nearby lands, which remain milder than they would if the ocean were not there. Oceans also hold the coldness of winter into the ________________ months of summer. During summer, the ocean cools nearby lands.

**Homework:** Define an ocean current. Tell where warm currents move warm ocean water and where cold currents move cold ocean water.
How Does Air Pressure Affect Weather?

Main Idea Earth’s atmosphere is a mixture of gases that surrounds the planet. The atmosphere exerts a pressure that decreases with distance above Earth’s surface.

- Earth’s atmosphere is made up mostly of nitrogen and oxygen.
- Air pressure is the force air exerts on Earth. Air pressure at Earth’s surface is always changing.
- Low-pressure systems are associated with changing weather. High-pressure systems are associated with fair weather.

A. Fill in the blanks to tell about the different layers of Earth’s atmosphere.

The ________ is the first part of Earth’s atmosphere struck by ________.

The top of the ________ has the ________ temperatures in Earth’s atmosphere.

The ________ contains most of the ________ in Earth’s atmosphere.

The ________ contains about 75 percent of the ________ in Earth’s atmosphere.

B. Fill in the blanks to tell about air pressure and altitude.

1. The air pressure in the ________ is greater than the air pressure in any other layer in the atmosphere.

2. As the distance from Earth’s surface increases, the air pressure ________.

3. Air pressure decreases with altitude because there are ________ air molecules as you move away from Earth’s surface.
How Does Air Pressure Affect Weather?

C. Complete the diagram to tell how air pressure systems form in Earth’s atmosphere.

**Causes**

- Earth’s surface heats the air above it.

**Effects**

- As the air warms it lightens and ______ in the atmosphere.

- Earth’s surface cools the air above it.

- The cold air is dense and ______ in the atmosphere.

D. Rewrite each sentence to make the statement about air pressure and weather true.

1. Clouds can form as warmer, lighter air rises in the atmosphere, which is why high-pressure systems are associated with unsettled weather.

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________

2. Low-pressure systems are associated with fair weather because clouds cannot form when cooler, heavier air sinks in the atmosphere.

   __________________________________________________________________________

   __________________________________________________________________________

   __________________________________________________________________________
How Does Air Pressure Affect Weather?

Write the word from the box next to its description. The words will be used more than once.

1. the force exerted by air on a given area
2. overall condition of the atmosphere at a given time and place
3. affected by factors such as humidity, wind speed, and temperature
4. it’s divided into four main layers
5. affected by the air pressure in a given area
6. a mixture of gases that surround the planet
7. it generally decreases with altitude
8. made up mostly of nitrogen and oxygen
9. an effect of the Sun’s uneven heating of Earth’s surface

Homework: Write a short paragraph describing how high-pressure and low-pressure systems affect the weather.
How Does Air Pressure Affect Weather?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>axis</td>
<td>a straight line around which an object rotates</td>
</tr>
<tr>
<td>force</td>
<td>a push or a pull</td>
</tr>
<tr>
<td>fossil fuels</td>
<td>fossil materials that burn, such as coal, oil, or natural gas</td>
</tr>
<tr>
<td>molecules</td>
<td>groups of two or more atoms linked together</td>
</tr>
<tr>
<td>radiation</td>
<td>energy in the form of electromagnetic waves or particles</td>
</tr>
<tr>
<td>water vapor</td>
<td>water in its gaseous state</td>
</tr>
</tbody>
</table>

Use a word from the box to complete each sentence.

1. Near oceans or large lakes, ____________ can make up as much as four percent of the air.

2. Burning ____________ increases the amount of carbon dioxide in the atmosphere.

3. ____________ from the Sun can harm living things.

4. As you move away from Earth’s surface, there are fewer air ____________.

5. Air exerts a(n) ____________ equally in all directions.

6. As Earth revolves around the Sun, the tilt of its ____________ affects the heating of Earth’s surface.

Homework: Write a paragraph that explains how the tilt of Earth’s axis affects the heating of its surface by the Sun.
Why Does Air Move?

Main Idea Wind is caused by differences in air pressure. These differences create both local winds and planetary winds.

• Wind is the movement of air from areas of high pressure to areas of low pressure.
• All winds are part of convection currents in the atmosphere.
• Planetary winds affect large areas of Earth.

A. Complete the paragraph to tell about air pressure.

The _____________ heating of Earth’s surface causes differences in _____________. When air is warmed, it becomes _____________ than surrounding air. When air is _____________, it becomes denser than the surrounding air. This creates local high-pressure and low-pressure systems that affect _____________ across the globe.

B. Answer the following questions to compare the different types of local breezes.

1. What are valley breezes?

   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

2. What are land breezes?

   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________
Why Does Air Move?

C. Number the statements in the correct order to tell about the mountain effect.

1. Dry winds sweep down the leeward side of the mountain.
2. In the colder air at higher elevations, water vapor condenses to form clouds.
3. Water from the ocean evaporates into water vapor in the air.
4. Air that crosses over the mountain has very little moisture left.
5. Sea breezes carry the moist air toward land.
6. Rain or snow may fall along the windward side of the mountain.
7. Moist air is forced up over the mountains.

D. Complete the diagram to tell about planetary winds.

- There are three main wind belts:
  - __________________________
  - __________________________

- They are __________________________
  - __________________________
  - __________________________

- They do not __________________________
  - __________________________
  - __________________________

Homework: Write a paragraph explaining how the jet stream and planetary wind belts affect weather systems.
Why Does Air Move?

Rewrite the underlined portion of each statement to make it true.

1. A mountain breeze occurs during the day when warm air rising from a mountain slope is replaced by cooler air from the valley moving in to replace it.

2. Planetary winds, like local breezes, are regional winds that affect a limited area of Earth.

3. A land breeze occurs during the day when cool air from the sea moves in to replace warm air rising over the sea.

4. Jet streams are the three wind belts in each hemisphere of Earth.

5. A sea breeze blows from water to land and occurs during the day when warm air over the sea moves in to take the place of cool air rising over the land.

6. A valley breeze occurs at night when cool air from the valley rises up mountain slopes to replace the cool air rising over the slopes.
Why Does Air Move?

Glossary

- **belts**: geographic regions that are distinctive in some way
- **circulation**: the process of moving or flowing along a path
- **friction**: the rubbing of one object or surface against another
- **global**: of the entire Earth; worldwide
- **prevailing**: most common

Use words from the box to complete the paragraph to tell about global weather.

The uneven heating by the Sun of Earth’s surface creates differences in air pressure. These differences in air pressure result in planetary winds. Planetary winds are long-lasting _______________ patterns that affect large areas of Earth. Three main wind _______________ cover each hemisphere. These winds do not travel in straight lines. They are directed by Earth’s rotation and _______________ with the surface. Planetary winds curve to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Jet streams are another system of _______ _________ winds occurring in the troposphere. Planetary winds and jet streams affect the direction in which weather systems move. For example, the _______ _______ westerlies blow from west to east across the United States. They have a great effect on U.S. weather.

**Vocabulary Skill: Prefixes**

The prefix *un*- means “not.” It usually changes a word to its opposite meaning. Determine the meaning of each word and then write a sentence using each word.

- **uneven**: ________________________________
- **unequal**: ________________________________
How Are Weather Forecasts Made?

Main Idea Scientists gather data about temperature, humidity, wind, and air pressure. They use this information to develop weather forecasts.

- Weather involves different variables, including temperature, humidity, wind, and air pressure, interacting in the atmosphere.
- Air masses form in the troposphere and create fronts where they meet, along which changes in weather occur.
- Different kinds of technology are used to predict the weather, including radar, weather satellites, and weather balloons.

A. Match the instrument to the weather variable it is used to measure.

1. wind vane   a. temperature
2. barometer   b. wind speed
3. thermometer c. wind direction
4. anemometer   d. air pressure

B. Answer the questions to tell about air masses and fronts.

1. What factor affects the temperature and moisture of an air mass?

2. What are the four main types of air masses that affect weather in North America?

3. How do air masses affect weather?
How Are Weather Forecasts Made?

C. Answer the following questions about weather maps.

1. A high-pressure system is pushing a cold front across the Northeast from Boston to Washington, D.C. Draw the front on the map. What kind of weather would you expect to find in New York today? Tomorrow?
   ___________________________________________________________  
   ___________________________________________________________

2. Is it warmer in San Francisco or Los Angeles? How can you tell?
   ___________________________________________________________  
   ___________________________________________________________

D. Fill in the blanks to complete the paragraph about predicting the weather.

________________________ use different tools to study the weather.  
________________________ is used to create images of storms using  
________________________ that bounce off different kinds of precipitation.  
Weather balloons are used to study weather conditions in  
________________________. Meteorologists then use the data they have collected to make ___________________ about the weather.
How Are Weather Forecasts Made?

Use the words from the box to complete the diagrams.

- scientist who studies weather
- makes observations and collects data
- forecasts future weather conditions
- body of air with the same temperature and moisture throughout
- forms a _______ when it meets another one
- large volumes of air constantly moving in the troposphere
- air mass
- front
- meteorologist

Vocabulary Skill: Multiple-Meaning Words

Many words in the English language have more than one meaning. Write two sentences that use different meanings of the word *front*.

1. ____________________________________________

   ____________________________________________

2. ____________________________________________

   ____________________________________________
How Are Weather Forecasts Made?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>continental</td>
<td>relating to a continent</td>
</tr>
<tr>
<td>forecast</td>
<td>prediction</td>
</tr>
<tr>
<td>maritime</td>
<td>located on or near the sea</td>
</tr>
<tr>
<td>polar</td>
<td>relating to, or near, the North Pole or the South Pole</td>
</tr>
<tr>
<td>tropical</td>
<td>relating to the tropics</td>
</tr>
<tr>
<td>variables</td>
<td>things that change or are subject to change</td>
</tr>
</tbody>
</table>

Use the words from the box to answer the following questions.

1. What does the weather depend on?
   ________________

2. What kind of air mass is generally cold?
   ________________

3. What kind of air mass tends to form over water and is moist?
   ________________

4. What does a meteorologist make after gathering data about the weather?
   ________________

5. What kind of air mass is generally dry?
   ________________

6. What kind of air mass forms at low latitudes and is generally warm?
   ________________
What Causes Storms?

Main Idea Severe storms are associated with low-pressure systems. In these systems, warm, moist air rises and cools. Water vapor in the cooling air condenses, forming clouds followed by precipitation.

- Thunderstorms bring strong winds, heavy rains, lightning, and thunder. Tornados can develop from thunderstorms.
- Blizzards are severe snowstorms with heavy snow, high winds, and low temperatures.
- Hurricanes are the most powerful storms on Earth. They form over warm ocean waters in the tropics.

A. Complete the diagram to tell about how thunderstorms form. Then answer the question that follows.

What three conditions must be met for a thunderstorm to form?

1. There must be plenty of moisture in the air;
2. There must be an approaching cold front (or extreme heating of the surface);
3. The rising air must remain warmer than the surrounding air.
What Causes Storms?

B. Complete the diagram to tell how thunderstorms and blizzards are similar and different.

Thunderstorms

- lightning
- ____________
- heavy rains

Blizzards

- associated with low-pressure system
- results when cold air meets warmer, moister air
- ____________
- low temperatures

C. Fill in the blanks to tell about the formation of a hurricane.

1. A hurricane begins as a _______________ system over warm, tropical waters.
2. As the system strengthens, _______________ begin to rotate around the area of low pressure.
3. As warm, moist air continues to rise, pressure in the center of the system _______________ _____ as the storm strengthens.
4. The hurricane continues to grow in _______________ and _______________ _____ while it moves over warm, tropical waters.
5. The hurricane will weaken and lose energy when it moves over _______________ water or moves over _______________.

Study Guide
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What Causes Storms?

blizzard  hurricane  thunderstorm  tornado

Use a term from the box to complete this diagram about severe weather. Then add two more facts about each type of weather to the diagram.

Homework: Write a paragraph describing how a thunderstorm forms.
What Causes Storms?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>condenses</td>
<td>changes from a gas to a liquid</td>
</tr>
<tr>
<td>discharge</td>
<td>a release of electrical energy</td>
</tr>
<tr>
<td>intensity</td>
<td>extreme force or strength</td>
</tr>
<tr>
<td>moisture</td>
<td>wetness</td>
</tr>
<tr>
<td>reserves</td>
<td>things kept back or saved for later use</td>
</tr>
<tr>
<td>visibility</td>
<td>the greatest distance over which it is possible to see without aid from instruments</td>
</tr>
</tbody>
</table>

Use the words in the box to complete the following sentences.

1. Clouds form when moisture in warm rising air ________________.

2. In order for a thunderstorm to form, there must be plenty of ________________ in the air.

3. Lightning is a powerful electric ________________ that can occur during a thunderstorm.

4. Droughts can kill crops and drain away water ________________.

5. Moving about in a blizzard is difficult because ________________ is low.

6. A hurricane continues to grow in size and ________________ while over warm, tropical waters.
What Is Earth’s Sun Like?

Main Idea The Sun is the largest and most massive body in the solar system. It provides nearly all the energy needed to sustain life on Earth.

- The Sun is a medium-sized yellow star. It is the central body of the solar system.
- The Sun is made mostly of hydrogen and helium and produces energy by nuclear fusion.
- The Sun is a main sequence star. It will eventually pass through the phases of red giant, planetary nebula, white dwarf, and black dwarf.

A. Complete the outline to tell about the Sun and its surface features. Then answer the question that follows.

I. The Sun
   A. a medium-sized ______________________
   B. located about ______________________ from Earth
   C. exerts a strong ______________________
   D. main source of ______________________ for Earth

II. The Sun’s Surface Features
   A. ______________________ are cooler areas on the Sun’s surface that occur in 11-year cycles.
   B. ______________________ are powerful eruptions of particles on the Sun’s surface.
   C. ______________________ are fast-moving gases that can travel in space.
   D. ______________________ are huge arcs of gas that extend high into the Sun’s atmosphere.

Why do solar flares and prominences occur in 11-year cycles?

______________________________________________________________________________________________

Sample response: Both solar flares and prominences are common during high sunspot activity. Since sunspots occur in 11-year cycles, so do solar flares and prominences.
C. Fill in the blanks to tell about the life cycle of a star. Then number the statements to show the correct sequence.

_____ Over time, the star shrinks into a _________________.

_____ The outer part of the star expands over time, while the core contracts. The star is known as a __________ _________.

_____ Out of nuclear fuel, the star eventually fades into a _________________.

_____ A star forms from rotating clouds of dust and gas called a _________________.

_____ A ________________ forms when the outer layers of the star are released.

_____ Nuclear fusion begins when temperatures reach 10 million °C and a ________________ is born.

_____ In a ________________, gravity and other forces cause the nebula to collapse. Clouds begin to glow as the temperature rises.
What Is Earth’s Sun Like?

nuclear fusion  sunspots

A. Complete the paragraph to tell about stars. Then label the diagram.

The Sun is the central body of the solar system. Like all ____________, the Sun produces energy by ____________. In this process, the nuclei of two forms of ____________ (tritium and deuterium) fuse, or combine, to form a helium nucleus and a neutron. A tremendous amount of ____________ is produced in this process from a small amount of ____________.

B. Complete the sentences to tell about sunspots.

1. Sunspots are ________________________.
2. They appear dark because _________________ ________.
3. Sunspots occur in cycles that _______________ ________ ________.
4. Periods of low and high sunspot activity correspond to _______________ ________.
What Is Earth’s Sun Like?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>collapse</td>
<td>to fall downward or inward suddenly</td>
</tr>
<tr>
<td>correspond</td>
<td>to match</td>
</tr>
<tr>
<td>disrupt</td>
<td>to throw into confusion or disorder</td>
</tr>
<tr>
<td>evaporate</td>
<td>to change from a liquid to a gas</td>
</tr>
<tr>
<td>stabilized</td>
<td>kept from changing</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the paragraph about the Sun.

All stars form from enormous rotating clouds of dust and gases. Over time, gravity and other forces cause the clouds to collapse into a very dense mass. When temperatures in this dense mass reach at least 10 million °C, nuclear fusion begins. A star is born. When a newly formed star has stabilized, it becomes a main–sequence star, like the Sun.

The Sun affects life on Earth. Sunspots are dark areas on the Sun’s surface. Periods of low and high sunspot activity correspond to temperature changes on Earth. Solar flares are powerful eruptions of particles that shoot into space. When particles released in solar flares reach Earth, they can disrupt radio communications. In addition, the Sun drives the water cycle. It causes water on Earth’s surface to evaporate, forming water vapor.

Vocabulary Skill: Antonyms

An antonym is a word that means the opposite of another word. Find an antonym for these words. Use the text from the lesson to help you.

evaporate: ______________
contract: ______________
What Orbits the Sun?

Main Idea The Sun and the bodies that revolve around it make up the solar system. The solar system is a small part of a much larger system called the Milky Way galaxy.

- The solar system consists of the Sun, nine planets, their moons, and many other smaller bodies that orbit the Sun.
- All but two planets in the solar system have at least one moon. Moons and asteroids are among the smaller bodies in the solar system.
- Comets may have short-period or long-period orbits around the Sun. Meteors are bits of matter that burn up when they enter Earth’s atmosphere.

A. Complete the summary about the formation of the solar system.

Scientists think that the solar system is about 4.6 billion years old. It formed from a hot, spinning cloud of gases and dust. Over time, gravity caused the center of the cloud to collapse. Heat and pressure the Sun built up in the center and a planet was formed.

Away from the center, temperatures were much cooler. Matter there began to come together to form rocky and solid material. Planets closest to the Sun formed from heavy, rocky material. Planets farther away were able to hold onto lighter and icy material and became much larger. Along with the planets and their moons, other smaller bodies formed, such as comets, meteoroids, and asteroids.

The paths, or orbits, of all these bodies are shaped like slightly flattened circles, called ellipses. The strong gravitational force of the Sun holds all the objects in the solar system in their orbits.
What Orbits the Sun?

B. Fill in the blanks to tell about moons, asteroids, comets, and meteors.

**Moons**
1. natural satellite
2. held in by their planets
3. some have
4. others show evidence of

**Asteroids**
1. small, rocky objects that orbit the Sun
2. most orbit in between
3. range widely in

**Comets**
1. made up of dust, ice, and frozen gas
2. contain a called the nucleus
3. gases and dust released from the nucleus when close to , forming a called a coma
4. form a that can reach out millions of kilometers into space

**Meteors**
1. begin as chunks of rock and metal called meteoroids
2. enter Earth’s and are heated by
3. as they fall to Earth, appearing as streaks of in the night sky
What Orbits the Sun?

asteroid  comet  galaxy  meteor
meteoroid  planet  solar system

Vocabulary Skill:
Sentence Context

Use a word from the box to complete each sentence. Use context clues to help you.

1. A(n) ________________ is a chunk of matter that is heated by friction with air as it falls through Earth’s atmosphere.

2. A(n) ________________ is a small body made up of dust, ice, and frozen gases.

3. A(n) ________________ is a large body that revolves around the Sun.

4. A(n) ________________ is a chunk of rock or metal that can sometimes fall into Earth’s atmosphere.

5. A(n) ________________ is a small, rocky object that orbits the Sun.

6. A(n) _______ ____ ______ is a huge system of gas, dust, and stars.

7. The _______ _______ is the Sun and all the bodies that travel around it.

Homework: Write a paragraph that includes five facts about the objects in the solar system.
What Orbits the Sun?

Glossary

- **collided** bumped together violently
- **orbit** to move around another object
- **revolves** orbits around a central point
- **rotates** turns around on an axis
- **vaporize** to change from a liquid to a gas

Use the words in the box to complete each sentence about objects in the solar system.

1. The Moon _____________ on its axis and _____________ around Earth.

2. Some scientists believe that asteroids are remnants of several planets that _____________ and broke apart.

3. When a comet approaches the Sun, frozen solids in its nucleus _____________.

4. Meteors begin as meteoroids, which are bits of rock or metal that _____________ the Sun.

Vocabulary Skill: Suffixes

The suffix -tion changes a word to noun form. For each word, write its noun form using -tion and then write a definition for the word. Use a dictionary to help you.

- **revolve**:
- **rotate**:
What Are the Planets Like?

Main Idea The four planets closest to the Sun are called the inner planets. The remaining five planets are the outer planets.

- Mercury, Venus, Earth, and Mars are the inner planets. They are small and rocky and have few or no moons.
- Jupiter, Saturn, Uranus, Neptune, and Pluto are the outer planets. With the exception of Pluto, the outer planets are large and gaseous, and have many moons.
- Space probes can be used to explore regions of space that are too difficult or dangerous for humans to explore.

A. Write the letter of each description under the planet it describes.

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune Pluto

a. a large planet best known for its rings of ice particles
b. unlike other outer planets, this planet is small, rocky, and icy
c. a planet with a thick atmosphere made mostly of carbon dioxide
e. a planet with 11 moons and the coldest surface temperature
f. the smallest inner planet, with surface temperatures that vary widely
g. the only planet known to have liquid water
h. a planet famous for its Great Red Spot
i. a planet home to the largest volcano in the solar system
j. a planet tilted sharply on its axis with a system of 11 rings
What Are the Planets Like?

B. Rewrite each statement comparing the inner and outer planets to make it true.

1. The inner planets are large and gaseous, while the outer planets are small and rocky.

   ____________________________________________________________________________

   ____________________________________________________________________________

2. The outer planets generally have fewer moons than the inner planets.

   ____________________________________________________________________________

   ____________________________________________________________________________

C. Complete the diagram to tell about the three types of spacecraft used by astronomers to explore space.

   Spacecraft Used for Space Exploration

   Space shuttle: ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   Space station: ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   Space probe: ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
What Are the Planets Like?

inner planet    outer planet

Answer the questions to tell about inner planets and outer planets.

1. Which planets make up the inner planets?
   
2. What is the relative size of the inner planets?
   
3. Of what substance are the inner planets mostly composed?
   
4. Which planets make up the outer planets?
   
5. What is the relative size of the outer planets?
   
6. Of what substance are the outer planets mostly composed?
   
---

Homework: Write one paragraph describing the characteristics of an inner planet and one paragraph describing an outer planet.
What Are the Planets Like?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cratered</td>
<td>having a surface covered with shallow holes</td>
</tr>
<tr>
<td>dense</td>
<td>having relatively high density</td>
</tr>
<tr>
<td>erosion</td>
<td>the movement of rock material from one place to another</td>
</tr>
<tr>
<td>greenhouse effect</td>
<td>the trapping of the Sun’s radiation in a planet’s atmosphere</td>
</tr>
<tr>
<td>plane</td>
<td>a flat or level surface</td>
</tr>
<tr>
<td>velocities</td>
<td>speeds</td>
</tr>
</tbody>
</table>

Use words from the box to complete the chart about the planets.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>has a heavily ________ surface, caused by collisions with other objects in space</td>
</tr>
<tr>
<td>Venus</td>
<td>atmosphere is 96 percent carbon dioxide, creating tremendous pressure and a strong ___ ____________</td>
</tr>
<tr>
<td>Mars</td>
<td>its surface shows sign of water ____________, indicating that it may once have been more like Earth</td>
</tr>
<tr>
<td>Saturn</td>
<td>the least _________ of any planet</td>
</tr>
<tr>
<td>Neptune</td>
<td>its winds reach _____________ of 2,700 km/hr</td>
</tr>
<tr>
<td>Uranus</td>
<td>its axis is tilted so much that it is nearly parallel to the _____________ of its orbit</td>
</tr>
</tbody>
</table>

Homework: Write a paragraph that describes interesting characteristics of Earth, Jupiter, and Pluto.
What Keeps Planets in Their Orbits?

Main Idea The path of a planet around the Sun is caused by the gravitational attraction between the Sun and the planet.

- Gravitation causes objects to fall back to Earth. The strength of the gravitational force depends on the mass of the objects and the distance between them.
- The solar system formed from a cloud of dust and gas called a nebula.
- Planets orbit in curved paths because the forward motion of the planet is balanced by the downward pull of the Sun’s gravity.

A. Answer the following questions to tell about gravitational forces.

1. What is gravitation?
   (Sample response: Gravitation is an attractive force between objects that have mass.)

2. Why is gravitation an example of a non-contact force?
   (Sample response: Gravitation acts on objects at a distance, without touching them.)

3. What two factors affect gravitational force?
   (Sample response: The masses of the objects and the distance between the objects affect the strength of gravitational force.)

4. What effect does mass have on the strength of a gravitational force?
   (Sample response: The greater the masses of the objects, the stronger the gravitational force is between them.)

5. What effect does distance have on the strength of a gravitational force?
   (Sample response: The smaller the distance between the objects, the stronger the gravitational force is between them.)
What Keeps Planets in Their Orbits?

B. Complete the diagram to tell about the formation of the solar system.

The solar system began as a _______ of gas and dust called a _______. The force of _______ collapsed the center of this cloud into a star, which became _______.

The inner planets formed near the Sun, where _______ were very _______. Lighter elements were _______ by the intense heat, which is why the inner planets are composed mainly of _______.

The outer planets formed _______ from the Sun, where temperatures were _______. They formed from _______, gas, and dust. They grew in _______ until even the light elements could not escape their _______. This is why the outer planets are made mostly of light elements.

C. Complete the diagram to tell about the orbits of planets around the Sun.

1. A planet travels in an _______ _______ path around the Sun.

3. The planet _______ as it nears the Sun and _______ when it is farther away.

2. The _______ motion of the planet balances the Sun's _______ on it, so the planet follows a _______ path around the Sun.
What Keeps Planets in Their Orbits?

gravity

Place a check mark next to all the statements that are true about gravity.

1. It is an attractive force between objects that have mass.
2. It is considered a contact force because it acts on objects directly.
3. It is a force that causes an object to fall to the ground when dropped.
4. It is generally the name for the attraction by Earth on objects at or near its surface.
5. It affects the weight of an object.
6. It causes objects to slow down as they fall.
7. It played a large role in the formation of the solar system.
8. It is a very weak force on the surface of Earth.

Homework: Imagine that you are standing on a balcony four stories above the ground holding a tennis ball. Using what you have learned in this lesson, write a paragraph that describes what happens to the ball when you drop it off the balcony.
What Keeps Planets in Their Orbits?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>attraction</td>
<td>the act or power of attracting</td>
</tr>
<tr>
<td>mass</td>
<td>a measure of the amount of matter in an object</td>
</tr>
<tr>
<td>proportional</td>
<td>corresponding in size or amount</td>
</tr>
<tr>
<td>resistance</td>
<td>a force that tends to oppose or slow motion</td>
</tr>
<tr>
<td>sensation</td>
<td>a feeling or awareness</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the following sentences.

1. Gravitation is a force between objects that have ________________.

2. Gravitational force is directly ________________ to the product of the masses of the object.

3. The gravitational ________________ by Earth on or near its surface is usually called gravity.

4. If you are falling, and your surroundings are falling at the same rate, you can experience a ________________ called weightlessness.

5. Air ________________, or drag, slows the acceleration of falling objects.

Homework: Use terms you have learned in this lesson to write a paragraph explaining why the planets in the solar system orbit the Sun.
What Are Atoms and Elements?

Main Idea: All matter is made up of particles called atoms, the smallest units of elements. As new tools can picture, atoms often form well-ordered patterns, or arrays.

- An atom has at its center a nucleus, which is surrounded by moving electrons.
- An element has only one kind of atom. An element’s properties are determined by the way those atoms join together.
- While a few elements are found in pure form, most elements form compounds with other elements.

A. Complete the diagram by labeling the parts of an atom.

B. Complete each sentence to tell about matter.

1. All matter is made up of _________________.
2. Elements are made up of _________________.
3. An atom is the _________________ of an element.
4. The nucleus is the structure in _________________.
5. The nucleus contains two kinds of particles: _________________.
6. Moving in the space around the nucleus are _________________.

Study Guide
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What Are Atoms and Elements?

C. Complete the diagram about the organization of atoms.

- Atoms can ________________ in different ways.
- Each arrangement provides different _____________.
- Examples of properties include _________________.
- Some elements are found in _________________.
- Most elements form ________________________ by combining with other elements.
- Many compounds are made of _________________.

D. Put a check next to each description of a scanning tunneling microscope that is true.

- _____ uses lenses and light to magnify images
- _____ was invented before the electron microscope
- _____ fits on a table top
- _____ shows an individual atom
- _____ shows how atoms group together in arrays
- _____ tells scientists everything about atoms
What Are Atoms and Elements?

atom  electron  neutron  proton
compound  element  nucleus

Write each word from the box next to its definition. Some words will be used more than once.

______________ a particle that lacks charge
______________ a pure substance that is made up of two or more elements that are chemically combined
______________ the smallest particle of an element
______________ the structure in the center of an atom
______________ a negatively charged particle
______________ a substance that cannot be broken apart chemically into other substances
______________ a positively charged particle
______________ contains two types of particles
______________ made up of only one kind of atom
______________ moves in space around the nucleus
______________ has a mass that is about equal to the mass of a proton

Vocabulary Skill:
Word Origins

The word neutron is based on the Latin word neuter, which means “neither.” How can this information help you remember the meaning of neutron?

______________________________________________

______________________________________________
What Are Atoms and Elements?

Glossary

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum</td>
<td>a very lightweight, silver-white metallic element</td>
</tr>
<tr>
<td>carbon</td>
<td>a very common nonmetallic element that occurs in combination with other elements in every living thing</td>
</tr>
<tr>
<td>copper</td>
<td>a tough, reddish–brown metallic element that resists rust</td>
</tr>
<tr>
<td>helium</td>
<td>a very light, colorless, odorless gas that will not burn</td>
</tr>
<tr>
<td>silver</td>
<td>a shiny, white, precious metallic element that conducts heat and electricity better than any other substance</td>
</tr>
</tbody>
</table>

Place each word from the box in the correct category in the chart. Then answer the question that follows.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Nonmetal</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum</td>
<td>carbon</td>
</tr>
<tr>
<td>copper</td>
<td>helium</td>
</tr>
<tr>
<td>silver</td>
<td></td>
</tr>
</tbody>
</table>

The elements you sorted into different groups have different properties. What is the cause of these different properties?

Homework: Use toothpicks and balls made of molded clay to construct a model of either graphite or diamond (see page 290). Then write a description of the model.
What Is the Periodic Table?

Main Idea Scientists have identified more than 100 elements, including metals, semimetals, and nonmetals. The elements are organized in the periodic table.

- The first periodic table was created by Dmitri Mendeleyev.
- The properties of an element determine its placement on the periodic table.
- The standardized periodic table has three categories: metals, semimetals, and nonmetals.

A. Complete the diagram to tell about the history of the periodic table.

Around ________, the Greek philosopher Empedocles suggested that all matter is made up of four elements—_______________________________.

In ________, English chemist Robert Boyle argued that earth, air, fire, and water _________________________________.

In ________, French chemist Antoine-Laurent Lavoisier made one of the first modern _________________________________.

In ________, Russian chemist Dmitri Mendeleyev developed a way to _________________________________.

The modern periodic table is a table in which the elements are arranged by _________________________________.

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What Is the Periodic Table?

B. Rewrite each statement about the periodic table to make it true.

1. Elements are arranged alphabetically.

2. An element’s atomic number is determined by its temperature.

3. Chemical symbols are the first two letters in an element’s name.

4. Each column is called a period and each row is called a group.

C. Use information from the periodic table on pages 300 and 301 to complete the chart below.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Element</th>
<th>Number of Protons</th>
<th>Metal, Semimetal, or Nonmetal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>Aluminum</td>
<td>13</td>
<td>metal</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Ne</td>
<td>Neon</td>
<td>10</td>
<td>nonmetal</td>
</tr>
<tr>
<td>K</td>
<td>Potassium</td>
<td>19</td>
<td>metal</td>
</tr>
<tr>
<td>Si</td>
<td>Silicon</td>
<td>14</td>
<td>semimetal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>metal</td>
</tr>
</tbody>
</table>
What Is the Periodic Table?

Use pages 300 and 301 in your book and the words from the box to complete the table.

<table>
<thead>
<tr>
<th></th>
<th>Periodic Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>en</td>
</tr>
</tbody>
</table>
| 2 |   He
|    | Helium        |
| 5 |   B
|    | Boron         |
| 6 |   C
|    | Carbon        |
| 7 |   N
|    | Nitrogen      |
| 8 |   O
|    | Oxygen        |
| 9 |   F
|    | Fluorine      |
| 10|   Ne
|    | Neon          |
| 13|   Al
|    | Aluminum      |
| 14|   Si
|    | Silicon       |
| 18|   Ar
|    | Argon         |
| 28|   Ni
|    | Nickel        |
| 29|   Cu
|    | Copper        |
| 30|   Zn
|    | Zinc          |
| 31|   Ga
|    | Gallium       |
| 32|   Ge
|    | Germanium     |
| 46|   Pd
|    | Palladium     |
| 78|   Pt
|    | Platinum      |
| 84|   Po
|    | Polonium      |
| 86|   Rn
|    | Radon         |

Vocabulary Skill: Prefixes

The prefix non- means “not” and the prefix semi- means “having some of the characteristics of.” Use this information to write your own definitions of nonmetal and semimetal.

Sample response: A nonmetal is not a metal and a semimetal is a material that has some characteristics of a metal.
What Is the Periodic Table?

Glossary

brittle  breaks easily  
conduct  to transmit, to be a channel for  
luster  the ability to reflect light  
mixture  two or more substances combined together  
react  to act chemically  
semiconductor  a mineral substance that conducts electricity better than an insulator but not so well as a metal

Use a word from the box to complete each sentence about the properties of elements.

1. One of the properties most metals have is _____________.
2. Copper wires are used to _____________ electricity.
3. Brass is a _____________ of copper and zinc.
4. Under some circumstances silicon conducts electricity and at other times does not, so silicon is a _____________.
5. Solid nonmetals are usually _____________.
6. Oxygen can _____________ with iron resulting in rust.

Homework: Choose an element from the periodic table. Write down everything you know about that element from the information on the periodic table.
Where Are Elements Found?

Main Idea Most things on Earth are made of only a few elements—far fewer than the more than 100 elements that scientists have discovered.

- Only eight elements make up almost 99 percent of Earth’s crust.
- A molecule is a group of two or more atoms that acts as a single unit.
- Carbon compounds are the main parts of all living things.

A. Complete the outline to tell about rare and common elements.

I. Most elements are quite rare on Earth.
   A. For example, all of the gold that has ever been mined is not much compared to ________________________.

II. Other elements are rarer still.
   A. Many of the elements after _________ on the periodic table exist only in _________ and only for ________________________.

III. Some elements are very common on Earth.
   A. Nearly 99 percent of Earth’s _________ is made of only 8 elements: __________________________
      __________________________
   B. Earth’s _________ is made of 2 elements:
      __________________________

B. Place a check next to the elements found in living things.

- [ ] hydrogen
- [ ] nitrogen
- [ ] carbon
- [ ] oxygen
- [ ] silicon
- [ ] aluminum
- [ ] iron
- [ ] calcium
- [ ] uranium
Where Are Elements Found?

C. Rewrite each statement about molecules to make it true.

1. Very few compounds are made of molecules.

   Many compounds are made of molecules.

2. A molecule is a group of two or more compounds that are chemically joined and that act as a single unit.

   A molecule is a group of two or more atoms that are chemically joined and that act as a single unit.

3. Very few molecules can be made from only a few kinds of atoms.

   Many molecules can be made from only a few kinds of atoms.

D. Complete the chart to tell about carbon compounds.

<table>
<thead>
<tr>
<th>Carbon Compound</th>
<th>Purpose</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________</td>
<td>provide the body with energy</td>
<td>____________________________</td>
</tr>
<tr>
<td>__________________</td>
<td></td>
<td>meat, fish, soybeans, eggs, and dairy products</td>
</tr>
<tr>
<td>lipids</td>
<td></td>
<td>____________________________</td>
</tr>
<tr>
<td>__________________</td>
<td></td>
<td>DNA</td>
</tr>
</tbody>
</table>
Where Are Elements Found?

Complete the diagram to tell about molecules.

- A group of two or more atoms that are ____________
- A molecule acts as ____________
- Some are quite ________, while others are ________
- Many molecules can be made from only ____________

Vocabulary Skill: Synonyms

Synonyms are words that have similar meanings. For example, component and ingredient are synonyms for element. Think of a synonym for compound and use it in a sentence. If you substitute compound for the synonym, does it change the meaning of the sentence?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
Where Are Elements Found?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrocarbon</td>
<td>any compound made of hydrogen and carbon</td>
</tr>
<tr>
<td>oxygen</td>
<td>a colorless, odorless gas that forms about one fifth of the air and about one third of water</td>
</tr>
<tr>
<td>plastic</td>
<td>a hydrocarbon</td>
</tr>
<tr>
<td>polymer</td>
<td>long chains of linked molecules</td>
</tr>
<tr>
<td>rare</td>
<td>seldom seen or found</td>
</tr>
<tr>
<td>sucrose</td>
<td>table sugar</td>
</tr>
</tbody>
</table>

Use the terms from the box to complete the puzzle about elements.

Across

1. DNA is an example of this
2. 46% of Earth’s crust
3. describes most of the elements
4. a substance with a sweet taste

Down

1. an example of a hydrocarbon
5. made of two elements: carbon and hydrogen

Homework: Using the analogy of letters and words you read about on page 311 in your textbook, write a paragraph explaining how many molecules can be made from only a few kinds of atoms.
What Are Compounds?

Main Idea Two or more elements can combine to form a compound. Compounds have different properties from the elements that make them up.

- The properties of a compound are different from the elements that make them up.
- Compounds are described using chemical formulas.
- Water is a unique compound that is found everywhere on Earth.

A. Complete the diagram to tell about compounds. Then answer the question that follows.

What is an important factor in all chemical reactions? Explain.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
What Are Compounds?

B. Complete the sentences to tell about chemical formulas.

1. $C_{12}H_{22}O_{11}$ is the formula for __________. It indicates that every molecule of that compound has __________ atoms of carbon, __________ atoms of hydrogen, and __________ of oxygen.

2. __________ is the formula for calcium carbonate. It indicates that every molecule of that compound has one atom of __________, one atom of __________, and three atoms of __________.

3. __________ is the formula for iron oxide. It indicates that each molecule of that compound has __________ atoms of __________ and __________ atoms of __________.

C. Complete the chart to tell about common compounds.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide</td>
<td>glass, sand</td>
</tr>
<tr>
<td>__________</td>
<td>glass, sand</td>
</tr>
<tr>
<td>polymers</td>
<td>__________</td>
</tr>
<tr>
<td></td>
<td>__________</td>
</tr>
</tbody>
</table>

D. Place a check by each statement that is true about water.

_____ Three-fourths of Earth’s surface is water.

_____ Three-fourths of the human body is water.

_____ While water is liquid at room temperature, most compounds are not.

_____ Water dissolves more substances than any other liquid.

_____ Water molecules look like a chain of atoms.

_____ Water molecules attract each other.
What Are Compounds?

**chemical formula**    **chemical reaction**

Use the descriptions below to complete each diagram.

- A chemical change
- A shorthand way to describe a compound
- A process in which one or more substances are changed into one or more different substances
- Uses chemical symbols and numbers to show the makeup of a compound
- A process that requires energy
- Used by scientists to identify chemical compounds

---

**Homework:** Observe a meal being prepared. Write a short paragraph describing one or more chemical reactions that you see taking place.
What Are Compounds?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>chemical property</td>
<td>how a substance reacts with other substances</td>
</tr>
<tr>
<td>dissolve</td>
<td>to change from a solid or gas to a liquid</td>
</tr>
<tr>
<td>elements</td>
<td>things that are made up of only one kind of element</td>
</tr>
<tr>
<td>molecular compound</td>
<td>a compound made of molecules</td>
</tr>
<tr>
<td>stable compound</td>
<td>a compound that does not chemically change very quickly or easily</td>
</tr>
</tbody>
</table>

Use words from the word box to complete the following sentences.

1. Water is a ________________.
2. Water is made up of two ________________: hydrogen and oxygen.
3. Water has a unique ________________: It is a liquid at room temperature.
4. Water is not considered a ________________, because it can be chemically changed very quickly.
5. Water has the ability to ________________ many compounds.

Vocabulary Skill:
Multiple-Meaning Words

The word current has more than one meaning. What is the meaning of current in this sentence?

Scientists proved that water was a compound when they broke it into other substances by passing an electric current through it.
**Main Idea** Physical and chemical properties are characteristics used to describe, identify, and classify matter.

- A physical property can be observed without changing the matter. A chemical property is how a substance reacts with other substances.
- Solubility is the measure of how much of one substance can dissolve in another.
- The conductivity of a material is its ability to carry energy.

**A. Classify each property in the box as either a physical property or a chemical property using the chart below.**

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Chemical Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>boiling point</td>
<td>odor</td>
</tr>
<tr>
<td>color</td>
<td>reactivity</td>
</tr>
<tr>
<td>conductivity</td>
<td>size</td>
</tr>
<tr>
<td>density</td>
<td>solubility</td>
</tr>
<tr>
<td>flexibility</td>
<td>state</td>
</tr>
<tr>
<td>melting point</td>
<td></td>
</tr>
</tbody>
</table>
What Are Some Properties of Compounds?

B. Complete the outline to describe physical properties.

I. Mass, volume, and density are physical properties.
   A. Mass
      1. Mass is a measure of ________________________________
         ________________________________.
      2. Mass can be measured in ________________________________.
   B. Volume
      1. Volume is ________________________________
      2. Volume can be measured in ________________________________.
      3. Liquid volumes are measured in ________________________________.
   C. Density
      1. Density of a material is ________________________________

II. Another physical property is state of matter: solid, liquid, or gas.
   A. The melting point is ________________________________
   B. The boiling point is ________________________________

III. Solubility and conductivity are also physical properties.
   A. Solubility
      1. Solubility is the measure of ________________________________
         ________________________________.
   B. Conductivity
      1. The conductivity of a material is ________________________________
         ________________________________.
      2. Two types of conductivity are ________________________________
         and ________________________________.
What Are Some Properties of Compounds?

boiling point  conductivity  melting point  solubility
chemical property  density  physical property

Circle the term in parentheses that correctly completes each statement about the properties of matter.

1. The (boiling point, melting point) of a substance is the temperature at which it changes from a liquid to a gas.

2. The measure of how much of one substance can dissolve in another substance is called (density, solubility).

3. A characteristic that can be measured or detected by the senses is called a (chemical property, physical property).

4. The (density, conductivity) of a material is its ability to carry energy.

5. The temperature at which a solid substance changes to a liquid is called its (melting point, solubility).

6. A (chemical property, physical property) is the ability or tendency of a material to change its chemical makeup.

7. The (density, solubility) of a material is its mass per unit volume, or ratio of mass to volume.

Vocabulary Skill:
Word Parts

The suffix -ability means “able to” and the root solu- is derived from the Latin word solvere, meaning “loosen.” Explain how the word solubility is related to the meanings of its parts.

Sample response: How easily a substance is able to “loosen” is related to how easily it can be dissolved in another substance.
What Are Some Properties of Compounds?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>mass</td>
<td>a measure of the amount of matter in an object</td>
</tr>
<tr>
<td>rigid</td>
<td>have a definite shape and volume</td>
</tr>
<tr>
<td>state</td>
<td>the physical condition of a material</td>
</tr>
<tr>
<td>thermal</td>
<td>of or about heat</td>
</tr>
<tr>
<td>volume</td>
<td>the amount of space a sample of matter takes up</td>
</tr>
</tbody>
</table>

Write each word from the box next to the clue it matches.

_____________ measured in grams or kilograms
_____________ solid
_____________ measured in cubic centimeters for solids
_____________ liquid
_____________ not changing
_____________ gas
_____________ warmed

Homework: Look around your home. Make a list of the ways plastic and rubber are used as electrical and thermal insulators. You may want to do some research on insulators in order to lengthen your list.
What Are Acids, Bases, and Salts?

Main Idea Acids, bases, and salts are classes of compounds, each with characteristic properties. The strengths of acids and bases are measured with the pH scale.

• Acids release hydrogen ions and react easily with bases.
• Bases accept hydrogen ions and react easily with acids.
• Salts are formed when a strong acid reacts with a strong base.

A. Use the items below to complete the diagram to compare and contrast acids and bases.

<table>
<thead>
<tr>
<th>Accept hydrogen ions</th>
<th>React easily with acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleach</td>
<td>Release hydrogen ions</td>
</tr>
<tr>
<td>React to litmus paper</td>
<td>Turn blue litmus paper red</td>
</tr>
<tr>
<td>React easily with other substances</td>
<td>Turn red litmus paper blue</td>
</tr>
<tr>
<td>React easily with bases</td>
<td>Vinegar</td>
</tr>
</tbody>
</table>

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What Are Acids, Bases, and Salts?

B. Rewrite each statement about acids and bases to make it true.

1. An acid typically receives hydrogen ions and a base typically releases hydrogen ions.

2. Acids and bases can be identified by mixing them with water.

3. Water is an example of an acid.

4. A value called pH stands for parts of helium.

5. Acids and bases have pH values of zero.

C. Put a check next to each true statement about salts.

____ typically made from a metal and a nonmetal
____ have high melting points
____ most dissolve slowly in water
____ found in abundance in the ocean
____ raise the melting point of water
____ needed by the human body
What Are Acids, Bases, and Salts?

Write each characteristic below in the appropriate column in the chart. Then answer the question that follows.

detergents  
fruit juices  
pH values greater than 7  
pH values less than 7  
potassium  
sodium chloride  
used to digest food

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
<th>Salts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the purpose of an indicator?

Vocabulary Skill: Word Derivations

What is the origin of the word acid? Use a dictionary to help you.
What Are Acids, Bases, and Salts?

Glossary

- **litmus paper**: paper treated with litmus, a dye that changes color in the presence of acids or bases
- **neutral**: neither one thing or the other
- **reaction**: action in response to some influence or force
- **substance**: a material of a particular kind or composition

Use the words from the box to complete the diagram.

- Litmus paper is used to determine whether a substance is an acid or a base.
- It is called an acid-base indicator because its color indicates whether a substance is an acid or a base.

- Acids turn blue litmus paper red.
- Bases turn red litmus paper blue.
- Litmus paper will not change color in water because water is a neutral substance.

**Homework**: Draw a pH scale. Color the portion of the scale that would include acids red and label it. Color the portion of the scale that would include bases blue and label it. Indicate where on the scale the substance water would fit. Estimate the placement of specific acids and bases on the scale based on the descriptions of “weak” and “strong” found in this chapter.
What Are the Three States of Matter?

Main Idea Matter can exist in three familiar states: solids, liquids, and gases. These states are determined by the motion and arrangement of particles.

- The properties of a substance’s particles determine its state.
- Solids have a definite shape and volume and their particles are arranged very close together.
- Liquids have a definite volume, but no definite shape. Their particles are close together and can move about.
- Gases do not have a definite shape or volume. Their particles are spread far apart and are constantly moving.

A. Use the descriptions from the box to complete the chart to tell about the states of matter.

<table>
<thead>
<tr>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Arrangement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particle Movement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What Are the Three States of Matter?

B. Write the name of the state of matter that matches the description.

___________ matter that has a definite volume and a definite shape

___________ matter that has a definite volume, but no definite shape

___________ matter that does not have a definite shape or volume

C. Arrange the three states of matter—solid, liquid, and gas—from least compressible to most compressible.

Least Compressible

___________

___________

___________

Most Compressible

D. Write the terms helium, oil, and wood in the diagram. Then complete the sentence that follows to explain your reasoning.

Least Compressible

___________

___________

___________

Most Compressible

The most compressible state of matter is ________ ________
because its particles can ________ ________.
What Are the Three States of Matter?

<table>
<thead>
<tr>
<th>Matter</th>
<th>Definite Shape</th>
<th>No Definite Shape</th>
<th>Definite Volume</th>
<th>No Definite Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary Skill: Word Origins

Gas is a coined, or invented, word. Use a dictionary to identify the origin of this word.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
What Are the Three States of Matter?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>attraction</td>
<td>act or power of gathering</td>
</tr>
<tr>
<td>fluid</td>
<td>any substance whose particles can flow freely</td>
</tr>
<tr>
<td>state</td>
<td>physical form</td>
</tr>
<tr>
<td>tension</td>
<td>a stretched condition</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences about the states of matter.

1. A solid is one ____________ of matter.

2. Water is a ____________, and flows easily at room temperature.

3. Surface ____________, a force of attraction among the particles at the surface of a liquid, is a property of liquids.

4. In a solid, the small forces of ____________ between particles keeps them from moving from place to place.

Homework: Complete a chart like the one shown with examples of each of the states of matter.

States of Matter

<table>
<thead>
<tr>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What Are Mixtures and Solutions?

**Main Idea** In a mixture, the parts keep their physical properties. These properties can be used to separate the mixture. Mixtures that are evenly mixed at the atomic or molecular level are called solutions.

- Mixtures are physical combinations of two or more substances in which the substances are not chemically combined.

- Solutions are mixtures in which the particles are evenly mixed at the atomic or molecular level.

- Solutions can be separated by making use of the different properties of the mixed materials.

- Alloys are solutions of two or more metals or of a metal and another solid.

**A. Fill in the blanks to complete the description of a mixture.**

- A physical combination of __________________________
- the substances are not __________________________
- each substance keeps its __________________________
- it cannot be represented by a __________________________
What Are Mixtures and Solutions?

B. Rewrite each statement about mixtures to make it true.

1. In a heterogeneous mixture, two or more substances are evenly mixed.

2. In a homogeneous mixture, two or more substances are distributed unevenly.

3. In a solution, particles do not mix at the atomic or molecular level.

4. The methods of separating a solution include filtering and condensation.

C. Complete the chart to tell about alloys and their uses.

<table>
<thead>
<tr>
<th>Alloy</th>
<th>A Mixture of</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>bronze</td>
<td>iron, carbon, and other solids</td>
<td>musical instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sterling silver</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What Are Mixtures and Solutions?

mixture    solution

A. Use the words from the box to complete each sentence to tell about mixtures and solutions.

1. A __________ is a homogeneous mixture of two or more substances that are evenly distributed.

2. A __________ is a physical combination of two or more substances.

B. Classify each of the following items as a mixture or a solution.

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>air</td>
<td>birdseed</td>
</tr>
<tr>
<td>salad</td>
<td>salt water</td>
</tr>
<tr>
<td>soda water</td>
<td>vegetable soup</td>
</tr>
<tr>
<td>pink lemonade</td>
<td>sand and pebbles</td>
</tr>
<tr>
<td>salt water</td>
<td>soda water</td>
</tr>
</tbody>
</table>

Vocabulary Skill:
Root Words

Genus is a Latin word meaning “type” or “kind.” The prefix hetero- means “different” and the prefix homo- means “the same.” Using this information, write a definition for each word.

Sample response:

Heterogeneous means “made up of different kinds of things,” while homogeneous means “made up of the same things.”
What Are Mixtures and Solutions?

Glossary

- **solute**: a substance being dissolved
- **solvent**: a substance that dissolves the solute

Identify the solution, the solute, and the solvent to complete the following descriptions.

1. Sugar cane juice is made up of water and sugar.
   - A. The solution is ___________.
   - B. The solvent is ____________.
   - C. The solute is ____________.

2. Salt water is made up of salt and water.
   - A. Salt water is the ____________.
   - B. Water is the ____________.
   - C. Salt is the ____________.

3. Acid rain is made up of water and acids or other chemicals.
   - A. The solution is ____________.
   - B. The solvent is ____________.
   - C. The solute is ____________.

Homework: Write a paragraph describing how you can separate a solution of salt water.
How Does Matter Change?

Main Idea A chemical change involves a change in the identity of matter, whereas a physical change does not.

- Most solids will expand when heated and contract when cooled.
- A solid changes to a liquid when heated to its melting point, and a liquid changes to a solid when cooled to its freezing point.
- Vaporization, condensation, sublimation, and deposition are all physical changes.

A. Complete each sentence to tell about changes in matter.

1. A change of size, shape, or state of matter is a(n) ___________.

2. The increase in the size of a substance due to a change in temperature is called ___________.

3. When a solid undergoes ____________, it takes up less space due to cooling.

4. Although heating or cooling may change the volume of matter, the ___________ will stay the same.

5. Vaporization is the change of state from a ___________ to a ___________.

6. Slow or gradual vaporization is called ____________.

7. ____________ is a change of state from a gas to a liquid.

8. The process of changing directly from a solid to a gas is called ____________.

9. The opposite of sublimation is ____________.
How Does Matter Change?

B. Rewrite each statement about physical changes to make it true.

1. A solid begins to change to a liquid at its freezing point.

2. When energy is removed from a liquid, the liquid will begin to melt.

3. The melting point and freezing point for any substance is 0°C.

C. Use the diagram below to answer the following questions about the changes in matter.

1. What happens when energy is removed from a liquid?

2. What happens in vaporization?

3. What happens in sublimation?

4. What happens in deposition?
How Does Matter Change?

condensation evaporation
sublimation vaporization

A. Use the words from the box to complete each sentence about physical changes to matter.

1. ____________ is the change of state from a liquid to a gas.

2. ____________ is the change of state from a gas to a liquid.

3. Slow or gradual vaporization is called ____________.

4. The process of changing from a solid to a gas is called ____________.

B. Write each word from the box next to the statement that describes it.

___________ water droplets forming on the outside of a glass of ice water
___________ water being heated in a tea kettle
___________ a solid changes directly into a gas
___________ there is less water in a fish tank after a week

Vocabulary Skill: Antonyms

Antonyms are words with opposite meanings. Find a pair of antonyms in the lesson.
How Does Matter Change?

Glossary

contraction the act or process of making smaller
expansion the act or process of making larger
thermal of or relating to heat
vibrate to move back and forth rapidly

Use the words from the box to complete the diagram to tell about physical changes. Then answer the question that follows.

The temperature of a solid rises. A solid is cooled.

Particles in the solid _________ more rapidly.
The particles _________ more slowly.

The solid undergoes _________ _________.
The solid undergoes _________ _________.

Why do engineers add expansion joints to bridges in order to make them safer?

____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________
____________________________________________________________________________________

Homework: Write a short paragraph explaining why ice floats. Try to use as many words from the box in your answer as you can.
What Happens in a Chemical Reaction?

**Main Idea** A chemical change involves making and breaking chemical bonds to form new substances. Chemical changes can either absorb or release energy.

- A chemical change results in one or more new substances.
- Matter is neither created nor destroyed in chemical and physical changes.
- Energy is always involved in a chemical reaction.

**A. Circle the items that are examples of chemical changes.**

- bananas ripening
- dry ice sublimating into carbon dioxide gas
- burning natural gas on a stove
- frost forming on grass
- lichens growing on rocks
- liquid water freezing into ice
- burning wood in a campfire
- rust forming on a bicycle chain

**B. Put a check next to the items that are signs of a chemical change.**

- change in color
- the release of heat
- decrease of matter
- growth of living organism
- increase of matter
- release of light
What Happens in a Chemical Reaction?

C. Rewrite each statement about chemical reactions to make it true.

1. A chemical change is a change in matter that results in a change in color.
   
   ____________________________

2. In any sample of matter, forces called reactants hold the atoms or molecules together.
   
   ____________________________

3. Scientists use ratios to describe the reactants and products of a chemical reaction.
   
   ____________________________

D. Circle the choice that best completes each sentence about the conservation of matter.

1. In a physical change, the amount of matter (increases, stays the same, decreases).
   
   ____________________________

2. In a chemical change, the amount of matter (increases, stays the same, decreases).
   
   ____________________________

3. Regardless of the kind of change, matter is (created, conserved, destroyed).
   
   ____________________________

4. The mass of materials before a chemical change is (less than, equal to, more than) the mass afterwards.
   
   ____________________________

5. In a chemical reaction, the total mass of the reactants is (less than, equal to, greater than) the total mass of the products.
   
   ____________________________
What Happens in a Chemical Reaction?

A. Use the words from the box to complete each sentence to tell about products and reactants.

1. When a substance enters into and is altered through the course of a chemical change, it is called a reactant.

2. A substance that results from a chemical change is called a product.

B. Label the reactants and products in the following chemical equations.

\[ \text{iron} + \text{oxygen} \rightarrow \text{rust} \]

\[
\begin{align*}
\text{ reactant} & \quad \text{ reactant} \\
2\text{H}_2\text{O} & \quad 2\text{H}_2 + \text{O}_2
\end{align*}
\]

C. Using chemical formulas, write a chemical equation for the following chemical reaction. Six molecules of water and six molecules of carbon dioxide are the reactants. One molecule of sugar and six molecules of oxygen are the products.

Homework: Choose one of the locations listed below. Then write a paragraph describing at least three chemical reactions that could occur at that location.

• a kitchen
• a campsite
• a science laboratory
What Happens in a Chemical Reaction?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>breaking</td>
<td>coming apart</td>
</tr>
<tr>
<td>created</td>
<td>brought into being; made</td>
</tr>
<tr>
<td>decays</td>
<td>rots</td>
</tr>
<tr>
<td>destroyed</td>
<td>done away with</td>
</tr>
<tr>
<td>forming</td>
<td>taking shape</td>
</tr>
<tr>
<td>ripens</td>
<td>matures; develops</td>
</tr>
</tbody>
</table>

Use the words in the box to complete the sentences about chemical changes.

1. In any sample of matter, forces called chemical bonds hold the atoms or molecules together. Chemical changes involve ___________ existing bonds and ___________ new ones.

2. Fruit changes chemically when it either ___________ or ___________. You can use a scale to prove mass is conserved when matter changes.

3. When matter changes, mass is neither ___________ nor ___________.

Vocabulary Skill: Antonyms

Antonyms are words with opposite meanings. Write the three pairs of antonyms from the box above.

______________________________
______________________________
______________________________
Study Guide

Lesson Main Idea Worksheets
Lesson Science Vocabulary Worksheets
Lesson Support Vocabulary Worksheets
IMPORTANT NOTICE
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To the Teacher

Use this Study Guide with each lesson of Houghton Mifflin Science, California Edition. This Study Guide provides a variety of activities that help students check their understanding of each lesson’s main idea and practice using the lesson’s vocabulary.

Main Idea

Main Idea pages provide reinforcement for the core lesson content. A main idea statement is followed by three or four sentences that tell the details of the lesson’s main idea. These details outline the main idea providing scaffolding for students as they complete the interactive activities and strengthen their understanding of key lesson content. These activities may also be used to review and prepare for tests.

Science Vocabulary

The Science Vocabulary page of each lesson reinforces key science vocabulary words while helping students access lesson content. The key science vocabulary words are listed on the first Learn by Reading page of each lesson in the student’s textbook. All of the key vocabulary words in a lesson are covered in interactive activities designed to offer meaningful practice using these science words.

Support Vocabulary

The words found on the Support Vocabulary page have high general utility across the curriculum. These words are important to understanding the content of the lesson, but are not defined in the text. A glossary appears on the page for reference as students complete the activities. The Support Vocabulary page gives all students a way to work with everyday words that provide meaning for science concepts.

Homework activities allow students an opportunity to demonstrate their understanding of the important concepts and key science vocabulary in each chapter.

Vocabulary Skill practice addresses the Vocabulary Skill presented in the Vocabulary Preview of each chapter as well as other grade-level vocabulary skills.
What Are the Parts of a Cell?

Main Idea Cells are the basic building blocks of living things. Cells contain special structures to transport cell materials.

- All living things are made of cells. Cells are the basic unit of all living things. All cells come from other cells.
- All living things depend on cells to carry out the basic functions of life.
- Cells are made up of organelles that perform specific functions.

A. Use the words from the box to complete the diagram of a plant cell.

cell membrane cell wall cytoplasm endoplasmic reticulum
lysosome nucleus Golgi apparatus vacuole

---

Study Guide
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What Are the Parts of a Cell?

B. Complete the sentences comparing the similarities and differences between plant and animal cells.

1. Plant cells make their own food, but animals take in their food by ______ eating other living things ______.

2. While the cells of both plants and animals are surrounded by a thin, flexible ______ cell membrane ______, only plant cells have a ______ cell wall ______, a rigid outer layer for protection and support.

3. Both plant cells and animal cells store water, food, and waste in ______ vacuoles ______; animal cells may have ______ several ______ vacuoles, while plant cells often have ______ one large, central ______ vacuole.

4. ______ Lysosomes ______ help cells break down nutrients and old cell parts and are common in ______ animal ______ cells but rare in ______ plant ______ cells.

5. ______ Chloroplasts ______, containing pigments that absorb sunlight, are found in ______ plant ______ cells but not in ______ animal ______ cells.

C. Add a word to each group. Then write a sentence that describes the group.

lysosomes, vacuoles, ______ ribosomes ______

Lysosomes, vacuoles, and ribosomes are all organelles.

energy, support, ______ reproduction ______

Energy, support, and reproduction are all basic needs of cells.

bacteria, yeast, ______ algae ______

Bacteria, yeast, and many kinds of algae are all single cell organisms.
What Are the Parts of a Cell?

**cell**
- the basic unit of a living organism
- comes from another cell
- carrying out the functions of life

**cytoplasm**
- thick fluid between the nucleus and the cell membrane
- surrounds lysosomes, vacuoles, and other cell parts

**nucleus**
- directs the activities of a cell
- stores DNA

**organelle**
- a small structure in cells that performs a specific function
- a ribosome is one of these

Match the words from the box to each description. The words will be used more than once.

Homework: A mnemonic is a device such as a pattern of letters, words, or ideas that assists in remembering something. For example: Chloroplasts are filled with chlorophyll. Create a mnemonic to help you remember the name and function of a cell part or an organelle.
What Are the Parts of a Cell?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>conclusion</td>
<td>decision or opinion reached by reasoning</td>
</tr>
<tr>
<td>function</td>
<td>proper work, normal action or use</td>
</tr>
<tr>
<td>membrane</td>
<td>a thin soft layer of tissue that lines or covers something</td>
</tr>
<tr>
<td>organism</td>
<td>a living thing formed of separate parts that work together to carry on the various processes of life</td>
</tr>
<tr>
<td>pigment</td>
<td>substance that occurs in and colors the tissues of a living thing</td>
</tr>
<tr>
<td>proteins</td>
<td>complex chemical compounds that make up the parts of cells and allow the cell to perform chemical reactions</td>
</tr>
</tbody>
</table>

Complete each sentence to tell about cells.

1. Cells are the building blocks of every living ______ organism ______.
2. Every organelle has a specific ______ function ______.
3. The Golgi apparatus receives and processes ______ proteins ______.
4. The ______ pigment ______ chlorophyll gives plants their green color.
5. Food, water, and gases enter cells through the cell ______ membrane ______.
6. In the late 1800s, scientists made a ______ conclusion ______ that cells come from other cells.

Vocabulary Skill: Word Parts

In the word *multicellular*, the prefix *multi-* means “many,” and the suffix *-ular* indicates the word is an adjective. Based on this information, write a definition for the word.

Sample response: *Multicellular* means “having or consisting of many cells.”
How Do Cells Make and Use Energy?

Main Idea To get energy, plant and animal cells break down sugar, releasing water and carbon dioxide.

- All living things require energy to survive.
- Cells break down glucose and capture its energy in a process called cellular respiration.
- Cells need energy to move, make proteins, divide, and transport materials.

A. Complete the sentences to tell how cells use energy.

1. Plants get energy from food they make for themselves. Animals get energy from ______food they take in from the outside______.

2. In order to acquire glucose, some animals eat plants. Other animals eat ___________plant-eaters__________________.

3. Energy for a flashlight is stored in a battery. Energy for a cell is stored in ___________ATP molecules__________________.

4. Animals are able to store glucose. However, animals cannot store ___________oxygen and carbon dioxide__________________.

5. When animals breathe in, they inhale oxygen, which is required for cellular respiration. When animals breathe out, they exhale ______carbon dioxide_________, which is a waste product of cellular respiration__________________.

6. Some proteins allow cells to control the chemical reactions inside. Other proteins provide ___structure and support_____ for organisms__________________.

7. In passive transport, materials move from areas of high concentration to areas of low concentration. In active transport, materials move from areas of low concentration ______to areas of high concentration__________________.
How Do Cells Make and Use Energy?

B. Complete the diagram to describe cellular respiration.

Glucose and **oxygen** enter a cell.

A chemical **reaction** occurs.

Water, **carbon dioxide**, and **energy** are produced.

C. Rewrite each sentence about energy to make it true.

1. Two factors that determine how much energy an animal needs are whether it has fur and how much it sleeps each day.
   
   **Two factors that determine how much energy an animal needs are how big it is and how fast it moves.**

2. Plants require less energy than animals because they are much smaller than most animals.

   **Plants require less energy than animals because they don’t need energy to move from place to place.**

3. Plants use energy to carry out cellular respiration.

   **Plants use energy for growth and transporting materials.**
How Do Cells Make and Use Energy?

Match the words from the box to each description. The words may be used more than once.

- **cellular respiration**
  - cells break down glucose in this process
- **osmosis**
  - works to keep water inside cells
- **diffusion**
  - the process that spreads substances through a gas or liquid
- **cellular respiration**
  - serves to change glucose and oxygen into carbon dioxide gas and water
- **diffusion**
  - spreads materials into and out of cells
- **osmosis**
  - takes place across a membrane that lets water pass, but keeps out many things that are dissolved in the water

**Homework:** Draw a cartoon illustrating the concepts of active transport and passive transport. For example, the cartoon could be of people crowding onto a subway car (active transport) and people exiting a subway car (passive transport). Be sure to label your drawing.
How Do Cells Make and Use Energy?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>division</td>
<td>condition of being separated into equal parts</td>
</tr>
<tr>
<td>propeller</td>
<td>a wheel with curved blades</td>
</tr>
<tr>
<td>reactions</td>
<td>processes in which substances act on each other</td>
</tr>
<tr>
<td>structure</td>
<td>the arrangement of parts and elements</td>
</tr>
<tr>
<td>transport</td>
<td>process of carrying from one place to another</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the paragraph about why cells need energy.

Cells need energy to perform important life functions. First, all cells make and use proteins. Some proteins allow cells to control chemical _____ reactions ____. Other proteins provide _____ structure _____ and support for organisms. Cells also need energy to create movement. For example, some single-celled organisms use a structure that acts as a _____ propeller ____. Cell _____ division _____, which allows an organism to grow, also requires energy. Finally, the _____ transport _____ of materials across a cell membrane requires energy.

Vocabulary Skill: Word Parts

The word transport consists of the prefix trans-, which means “across,” and the root port, which means “to carry.” Write your own definition of transport based on this information.

Sample response: Transport means “to carry across.”
How Are Cells Organized?

Main Idea Cells join together to perform basic life functions in multicellular organisms.

- Tissues are made up of specialized cells of the same type.
- Organs are made up of tissues that perform specific functions.
- Organisms are made up of organ systems that perform specific functions.

A. Complete the chart to tell about the specialization of cells.

<table>
<thead>
<tr>
<th>Type of Cell</th>
<th>Characteristics</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>skin</td>
<td>flat, arranged close</td>
<td>form a protective layer around the body</td>
</tr>
<tr>
<td></td>
<td>together</td>
<td></td>
</tr>
<tr>
<td>nerve</td>
<td>long with many branches</td>
<td>deliver electrical impulses over long distances</td>
</tr>
<tr>
<td>muscle</td>
<td>larger than other cells, can contract and relax</td>
<td>cause movement</td>
</tr>
</tbody>
</table>

B. Complete each sentence to tell about organ systems.

1. The __digestive system__ breaks down food into __nutrients__ that cells can absorb.

2. The __respiratory system__ brings oxygen to the body and __removes carbon dioxide__.

3. The circulatory system brings __oxygen__ and __nutrients__ to body cells and removes __wastes__.
How Are Cells Organized?

C. Add the descriptions to the chart to tell how cells are organized.

<table>
<thead>
<tr>
<th>Cells:</th>
<th>the basic building blocks of living things</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissues:</td>
<td>a large group of similar specialized cells</td>
</tr>
<tr>
<td>Organs:</td>
<td>a group of related tissues that perform a specialized function</td>
</tr>
<tr>
<td>Organ Systems:</td>
<td>a group of related organs that work together</td>
</tr>
<tr>
<td>Organism:</td>
<td>a living thing made up of a combination of organ systems</td>
</tr>
</tbody>
</table>
How Are Cells Organized?

organ  organ system  tissue

A. Use the words from the box to complete the diagram about cellular organization.

Organ system  is made up of  organ  is made up of  tissue

B. List four examples of cell organization in each of the following categories.

<table>
<thead>
<tr>
<th>Tissues</th>
<th>Organs</th>
<th>Organ Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>muscle</td>
<td>heart</td>
<td>digestive</td>
</tr>
<tr>
<td>nerve</td>
<td>brain</td>
<td>respiratory</td>
</tr>
<tr>
<td>bone</td>
<td>stomach</td>
<td>circulatory</td>
</tr>
<tr>
<td>skin</td>
<td>liver</td>
<td>muscular</td>
</tr>
</tbody>
</table>

Homework: Choose an organ system that you would like to learn more about. Use the library or the Internet to research your choice, and then write a summary of what you learned.
How Are Cells Organized?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>absorb</td>
<td>to take in and make part of itself</td>
</tr>
<tr>
<td>complex</td>
<td>made up of a number of parts</td>
</tr>
<tr>
<td>contract</td>
<td>to draw together, make shorter</td>
</tr>
<tr>
<td>expel</td>
<td>to force or drive out</td>
</tr>
<tr>
<td>relax</td>
<td>to loosen up, become less stiff</td>
</tr>
<tr>
<td>simple</td>
<td>made up of one part</td>
</tr>
<tr>
<td>specialize</td>
<td>to perform a specific function</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences to tell about cellular organization.

1. Single-cell organisms have a _______ simple _______ structure compared to the _______ complex _______ structure of a multicellular organism.

2. Cells _______ specialize _______ in their functions.

3. Arm muscles _______ contract _______ to pick up an object and _______ relax _______ to put it down.

4. Cells _______ absorb _______ nutrients and _______ expel _______ wastes.

Vocabulary Skill: Antonyms

Antonyms are words that have opposite meanings. Identify the pair of antonyms in the box.

contract/relax
How Do Plants Produce Food?

Main Idea Plants use energy from the Sun to make food. They combine carbon dioxide and water to make sugar, and release oxygen in the process.

- During photosynthesis, plants make their own food using energy from the Sun.
- Photosynthesis occurs in the chloroplasts of the leaves of plants. Chlorophyll is the pigment in chloroplasts that absorbs light.
- Plants remove carbon dioxide from the air and add oxygen and water vapor.

A. Complete the diagram to tell about the process of photosynthesis.

Photosynthesis takes place in organelles called chloroplasts located in a plant's leaves.

Inside the chloroplasts, a pigment called **chlorophyll** absorbs light.

During photosynthesis, the Sun's energy is used to split **water** molecules into hydrogen and oxygen.

The hydrogen then joins with carbon from carbon dioxide to form **glucose**.

The plant releases **oxygen** gas and water vapor into the atmosphere.
How Do Plants Produce Food?

B. Rewrite each statement about photosynthesis to make it true.

1. Photosynthesis occurs in the roots of plants.
   \textit{Photosynthesis occurs in the leaves of plants.}

2. Carbon dioxide enters a leaf through its veins.
   \textit{Carbon dioxide enters a leaf through its stomata.}

3. Chloroplasts use the energy of sunlight and oxygen to make glucose.
   \textit{Chloroplasts use the energy of sunlight, carbon dioxide, and water to make glucose.}

4. Photosynthesis produces carbon dioxide and glucose.
   \textit{Photosynthesis produces oxygen and glucose.}

C. Complete the diagram to tell about the effects of human activities on the cycles of carbon and oxygen.

\begin{itemize}
  \item \textbf{Causes}
    \begin{itemize}
      \item People are burning fossil fuels at a very fast rate.
    \end{itemize}
  \item \textbf{Effects}
    \begin{itemize}
      \item The result is a rapid return of carbon to the atmosphere.
      \item Fewer trees are available to remove carbon and release oxygen.
    \end{itemize}
\end{itemize}

People are cutting down forests.
How Do Plants Produce Food?

chlorophyll  grana  stomata
chloroplast  photosynthesis

Complete the diagram with words from the box to tell about the process of photosynthesis.

A chloroplast contains chlorophyll.

Chlorophyll can be found in the grana of chloroplasts.

During photosynthesis plants make their own food.

Oxygen is released through the stomata of leaves.

Vocabulary Skill: Prefixes

The prefix *chloro*- indicates the color green. What part of a tree is responsible for making its leaves green?

Chlorophyll is responsible for making its leaves green.
How Do Plants Produce Food?

Glossary

- **blade**: the flat, wide part of a leaf
- **compound**: having more than one part
- **epidermis**: a skinlike layer of cells in plants
- **simple**: not divided into parts, single
- **veins**: vessels forming the framework of a leaf

Use the words from the box to complete the sentences about the structure of leaves.

1. The broad, flat portion of the leaf is called the __________ blade_________.

2. A ______ simple ______ leaf has a blade that is one piece.

3. A ______ compound_______ leaf has a blade that is divided into parts.

4. The outer layer of a leaf is called the __________ epidermis_________.

5. __________ Veins_______ carry materials in and out of the leaf, connecting the leaf’s cells to the rest of the plant.

**Homework**: Draw a diagram of the process of photosynthesis. Be sure to show what is needed for the process to occur and what results. Then write a paragraph that explains the process shown in your diagram.
How Do Plants Move Materials?

Main Idea Plants have specialized tissues and use natural forces to transport water, minerals, and nutrients.

- In nonvascular plants, materials move from cell to cell through diffusion.
- In vascular plants, specialized tissues transport materials.
- Water moves up in vascular plants through the xylem because of cohesion, root pressure, and transpiration. Gravity moves sugar down through the phloem.

A. Write *vascular* by each example or characteristic of a vascular plant. Write *nonvascular* by each example or characteristic of a nonvascular plant.

- **vascular** sunflower
- **nonvascular** mosses
- **vascular** absorb water and minerals through roots
- **nonvascular** grow well with little light
- **vascular** redwood
- **vascular** roots, stems, and leaves
- **nonvascular** liverworts
- **vascular** veins
- **nonvascular** no leaves, stems, or roots
- **nonvascular** materials move from cell to cell
How Do Plants Move Materials?

B. Use these terms to label the diagram of a vascular plant: *phloem, xylem, and vascular cambium.*

![Diagram of a vascular plant with labeled parts: phloem, xylem, and vascular cambium.]

C. Put a check by each statement that is true about the movement of water and nutrients through a vascular plant.

- ✔ Water moves up in plants because of three factors: root pressure, cohesion, and transpiration.
- ✔ Root pressure is strong enough to push water through a plant on its own.
- ✔ Water molecules cling to each other as a result of a force called cohesion.
- ✔ Adhesion forces water to go down.
- ✔ Water is pulled upward by transpiration.
- ✔ Gravity pulls sugar from the leaves down to nourish the plant.
- ✔ About 99% of the water that enters the roots is transpired by the leaves.
How Do Plants Move Materials?

A. Match each word from the box with its description.

- **xylem** conducts water and minerals from roots to stems and leaves
- **phloem** conducts sugar from leaves to the rest of the plant
- **transpiration** evaporation of water through the surface of leaves
- **vascular plant** has specialized tissues that transport materials throughout it
- **nonvascular plant** lacks structures that transport sugar, water, and other materials between plant parts

B. Complete the diagram to compare and contrast vascular plants and nonvascular plants.

![Venn Diagram](image-url)

- **Vascular Plant**
  - can be very small or very large
  - has roots, stems, and leaves
  - contains important tissues: **xylem** and **phloem**
  - moves water up by root pressure, cohesion, and **transpiration**

- **Nonvascular Plant**
  - is almost always small
  - lacks true leaves, stems, and roots
  - lacks ways to deliver water to distant parts
  - Gases, water, and minerals move only by diffusion.
How Do Plants Move Materials?

Glossary

- adhesion: condition of holding to, sticking to
- cohesion: attraction between molecules of the same kind
- gravity: the natural force that causes objects to tend to move to the center of the Earth
- nutrient: any substance that a living thing needs for energy, growth, and repair of tissues
- tissues: a group of cells that are similar in form and function

Use the words from the box to complete the sentences about the flow of materials through a vascular plant.

1. Sugar produced in the leaves of a plant being pulled down through the plant is an example of _____ gravity at work.

2. Water molecules being attracted to other water molecules is an example of _____ cohesion.

3. Glucose is an example of a _____ nutrient.

4. Water molecules clinging to molecules of other substances is an example of _____ adhesion.

5. Vascular _____ tissues _____ conduct water, minerals, and sugar between different parts of the plant.

Homework: Write a brief explanation of the process of transpiration. Use sequence words to help clarify the steps in the process.
What Are the Respiratory and Circulatory Systems?

Main Idea The respiratory system brings oxygen into the body and removes wastes. The circulatory system carries oxygen to the cells and carries away wastes.

- The respiratory system brings oxygen to the blood and removes carbon dioxide from the blood.
- The circulatory system brings oxygen and nutrients to cells and takes away carbon dioxide and other wastes.
- The heart is the central organ of the circulatory system.

A. Complete the diagram to tell how the respiratory system delivers oxygen to the blood.

1. When you inhale, you take oxygen-filled air into your ____nose____ or ____mouth____.

2. The air moves into a sturdy tube called the ____trachea____, which leads down your chest toward the ____lungs____.

3. The trachea divides into two main tubes called ____bronchi____.

4. Inside the lungs each bronchus divides into smaller and smaller tubes, leading to grapelike sacs called ____alveoli____.

5. Each of these tiny structures borders a ____capillary____.
What Are the Respiratory and Circulatory Systems?

B. Complete the diagram to show how blood circulates through the body.

Blood picks up oxygen in the **lungs**.

Blood travels from the lungs to the **heart**.

Blood travels through **arteries** to all other parts of the body.

The heart pumps the blood back into the **lungs** where it releases the carbon dioxide.

The blood flows into **veins** which carry it back to the heart.

Oxygen, sugars, and minerals in the blood pass from capillaries into the **body cells**.

Carbon dioxide and other wastes pass from the body cells into **capillaries**.

C. Complete the sentences to tell about the human heart and its functions.

1. The **heart** is at the center of the circulatory system.

2. The four chambers of the heart are the **right atrium**, the **left atrium**, the **right ventricle**, and the **left ventricle**.

3. The atria receive blood from the **veins**.

4. The **ventricles** pump blood to the body.
What Are the Respiratory and Circulatory Systems?

Use the words from the box to complete the sentences about the circulatory and respiratory systems. Some words may be used more than once.

1. Nutrients pass through the wall of a __________ into the body cells.

2. A(n) __________ is a blood vessel that carries blood away from the heart.

3. The __________ brings oxygen and nutrients to the body’s cells and removes carbon dioxide and other wastes from the cells.

4. The __________ is the organ that pumps blood through the circulatory system.

5. The lungs are the central organ of the __________.

6. Blood picks up oxygen in the __________.

7. A(n) __________ is a blood vessel that carries blood to the heart.

Vocabulary Skill:
Word Origins

The word *circulatory* comes from the Latin word *circulus*, which means “circle or ring.” Explain how the meaning of *circulus* relates to the circulatory system.

**Sample response:** The circulatory system is a system in which blood moves in a “circle” throughout the body.
What Are the Respiratory and Circulatory Systems?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>alveoli</td>
<td>tiny air sacs in the lungs</td>
</tr>
<tr>
<td>bronchi</td>
<td>two tubes leading from the trachea into the lungs</td>
</tr>
<tr>
<td>hemoglobin</td>
<td>a substance in red blood cells used to carry oxygen and carbon dioxide</td>
</tr>
<tr>
<td>plasma</td>
<td>the liquid part of the blood</td>
</tr>
<tr>
<td>platelets</td>
<td>small pieces of cells that help the blood clot</td>
</tr>
<tr>
<td>trachea</td>
<td>a sturdy tube that leads down the chest to the bronchi</td>
</tr>
</tbody>
</table>

Write the word from the box that matches each clue.

- **hemoglobin** found in red blood cells
- **trachea** leads to the bronchi
- **bronchi** carries air into the lungs
- **platelets** help the body heal wounds
- **plasma** carries blood cells
- **alveoli** bordered by a capillary

**Homework:** Draw a diagram that shows how blood is carried into the heart and out of the heart. Label the diagram.
What Is the Digestive System?

Main Idea To function properly, living things need nutrients found in foods. The digestive system breaks down food to release these nutrients.

• The digestive system breaks down food into nutrients the body can use. Starches break down into sugars in the mouth.
• The stomach mixes and stores food. It further breaks down food into a soupy mix.
• Digestion finishes in the small intestine and nutrients are absorbed into the blood. Water and minerals are absorbed from the large intestine.

A. Complete the outline about the digestive system.

I. You must take in food.
   A. Food provides the body with ___nutrients____.
   B. The body uses different kinds of nutrients for different purposes .

II. Your body releases nutrients from food in a process called ___digestion____.
   A. The ___digestive system____ is a group of organs that breaks food down into ___small particles____ that the body can use.
   B. These small particles enter the ___blood____.

III. You should eat a ___balanced____ diet.
   A. A balanced diet is made from a variety of ___different foods____.
   B. Drinking lots of water helps your digestive system work properly.
   C. You should avoid eating too many ___fats and sweets____.

IV. You should eat ___right____ every day.
   A. Your body can store certain ___nutrients____.
   B. Many ___vitamins and minerals____, however, cannot be stored.
What Is the Digestive System?

B. Complete the chart to tell about nutrients.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Uses</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>main source of energy for the body</td>
<td>pasta, potatoes, rice and other grains</td>
</tr>
<tr>
<td>Proteins</td>
<td>used to replace, repair, and grow new cells and tissues</td>
<td>fish, beef, chicken, beans</td>
</tr>
<tr>
<td>Vitamins and minerals</td>
<td>help in various ways, including helping nerves work</td>
<td>fruits, vegetables, fortified milk</td>
</tr>
<tr>
<td>Fats</td>
<td>provide energy and keep skin healthy</td>
<td>butter, oil, ice cream</td>
</tr>
</tbody>
</table>

C. Use the numbers 1 through 9 to put the stages of digestion in order.

3. Chewed food moves into the esophagus.
7. Undigested food and other substances pass to the large intestine.
5. Food enters the small intestine where most digestion takes place.
1. Digestion begins in the mouth.
6. Nutrients from the digested food pass from villi into the blood.
8. Water and minerals from food are absorbed into the blood.
2. Chewing grinds food into smaller pieces, and saliva moistens the food and begins to break it down.
4. The stomach squeezes the food and mixes it with digestive fluids.
9. Remaining undigested food passes as solid waste.
What Is the Digestive System?

Use the words in the box to complete the paragraph about digestion. Some words may be used more than once.

The __**digestive system**__ is a group of organs that breaks down food into small pieces the body can use. Food moves from the mouth to the stomach through the __**esophagus**__. The __**stomach**__ is a muscular organ that stores and helps digest food. When food leaves the stomach, it enters the __**small intestine**__ where more digestion takes place. Nutrients from the digested food pass through villi in the __**small intestine**__ into the blood and to every cell in the body. Undigested food and other substances pass to the __**large intestine**__.

**Vocabulary Skill: Word Origins**

The word *digestive* comes from the Latin word *digestus*, meaning “to divide or distribute.” Write an explanation of the term *digestive system* using this information.

**Sample response:** The digestive system divides food into small particles that are distributed to the body cells.
What Is the Digestive System?

Glossary

- **acid**: a corrosive chemical substance
- **carbohydrates**: organic compounds that release energy when broken down by an organism
- **enzymes**: substances produced by an organism that bring about specific biochemical reactions
- **glands**: organs that secrete particular chemical substances
- **nutrients**: substances that provide nourishment essential for growth and the maintenance of life

Use the words from the box to complete each sentence about the digestive system.

1. Digestion helps to release _______ nutrients _______ from food that the body can use.

2. People get most of the energy their bodies need from eating _______ carbohydrates _______.

3. Saliva is produced by _______ glands _______ that are located at the back and bottom of the mouth.

4. The _______ enzymes _______ in saliva break down the starch in foods like bread and potatoes.

5. Digestive fluids in the stomach contain a(n) _______ acid _______ that breaks down food.

Homework: Create a timeline to show how long it takes food to move through the digestive system. Begin your timeline with food entering the mouth.
**What Is the Excretory System?**

**Main Idea** All living things produce wastes. In humans, the excretory system removes wastes and helps maintain water levels.

- Kidneys filter wastes from blood and produce urine.
- People with kidney problems can often be helped with dialysis or a kidney transplant.
- Plants and animals use different methods of removing wastes.

**A. Complete the diagram to tell about the excretory system.**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>The body produces a lot of <strong>waste</strong>.</td>
<td>The <strong>excretory system</strong> removes it.</td>
</tr>
<tr>
<td>The body produces carbon dioxide.</td>
<td>The <strong>lungs</strong> remove it.</td>
</tr>
<tr>
<td>Blood carries wastes that contain <strong>nitrogen</strong>.</td>
<td>The <strong>liver</strong> converts nitrogen waste into <strong>urea</strong>.</td>
</tr>
<tr>
<td>Blood then contains <strong>urea</strong>.</td>
<td>The <strong>kidneys</strong> filter out the urea from blood.</td>
</tr>
<tr>
<td>When urea and water are filtered by the kidneys, <strong>urine</strong> results.</td>
<td>The <strong>ureters</strong> carry urine to the <strong>bladder</strong>.</td>
</tr>
<tr>
<td>The <strong>urine</strong> in the bladder causes it to increase in size.</td>
<td>Sensors detect its size and <strong>signal</strong> the <strong>brain</strong> that it needs to be emptied.</td>
</tr>
</tbody>
</table>
What Is the Excretory System?

B. Rewrite each statement about excretory system problems to make it true.

1. If the excretory system works poorly or stops working, vitamins and minerals will gradually build up in the body.
   If the excretory system works poorly or stops working, wastes and poisons will gradually build up in the body.

2. Kidney disease can only occur in adults.
   Kidney disease can occur in children and adults.

3. Drinking lots of water and eating a healthy diet are two important steps to keeping your ureters healthy.
   Drinking lots of water and eating a healthy diet are two important steps to keeping your kidneys healthy.

C. Put the steps in order to describe dialysis.

   3 Waste and extra fluid are removed from the blood.
   2 Blood is filtered in a machine.
   4 Filtered blood is returned to the body.
   1 Blood containing wastes is removed from the body.

D. Match each term with its waste removal system. Use each term only once.

   camels  mammals  plants
   earthworms  plant cells  snakes

   earthworms diffuse wastes directly to the outside
   snakes change nitrogen wastes into uric acid
   mammals make urea which they flush out with water
   camels make urine saltier than sea water
   plant cells often store wastes in a central vacuole
   plants may also keep wastes in unwanted parts
What Is the Excretory System?

**bladder**  **excretory system**  **kidney**

**A. Use the words from the box to complete each sentence.**

1. The job of the **excretory system** is to remove wastes and to maintain water balance.

2. The **kidney** is a bean-shaped organ located near the middle of the back.

3. The **bladder** is a muscular bag that holds urine.

**B. Write a word from the box next to each phrase that describes it. Some words may be used more than once.**

- **bladder** sensors detect its size and signal the brain when it needs to be emptied.
- **kidney** filters urea from the blood
- **kidney** helps the body maintain the right water balance
- **excretory system** involves different processes and organs spread throughout the body
- **kidney** surrounded by a layer of fat for protection
- **bladder** connected to kidneys by ureters

**Homework:** Write two or three sentences that explain how the kidneys and bladder work together in the excretory system.
What Is the Excretory System?

Glossary

dialysis  process of cleansing the blood artificially
filter  straining out substances from a liquid or gas by slow passage through tissues, cloth, paper, sand, or charcoal
urea  substance present in the urine of mammals
urine  the liquid waste product that is produced by the kidneys
wastes  materials that the body cannot use

Use the words from the box to complete the paragraph about the excretory system. Some words may be used more than once.

The excretory system removes ______ wastes ______ from the body.

As key organs of the excretory system, the kidneys ______ filter ______ the blood and produce ______ urine ______. The urine of all mammals contains ______ urea ______. If a person’s kidneys are not working, ______ wastes ______ can be removed from the blood by ______ dialysis ______. In this process, a machine is used to ______ filter ______ out ______ wastes ______ and other fluids.

Vocabulary Skills:
Word Origins

The word dial comes from a Latin word meaning “day.” The face of a sundial was called “the wheel of day” and people started using the word for other marked circles. How does the origin of dialysis relate to its meaning?

Sample response: The process is like a circle: Blood comes out of the body, through a machine, and back into the body.
Where Is Earth’s Water?

**Main Idea** Most of Earth’s water is salt water contained in the oceans.

- Oceans and seas make up 97 percent of Earth’s water.
- Earth’s fresh water is located in rivers, lakes, underground, and as ice in glaciers.
- Distillation and reverse osmosis are processes used to remove salt from salt water.

**A. Complete the diagram to tell about salt water oceans and seas.**

As water from runoff moves across the land, it dissolves **salts and other minerals** in **soil and rock**.

The runoff carries salts and other minerals into **streams and rivers**.

Eventually, the rivers empty into **oceans and seas**, bringing the salts and other minerals with them.

Over time—millions of years—the deposits accumulate, making the water **salty**.

**B. Complete the diagram to tell why fresh water is a valuable resource.**

Fresh Water: A Valuable Resource

- Much of the fresh water supply is **not available for everyday use**.
- It is **not evenly distributed** over Earth’s surface.
- **Pollution** can damage the water supply.
Where Is Earth’s Water?

C. Complete each sentence in the diagram to identify sources of Earth’s fresh water.

A(n) ________ river
is a body of water that flows downhill in a channel.

A(n) ________ stream
is a small river.

Lakes are bodies of water surrounded by land.

Groundwater is water that collects in spaces and cracks in rocks and soil underground.

About two-thirds of Earth’s fresh water is “locked away” as ice in glaciers and polar ice caps.

D. Complete the chart to tell about the process of desalination.

<table>
<thead>
<tr>
<th>Processes</th>
<th>Desalination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Distillation:</td>
<td>Ocean water is heated. Water vapor forms</td>
</tr>
<tr>
<td></td>
<td>and leaves behind the solid salts. In</td>
</tr>
<tr>
<td></td>
<td>a separate chamber, the water vapor is</td>
</tr>
<tr>
<td></td>
<td>cooled and condenses into fresh water.</td>
</tr>
<tr>
<td>2. Reverse osmosis:</td>
<td>Salt water is pumped at high pressure</td>
</tr>
<tr>
<td></td>
<td>through a membrane. Holes in the membrane</td>
</tr>
<tr>
<td></td>
<td>let water molecules pass through, but</td>
</tr>
<tr>
<td></td>
<td>trap dissolved salts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawbacks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The desalination plants are very expensive to run.</td>
<td></td>
</tr>
<tr>
<td>2. The plants produce brine, which can pollute groundwater and make water too salty for living things.</td>
<td></td>
</tr>
</tbody>
</table>
Where Is Earth’s Water?

Match each word from the box to the statement that describes it. Each word will be used more than once.

- **groundwater**  water that collects in spaces and cracks in rocks and soil underground
- **runoff**  the main source of salt in oceans and seas
- **groundwater**  one of the two main sources of fresh water
- **desalination**  the removal of salt from salt water to make fresh water
- **runoff**  rainwater that flows over land without sinking into the soil
- **desalination**  provides less than one percent of the world’s fresh water
- **runoff**  carries salts and other minerals into streams and rivers
- **groundwater**  makes up about 94 percent of Earth’s usable fresh water supply
- **desalination**  an expensive process that produces brine

**Homework:** Explain the difference between surface water and groundwater in a few sentences.
Where Is Earth’s Water?

Glossary

<table>
<thead>
<tr>
<th>Vocabulary Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>condenses</strong></td>
<td>changes from a gas or vapor to a liquid</td>
</tr>
<tr>
<td><strong>distillation</strong></td>
<td>the process of boiling a liquid and condensing and collecting the vapor to purify the liquid</td>
</tr>
<tr>
<td><strong>evaporates</strong></td>
<td>changes from a liquid to a gas or vapor</td>
</tr>
<tr>
<td><strong>membrane</strong></td>
<td>a thin sheet or skin</td>
</tr>
<tr>
<td><strong>molecules</strong></td>
<td>groups of two or more atoms joined together in a chemical bond</td>
</tr>
<tr>
<td><strong>osmosis</strong></td>
<td>the movement of a solvent through a membrane separating two solutions of different concentrations</td>
</tr>
</tbody>
</table>

The Process of **Distillation**

Ocean water is collected and heated.

The hot water **evaporates** and becomes water vapor, leaving the solid salts behind.

In a separate chamber, the water vapor is cooled and **condenses** back into liquid fresh water.

The Process of Reverse **Osmosis**

Salt water is pumped at high pressure through a thin membrane.

Holes in the membrane let water **molecules** pass through, but trap dissolved salts.

Fresh water is produced.

Vocabulary Skill: Multiple-Meaning Words

The word *condense* has more than one meaning. Write two meanings this word can have. Use a dictionary to help you.

Sample response: The word *condense* can mean “to change from a gas to a liquid form.” The word can also mean “to make or become less in size or volume.”
How Do Communities Get Water?

Main Idea Communities get fresh water from both underground sources and surface sources.

- Rivers provide drinking water.
- Dams create reservoirs that collect and store water for drinking and irrigation.
- Groundwater from wells and springs supply drinking water.
- Drinking water is processed in purification plants.

A. Complete each sentence to identify the sources and systems that provide Californians with fresh water.

Only about 35% of the ______ rain ______ and ______ snow ______ that falls in California becomes ______ runoff ______ that supplies rivers and lakes.

Reservoirs also provide water for irrigation, the supplying of ______ fresh water ______ to farm fields.

A(n) ______ reservoir ______ is a place that collects and stores water.

Dams ______ create reservoirs.

A(n) ______ aqueduct ______ is a system of channels, pipes, and tunnels that carries water a long distance.
How Do Communities Get Water?

B. Complete the sentences to tell about groundwater.

1. The source of most groundwater is ____________ that sinks into the ____________ soil.

2. Water at the surface seeps downward until it reaches a layer of ____________ solid rock____ or tightly packed clay.

3. Water cannot ________ penetrate ________ this layer, so it fills in the spaces in soil and rock ____________ above the layer ________.

4. When all the ________ spaces ________ are filled with ________ water ________, the ground is said to be ________ saturated ________.

C. Complete the diagram to compare and contrast wells and springs.

- **Well**: a hole that is ________ drilled ________ into an underground area with water

- **Spring**: a natural flow of water from underground

- **Venn Diagram**:
  - Well: 
    - **dug or drilled**
    - into an underground area with water
  - Spring: 
    - **source of groundwater**
    - a natural flow of water from underground
How Do Communities Get Water?

Use a word from the box to complete each sentence about the water supply.

1. A(n) _______watershed_______ is a region of land that drains into a river.

2. _______Irrigation_______ is the supplying of fresh water to farm fields.

3. A(n) _______spring_______ is a natural flow of water from underground.

4. A(n) _______aqueduct_______ is a system of channels, pipes, and tunnels that carries water a long distance.

5. A(n) _______reservoir_______ is a place that collects and stores water.

6. An underground layer of rock or soil through which water moves easily is a(n) _______aquifer_______.

7. The surface of a layer of saturated ground is the _______water table_______.

8. A(n) _______well_______ is a hole dug or drilled into an underground area saturated with water.

Homework: Write a short paragraph explaining why aqueducts are necessary in parts of California.
How Do Communities Get Water?

Glossary

- **groundwater**: water beneath the surface of the earth
- **precipitation**: water, such as rain, snow, or sleet that falls to the surface of Earth
- **purification**: the act of cleansing or purifying water
- **wetland**: a lowland area that is saturated with water

Use words from the box to complete the diagrams.

Vocabulary Skill: Multiple-Meaning Words

The word *root* has more than one meaning. Write two meanings this word can have.

Sample response: The word *root* can refer to the part of a plant that absorbs water from the soil, and it can mean “to cheer for a person or a team.”
How Can Fresh Water Be Used Wisely?

Main Idea Water should be conserved in order to make fresh water supplies last longer.

- California’s growing population and crops need huge amounts of fresh water.
- About 1,300 dams and reservoirs, six major aqueduct systems, and other structures shift water from wetter areas to drier areas.
- Californians can conserve water by recycling and by decreasing their use of water.

A. Complete the cause-and-effect diagram about California’s water needs.

**Causes**

- California has the **largest** population of any state.
- The state’s people and farm fields are not close to its major water **supplies**.
- Californians’ water needs have begun to grow **greater** than their supply.

**Effects**

- The state faces big challenges in providing enough **water** to everyone.
- A large system of canals, pipes, aqueducts, dams, pumps, and reservoirs serve to **transfer** water.
- New steps are being taken so that **everyone** has the water they need.
How Can Fresh Water Be Used Wisely?

B. Rewrite each statement about California’s water supply to make it true.

1. The 238-mile-long Los Angeles Aqueduct brings water from Los Angeles over the mountains to Owens Valley.

   The 238-mile-long Los Angeles Aqueduct brings water to

   Los Angeles over the mountains from Owens Valley.

2. The Sacramento-San Joaquin River system supplies water to northern California.

   The Sacramento-San Joaquin River system supplies water

   to central and southern California.

3. The Colorado River Aqueduct carries river water from the Colorado to the city of Los Angeles.

   The Colorado River Aqueduct carries river water from the

   Colorado to the city of San Diego.

4. “The 4.4 Plan” is an agreement between the states that share water from the Sacramento River and promotes laws and practices that increase water use.

   “The 4.4 Plan” is an agreement between the states that

   share water from the Colorado River and promotes laws and
   practices that cut back water use.

C. Complete the diagram to tell about water conservation.

Homework: Make a list of what you do to help conserve water.
How Can Fresh Water Be Used Wisely?

Match the words from the box with the phrases below.

- conservation
- conservation
- water reclamation
- water reclamation
- conservation

1. the careful use of a natural resource
2. replacing old toilets with newer models that use less water
3. recycling waste water
4. taking shorter showers
5. between 50 and 75 percent of waste water from homes and offices could be reused to wash cars or to water lawns
6. turning off the water as we brush our teeth

Vocabulary Skill: Suffixes

Some nouns can be formed by adding the suffix -tion to the verb form. Explain how to form a noun from the word conserve.

Sample response: For a word that ends in e, you first drop the e and add an a before adding the suffix -tion.
How Can Fresh Water Be Used Wisely?

Glossary

<table>
<thead>
<tr>
<th>word</th>
<th>definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>encourage</td>
<td>to stimulate; spur</td>
</tr>
<tr>
<td>irrigate</td>
<td>to supply with water by means of streams or pipes</td>
</tr>
<tr>
<td>recycling</td>
<td>extracting useful materials from waste</td>
</tr>
<tr>
<td>resource</td>
<td>an available supply that can be drawn upon as needed</td>
</tr>
<tr>
<td>seeps</td>
<td>passes slowly through small openings</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences about water conservation.

1. Conserving a ______ resource ______ will help it last longer.

2. Most of California’s water is used to ______ irrigate ______ farms and crops.

3. Much of the water used from irrigation canals evaporates, runs off the land, or ______ seeps ______ into soil.

4. The state of California has passed laws to ______ encourage ______ water conservation.

5. One law addresses water reclamation, the ______ recycling ______ of waste water.

Vocabulary Skill: Prefixes

The prefix re- means “once more” or “again” when added to a base word. How does knowing this prefix help you understand the meaning of recycle? Use an example to help you answer the question.

Sample response: When you recycle, you change a waste product into something you can use again. So you are returning the material to a earlier stage in the cycle. For example, tin is used to make soda cans. People can recycle the soda cans so that the tin can be used again to make new soda cans or other products.
How Does Water Change State?

Main Idea On Earth, water exists in three states: liquid water, solid ice, and a gas called water vapor. Water changes from one state to another in processes that make up the water cycle.

• Earth’s fresh water is cleaned and renewed in the processes that make up the water cycle.

• Liquid water evaporates and changes to water vapor in the air. When cooled, it changes back to a liquid or a solid and falls to Earth as rain, sleet, snow, or hail.

• Groundwater collects in underground spaces between soil and rock. Runoff is water that flows over the ground, eroding the soil.

A. Put a check next to each statement that is true about water in the environment.

1. ✔ The water cycle is a natural process that restores and cleans Earth’s water supply.

2. ____ Only 30 percent of the Earth’s surface is covered with water.

3. ✔ Unwanted materials can pollute water on Earth’s surface.

4. ✔ Most fresh water on Earth is found underground and in glaciers and ice caps.

5. ____ The water cycle adds pollution to Earth’s fresh water supply.

6. ____ Water exists in only two states: liquid water and water vapor.

7. ✔ People use fresh water for drinking, cooking, and growing food.

8. ✔ About 97 percent of the Earth’s water is salt water.

9. ____ In the water cycle, water moves from the Sun to Earth’s surface.
How Does Water Change State?

B. Use the diagram below to answer the questions about the water cycle.

1. What is shown as A?
   
   **water vapor**

2. What part of the water cycle is illustrated by B?
   
   **Water evaporates from Earth’s surface.**

3. What is shown as C?
   
   **clouds**

4. What part of the water cycle is illustrated by D?
   
   **Water vapor condenses into water droplets and forms clouds.**

5. What part of the water cycle is illustrated by E?
   
   **Water in the atmosphere returns to the surface as precipitation.**

6. What are four types of precipitation?
   
   **rain, sleet, snow, hail**

C. Explain how groundwater and runoff are different.

**Sample response:** Groundwater is water that soaks into the ground and collects in underground spaces between soil and rock. In contrast, runoff is water that flows downhill across Earth’s surface without sinking into the land below.
How Does Water Change State?

condensation  evaporation  groundwater
precipitation  transpiration  water vapor

Use the words from the box to complete the puzzle about the water cycle.

Across
1. any form of water that falls to Earth’s surface from clouds
2. water in the form of a gas
3. water that soaks into the ground and collects there

Down
4. a liquid changing to a gas
5. a process in which the leaves of plants release water vapor into the air
6. the change of state from a gas to a liquid
How Does Water Change State?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cycle</td>
<td>a series of events that happen one after another in the same order, over and over again</td>
</tr>
<tr>
<td>energy</td>
<td>the capacity for work or vigorous activity</td>
</tr>
<tr>
<td>process</td>
<td>a series of actions performed in making or doing something</td>
</tr>
<tr>
<td>renews</td>
<td>to make new or as if new again</td>
</tr>
<tr>
<td>restores</td>
<td>to bring back into existence or use</td>
</tr>
</tbody>
</table>

Use words from the box to complete the diagram about the Water Cycle.

Homework: Write a paragraph that explains how water changes from one state to another in the water cycle.
How Does Precipitation Form?

**Main Idea** Clouds form and release precipitation as rain, snow, sleet, and hail.

- As moist air rises, water vapor condenses and clouds can form.
- Luke Howard described four classes of clouds.
- Rain, sleet, snow, and hail are the major forms of precipitation.

A. **Number the events below to show the order in which they occur.**

   4. The rising warm air gradually cools.
   1. The Sun warms Earth’s surface.
   5. The cold air sinks back to the ground.
   3. The warm air rises further above Earth’s surface.
   2. The air just above Earth’s surface warms, too.

B. **Complete the diagram about cloud formation.**

   **Causes**
   - Warm air rises in a convection current.
   - The air cools.
   - The droplets remain suspended in the air.

   **Effects**
   - The air carries **water vapor** with it.
   - The water vapor **condenses** around tiny specks of dust or salt, forming tiny **droplets of liquid water**.
   - **Clouds form**.
How Does Precipitation Form?

C. Complete the diagrams to identify the four major forms of precipitation.

- **sleet**
  - begins as small drops of **rain**
  - reaches ground as tiny **ice pellets**
  - drops fall through air that is **colder** than water’s freezing point

- **snow**
  - type of flakes depends on temperature of cloud
  - made up of **small flakes** and pellets of ice

- **hail**
  - made up of round chunks of **ice**
  - chunks grow **heavier** as coats of ice are added inside cloud
  - begins to form when drops of rain **freeze** inside a cloud with cold updraft winds

- **precipitation**
  - most common form of precipitation
  - can form when tiny cloud droplets **combine**
  - drops of **liquid water**
  - can begin as **ice crystals**
How Does Precipitation Form?

Use the words from the box to complete each sentence about precipitation.

1. The temperature at which air becomes saturated is its **dew point**.

2. **Humidity** is the amount of water vapor in the air at any given time.

3. A **convection current** is a continuous loop of moving air or liquid that transfers energy.

4. If the air temperature drops below the **dew point**, water condenses and clouds or fog form.

5. One reason that **humidity** changes is because the temperature changes.

6. When the **relative humidity** is 100 percent, the air is said to be saturated.

Vocabulary Skill: Root Words

The word *humidity* comes from the Latin word *humere*, which means “to be moist.” Explain how knowing the meaning of the root helps you understand the meaning of *humidity*.

Sample response: Humidity is the amount of water vapor in the air, which you can describe as the “moistness” of the air.
How Does Precipitation Form?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cirrus</td>
<td>a cloud composed of feathery white patches, bands, or streamers of ice crystals, found typically at high altitudes</td>
</tr>
<tr>
<td>cumulus</td>
<td>a dense, white, fluffy cloud that billows upward from a flat base</td>
</tr>
<tr>
<td>cumulonimbus</td>
<td>a very dense cloud with massive projections that billow upward to great heights, usually producing heavy rains, thunderstorms, or hailstorms</td>
</tr>
<tr>
<td>stratus</td>
<td>a low-lying grayish cloud that resembles a layer of fog</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the chart about the different types of clouds. Then answer the question that follows.

<table>
<thead>
<tr>
<th>Type of Cloud</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stratus</td>
<td>These clouds form in layers and may cover large parts of the sky. Some may bring rain.</td>
</tr>
<tr>
<td>cumulus</td>
<td>These are puffy, white clouds with flat bottoms. They form in rising columns of warm air and generally mean the weather is fair.</td>
</tr>
<tr>
<td>cirrus</td>
<td>These high altitude clouds are thin and wispy, and made of ice crystals. They indicate that pleasant weather may change to rain.</td>
</tr>
<tr>
<td>cumulonimbus</td>
<td>These clouds may bring heavy rain or thunderstorms. They may extend up through the troposphere.</td>
</tr>
</tbody>
</table>

Why do clouds stay in the sky?

Sample response: A cloud is less dense than the air below it, so it floats.

Homework: Write a short paragraph describing the types of precipitation that fall in your city or town.
How Does the Ocean Affect Weather?

Main Idea Oceans have a major effect on Earth’s weather and climate.

- Earth’s oceans warm and cool more slowly than its lands because water has a relatively high specific heat capacity.
- Ocean currents move warm and cold water around the oceans, helping to even out Earth’s temperatures.
- Oceans help to moderate the climate of places near them, such as California.

A. Complete the summary about heating and cooling land and water.

The __specific heat capacity___ is the amount of energy it takes to raise the temperature of 1 gram of a material by 1°C. Land and water have different specific heat capacities. In general, land heats up ______faster______ and reaches ______higher_______ temperatures than do bodies of water. Land areas also lose heat ______more quickly______ and drop to ______lower_______ temperatures. As a result, it takes more ______energy_______ and ______time__________ to heat ocean water than it does to heat nearby land.

B. Put a check next to each description of surface ocean currents that is true.

___ move vertically within ocean
✔ can be warm or cold
___ form because of differences in water temperature and salinity
✔ move in great circles
✔ driven by surface winds and the effects of Earth’s rotation
✔ help balance temperatures at Earth’s surface
How Does the Ocean Affect Weather?

C. Fill in the blanks to tell how oceans help to moderate the climate of places near them.

**Summer**
- Land is warmer away from ocean.
- Coastland is cooler.

**Winter**
- Land is colder away from ocean.
- Coastland is warmer.

Ocean water holds summer heat longer than land.
Ocean water holds winter's coldness longer than land.
How Does the Ocean Affect Weather?

Rewrite each sentence to make the statement about the movement of ocean water true.

1. An ocean current is an area of cold water in the ocean.
   
   An ocean current is a moving stream of water in the ocean.

2. Water that flows within a current has a wide range of temperatures and densities.
   
   Water that flows within a current has similar temperature and density.

3. Ocean currents move cold water around Earth’s oceans. This helps cool the temperature of nearby land.
   
   Ocean currents move hot and cold water around Earth’s oceans.
   This helps moderate temperatures of nearby land.

4. There are three types of ocean currents—shallow currents, salty currents, and wave currents.
   
   There are two types of ocean currents—surface currents and deep currents.

Vocabulary Skill:
Multiple-Meaning Words

The word current has more than one meaning. Write a sentence with the word current using the same meaning that is found in the lesson.

Write another sentence using a different meaning.

Sample response: We didn’t go swimming at the beach because the current was too strong.

Samantha needs to give me her current address.
How Does the Ocean Affect Weather?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy</td>
<td>the capacity for work or vigorous energy</td>
</tr>
<tr>
<td>land</td>
<td>any part of Earth’s surface that is not water</td>
</tr>
<tr>
<td>ocean</td>
<td>the whole body of salt water that covers nearly three-fourths of Earth’s surface</td>
</tr>
<tr>
<td>temperature</td>
<td>the degree of heat or cold</td>
</tr>
<tr>
<td>warm</td>
<td>somewhat hot; not cold</td>
</tr>
</tbody>
</table>

Use a word from the box to complete the paragraph about ocean effects on weather and climate.

How much _______ energy _______ does it take to raise the _______ temperature _______ of 1 gram of water by 1°C? The term used to describe this amount is specific heat capacity. Water and _______ land _______ have different specific heat capacities. In general, land heats up faster and cools faster than bodies of water do. For this reason, oceans hold the heat of summer long into winter. During winter, the _______ ocean _______ warms nearby lands, which remain milder than they would if the ocean were not there. Oceans also hold the coldness of winter into the _______ warm _______ months of summer. During summer, the ocean cools nearby lands.

**Homework:** Define an ocean current. Tell where warm currents move warm ocean water and where cold currents move cold ocean water.
How Does Air Pressure Affect Weather?

Main Idea Earth’s atmosphere is a mixture of gases that surrounds the planet. The atmosphere exerts a pressure that decreases with distance above Earth’s surface.

- Earth’s atmosphere is made up mostly of nitrogen and oxygen.
- Air pressure is the force air exerts on Earth. Air pressure at Earth’s surface is always changing.
- Low-pressure systems are associated with changing weather. High-pressure systems are associated with fair weather.

A. Fill in the blanks to tell about the different layers of Earth’s atmosphere.

The \underline{\text{thermosphere}} is the first part of Earth’s atmosphere struck by \underline{\text{sunlight}}.

The top of the \underline{\text{mesosphere}} has the \underline{\text{coldest}} temperatures in Earth’s atmosphere.

The \underline{\text{stratosphere}} contains most of the \underline{\text{ozone}} in Earth’s atmosphere.

The \underline{\text{troposphere}} contains about 75 percent of the \underline{\text{air}} in Earth’s atmosphere.

B. Fill in the blanks to tell about air pressure and altitude.

1. The air pressure in the \underline{\text{troposphere}} is greater than the air pressure in any other layer in the atmosphere.

2. As the distance from Earth’s surface increases, the air pressure \underline{\text{decreases}}.

3. Air pressure decreases with altitude because there are \underline{\text{fewer}} air molecules as you move away from Earth’s surface.
How Does Air Pressure Affect Weather?

C. Complete the diagram to tell how air pressure systems form in Earth’s atmosphere.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth's surface heats the air above it.</td>
<td>As the air warms it lightens and <strong>rises</strong> in the atmosphere.</td>
</tr>
<tr>
<td>Earth's surface cools the air above it.</td>
<td>The cold air is dense and <strong>sinks</strong> in the atmosphere.</td>
</tr>
</tbody>
</table>

D. Rewrite each sentence to make the statement about air pressure and weather true.

1. Clouds can form as warmer, lighter air rises in the atmosphere, which is why high-pressure systems are associated with unsettled weather.

   **Clouds can form as warm air rises in the atmosphere,**
   **which is why low-pressure systems are associated with**
   **unsettled weather.**

2. Low-pressure systems are associated with fair weather because clouds cannot form when cooler, heavier air sinks in the atmosphere.

   **High-pressure systems are associated with fair weather**
   **because clouds cannot form when cooler, heavier air sinks**
   **in the atmosphere.**
How Does Air Pressure Affect Weather?

Write the word from the box next to its description. The words will be used more than once.

1.  **air pressure**  the force exerted by air on a given area
2.  **weather**  overall condition of the atmosphere at a given time and place
3.  **weather**  affected by factors such as humidity, wind speed, and temperature
4.  **atmosphere**  it’s divided into four main layers
5.  **weather**  affected by the air pressure in a given area
6.  **atmosphere**  a mixture of gases that surround the planet
7.  **air pressure**  it generally decreases with altitude
8.  **atmosphere**  made up mostly of nitrogen and oxygen
9.  **air pressure**  an effect of the Sun’s uneven heating of Earth’s surface

**Homework:** Write a short paragraph describing how high-pressure and low-pressure systems affect the weather.
How Does Air Pressure Affect Weather?

Glossary

- **axis**: a straight line around which an object rotates
- **force**: a push or a pull
- **fossil fuels**: fossil materials that burn, such as coal, oil, or natural gas
- **molecules**: groups of two or more atoms linked together
- **radiation**: energy in the form of electromagnetic waves or particles
- **water vapor**: water in its gaseous state

Use a word from the box to complete each sentence.

1. Near oceans or large lakes, ____ **water vapor** ____ can make up as much as four percent of the air.

2. Burning ____ **fossil fuels** ____ increases the amount of carbon dioxide in the atmosphere.

3. ____ **Radiation** ____ from the Sun can harm living things.

4. As you move away from Earth’s surface, there are fewer air ____ **molecules** ____.

5. Air exerts a(n) ____ **force** ____ equally in all directions.

6. As Earth revolves around the Sun, the tilt of its ____ **axis** ____ affects the heating of Earth’s surface.

**Homework**: Write a paragraph that explains how the tilt of Earth’s axis affects the heating of its surface by the Sun.
Why Does Air Move?

Main Idea Wind is caused by differences in air pressure. These differences create both local winds and planetary winds.

- Wind is the movement of air from areas of high pressure to areas of low pressure.
- All winds are part of convection currents in the atmosphere.
- Planetary winds affect large areas of Earth.

A. Complete the paragraph to tell about air pressure.

The _______uneven_______ heating of Earth’s surface causes differences in ____air pressure_____. When air is warmed, it becomes ____less dense_____ than surrounding air.

When air is ______cooled_______, it becomes denser than the surrounding air. This creates local high-pressure and low-pressure systems that affect ______weather_______ across the globe.

B. Answer the following questions to compare the different types of local breezes.

1. What are valley breezes?
   Valley breezes are local winds that occur during the day as ______cooler air over the valley replaces the rising warmer air over mountain slopes______

2. What are land breezes?
   Land breezes are local winds that occur at night when cooler air from the land moves in to replace the rising warmer air over the sea.
Why Does Air Move?

C. Number the statements in the correct order to tell about the mountain effect.

7. Dry winds sweep down the leeward side of the mountain.
4. In the colder air at higher elevations, water vapor condenses to form clouds.
1. Water from the ocean evaporates into water vapor in the air.
6. Air that crosses over the mountain has very little moisture left.
2. Sea breezes carry the moist air toward land.
5. Rain or snow may fall along the windward side of the mountain.
3. Moist air is forced up over the mountains.

D. Complete the diagram to tell about planetary winds.

There are three main wind belts: polar easterlies, westerlies, and trade winds.  

They are long-lasting circulation patterns that affect large areas of Earth.  

They do not travel in straight lines.  

---

Homework: Write a paragraph explaining how the jet stream and planetary wind belts affect weather systems.
Why Does Air Move?

jet stream  land breeze  mountain breeze
valley breeze  sea breeze  planetary winds

Rewrite the underlined portion of each statement to make it true.

1. A mountain breeze occurs during the day when warm air rising from a mountain slope is replaced by cooler air from the valley moving in to replace it.
   at night when cooler air from mountain slopes flows down the slopes to replace warm air rising above the valley.

2. Planetary winds, like local breezes, are regional winds that affect a limited area of Earth.
   unlike local breezes, are long-lasting circulation patterns that affect large areas of Earth.

3. A land breeze occurs during the day when cool air from the sea moves in to replace warm air rising over the sea.
   occurs at night when cool air from land moves toward the sea to replace rising warm air over the sea.

4. Jet streams are the three wind belts in each hemisphere of Earth.
   fast-moving global winds that occur in the upper troposphere.

5. A sea breeze blows from water to land and occurs during the day when warm air over the sea moves in to take the place of cool air rising over the land.
   blows from water to land and occurs during the day when cool air over the sea moves in to replace warm air rising over the land.

6. A valley breeze occurs at night when cool air from the valley rises up mountain slopes to replace the cool air rising over the slopes.
   occurs during the day when cool air from the valley rises up mountain slopes to replace the warm air rising over the slopes.
Why Does Air Move?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>belts</td>
<td>geographic regions that are distinctive in some way</td>
</tr>
<tr>
<td>circulation</td>
<td>the process of moving or flowing along a path</td>
</tr>
<tr>
<td>friction</td>
<td>the rubbing of one object or surface against another</td>
</tr>
<tr>
<td>global</td>
<td>of the entire Earth; worldwide</td>
</tr>
<tr>
<td>prevailing</td>
<td>most common</td>
</tr>
</tbody>
</table>

Use words from the box to complete the paragraph to tell about global weather.

The uneven heating by the Sun of Earth’s surface creates differences in air pressure. These differences in air pressure result in planetary winds. Planetary winds are long-lasting _____ circulation _____ patterns that affect large areas of Earth. Three main wind _____ belts _____ cover each hemisphere. These winds do not travel in straight lines. They are directed by Earth’s rotation and _____ friction _____ with the surface. Planetary winds curve to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Jet streams are another system of _____ global _____ winds occurring in the troposphere. Planetary winds and jet streams affect the direction in which weather systems move. For example, the _____ prevailing _____ westerlies blow from west to east across the United States. They have a great effect on U.S. weather.

Vocabulary Skill: Prefixes

The prefix un- means “not.” It usually changes a word to its opposite meaning. Determine the meaning of each word and then write a sentence using each word.

uneven: not even, not straight, not level
unequal: not equal, not the same, not even
How Are Weather Forecasts Made?

Main Idea Scientists gather data about temperature, humidity, wind, and air pressure. They use this information to develop weather forecasts.

- Weather involves different variables, including temperature, humidity, wind, and air pressure, interacting in the atmosphere.
- Air masses form in the troposphere and create fronts where they meet, along which changes in weather occur.
- Different kinds of technology are used to predict the weather, including radar, weather satellites, and weather balloons.

A. Match the instrument to the weather variable it is used to measure.

1. wind vane  a. temperature
2. barometer  b. wind speed
3. thermometer c. wind direction
4. anemometer d. air pressure

B. Answer the questions to tell about air masses and fronts.

1. What factor affects the temperature and moisture of an air mass?
   The temperature and moisture of an air mass depend on where the mass forms.

2. What are the four main types of air masses that affect weather in North America?
   The four main types of air masses are maritime polar, continental polar, maritime tropical, and continental tropical.

3. How do air masses affect weather?
   Air masses of different temperatures and humidity form fronts where they meet. Changes in weather usually occur along these fronts.
How Are Weather Forecasts Made?

C. Answer the following questions about weather maps.

1. A high-pressure system is pushing a cold front across the Northeast from Boston to Washington, D.C. Draw the front on the map. What kind of weather would you expect to find in New York today? Tomorrow?

   **Expect heavy rain with thunderstorms today and clear skies tomorrow.**

2. Is it warmer in San Francisco or Los Angeles? How can you tell?

   **It is warmer in San Francisco because air behind a front is warmer than air ahead of the front.**

D. Fill in the blanks to complete the paragraph about predicting the weather.

   **Meteorologists** use different tools to study the weather. **Radar** is used to create images of storms using **radio signals** that bounce off different kinds of precipitation.

   Weather balloons are used to study weather conditions in **the upper atmosphere**. Meteorologists then use the data they have collected to make **predictions** about the weather.
How Are Weather Forecasts Made?

air mass  front  meteorologist

Use the words from the box to complete the diagrams.

Vocabulary Skill:
Multiple-Meaning Words

Many words in the English language have more than one meaning. Write two sentences that use different meanings of the word front.

1. Cara is meeting her father in front of her school at 3:30.

2. The weather forecaster said that a cold front with heavy rains will come to our area tomorrow.
How Are Weather Forecasts Made?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>continental</td>
<td>relating to a continent</td>
</tr>
<tr>
<td>forecast</td>
<td>prediction</td>
</tr>
<tr>
<td>maritime</td>
<td>located on or near the sea</td>
</tr>
<tr>
<td>polar</td>
<td>relating to, or near, the North Pole or the South Pole</td>
</tr>
<tr>
<td>tropical</td>
<td>relating to the tropics</td>
</tr>
<tr>
<td>variables</td>
<td>things that change or are subject to change</td>
</tr>
</tbody>
</table>

Use the words from the box to answer the following questions.

1. What does the weather depend on?
   - variables

2. What kind of air mass is generally cold?
   - polar

3. What kind of air mass tends to form over water and is moist?
   - maritime

4. What does a meteorologist make after gathering data about the weather?
   - forecast

5. What kind of air mass is generally dry?
   - continental

6. What kind of air mass forms at low latitudes and is generally warm?
   - tropical
What Causes Storms?

Main Idea Severe storms are associated with low-pressure systems. In these systems, warm, moist air rises and cools. Water vapor in the cooling air condenses, forming clouds followed by precipitation.

- Thunderstorms bring strong winds, heavy rains, lightning, and thunder. Tornadoes can develop from thunderstorms.
- Blizzards are severe snowstorms with heavy snow, high winds, and low temperatures.
- Hurricanes are the most powerful storms on Earth. They form over warm ocean waters in the tropics.

A. Complete the diagram to tell about how thunderstorms form. Then answer the question that follows.

What three conditions must be met for a thunderstorm to form?

Sample response: There must be plenty of moisture in the air; there must be an approaching cold front (or extreme heating of the surface); and the rising air must remain warmer than the surrounding air.
What Causes Storms?

B. Complete the diagram to tell how thunderstorms and blizzards are similar and different.

- lightning
- thunder
- heavy rains
- associated with low-pressure system
- results when cold air meets warmer, moister air
- wind
- snow
- low temperatures

C. Fill in the blanks to tell about the formation of a hurricane.

1. A hurricane begins as a low-pressure system over warm, tropical waters.

2. As the system strengthens, thunderstorms begin to rotate around the area of low pressure.

3. As warm, moist air continues to rise, pressure in the center of the system falls steadily as the storm strengthens.

4. The hurricane continues to grow in size and intensity while it moves over warm, tropical waters.

5. The hurricane will weaken and lose energy when it moves over cooler water or moves over land.
What Causes Storms?

Use a term from the box to complete this diagram about severe weather. Then add two more facts about each type of weather to the diagram.

Homework: Write a paragraph describing how a thunderstorm forms.
What Causes Storms?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>condenses</td>
<td>changes from a gas to a liquid</td>
</tr>
<tr>
<td>discharge</td>
<td>a release of electrical energy</td>
</tr>
<tr>
<td>intensity</td>
<td>extreme force or strength</td>
</tr>
<tr>
<td>moisture</td>
<td>wetness</td>
</tr>
<tr>
<td>reserves</td>
<td>things kept back or saved for later use</td>
</tr>
<tr>
<td>visibility</td>
<td>the greatest distance over which it is possible to see</td>
</tr>
<tr>
<td></td>
<td>without aid from instruments</td>
</tr>
</tbody>
</table>

Use the words in the box to complete the following sentences.

1. Clouds form when moisture in warm rising air __________ condenses __________.

2. In order for a thunderstorm to form, there must be plenty of __________ moisture __________ in the air.

3. Lightning is a powerful electric __________ discharge __________ that can occur during a thunderstorm.

4. Droughts can kill crops and drain away water __________ reserves __________.

5. Moving about in a blizzard is difficult because __________ visibility __________ is low.

6. A hurricane continues to grow in size and __________ intensity __________ while over warm, tropical waters.
What Is Earth’s Sun Like?

**Main Idea** The Sun is the largest and most massive body in the solar system. It provides nearly all the energy needed to sustain life on Earth.

- The Sun is a medium-sized yellow star. It is the central body of the solar system.
- The Sun is made mostly of hydrogen and helium and produces energy by nuclear fusion.
- The Sun is a main sequence star. It will eventually pass through the phases of red giant, planetary nebula, white dwarf, and black dwarf.

A. Complete the outline to tell about the Sun and its surface features. Then answer the question that follows.

I. The Sun
   A. a medium-sized **yellow star**
   B. located about **150 million km** from Earth
   C. exerts a strong **gravitational pull**
   D. main source of **energy** for Earth

II. The Sun’s Surface Features
   A. **Sunspots** are cooler areas on the Sun’s surface that occur in 11-year cycles.
   B. **Solar flares** are powerful eruptions of particles on the Sun’s surface.
   C. **Solar winds** are fast-moving gases that can travel in space.
   D. **Solar prominences** are huge arcs of gas that extend high into the Sun’s atmosphere.

Why do solar flares and prominences occur in 11-year cycles?

**Sample response:** Both solar flares and prominences are common during high sunspot activity. Since sunspots occur in 11-year cycles, so do solar flares and prominences.
What Is Earth’s Sun Like?

B. Complete the diagram to tell about the Sun’s effects on Earth.

At the Sun's core, hydrogen is converted into helium through nuclear fusion. As a result, a huge amount of energy is produced.

Energy from the Sun provides heat to keep the Earth livable.

The Sun provides an energy source for all living things on Earth.

Heat from the Sun drives the water cycle.

The Sun’s uneven heating of Earth affects the weather.

C. Fill in the blanks to tell about the life cycle of a star. Then number the statements to show the correct sequence.

6. Over time, the star shrinks into a white dwarf.

4. The outer part of the star expands over time, while the core contracts. The star is known as a red giant.

7. Out of nuclear fuel, the star eventually fades into a black dwarf.

1. A star forms from rotating clouds of dust and gas called a nebula.

5. A planetary nebula forms when the outer layers of the star are released.

3. Nuclear fusion begins when temperatures reach 10 million °C and a star is born.

2. In a protostar, gravity and other forces cause the nebula to collapse. Clouds begin to glow as the temperature rises.
What Is Earth’s Sun Like?

A. Complete the paragraph to tell about stars. Then label the diagram.

The Sun is the central body of the solar system. Like all stars, the Sun produces energy by _____________. In this process, the nuclei of two forms of ____________ (tritium and deuterium) fuse, or combine, to form a helium nucleus and a neutron. A tremendous amount of ____________ is produced in this process from a small amount of ____________.

![Diagram of nuclear fusion]

B. Complete the sentences to tell about sunspots.

1. Sunspots are _____________.
2. They appear dark because _____________.
3. Sunspots occur in cycles that _____________.
4. Periods of low and high sunspot activity correspond to _____________.

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Use the words from the box to complete the paragraph about the Sun.

All stars form from enormous rotating clouds of dust and gases. Over time, gravity and other forces cause the clouds to **collapse** into a very dense mass. When temperatures in this dense mass reach at least 10 million °C, nuclear fusion begins. A star is born. When a newly formed star has **stabilized**, it becomes a main–sequence star, like the Sun.

The Sun affects life on Earth. Sunspots are dark areas on the Sun’s surface. Periods of low and high sunspot activity **correspond** to temperature changes on Earth. Solar flares are powerful eruptions of particles that shoot into space. When particles released in solar flares reach Earth, they can **disrupt** radio communications. In addition, the Sun drives the water cycle. It causes water on Earth’s surface to **evaporate**, forming water vapor.

**Vocabulary Skill: Antonyms**

An antonym is a word that means the opposite of another word. Find an antonym for these words. Use the text from the lesson to help you.

*evaporate: **condense**
contract: **expand***
What Orbits the Sun?

Main Idea The Sun and the bodies that revolve around it make up the solar system. The solar system is a small part of a much larger system called the Milky Way galaxy.

- The solar system consists of the Sun, nine planets, their moons, and many other smaller bodies that orbit the Sun.
- All but two planets in the solar system have at least one moon. Moons and asteroids are among the smaller bodies in the solar system.
- Comets may have short-period or long-period orbits around the Sun. Meteors are bits of matter that burn up when they enter Earth’s atmosphere.

A. Complete the summary about the formation of the solar system.

Scientists think that the solar system is about 4.6 billion years old. It formed from a hot, spinning cloud of gases and dust. Over time, gravity caused the center of the cloud to collapse. Heat and pressure built up in the center and the Sun was formed.

Away from the center, temperatures were much cooler. Matter there began to come together to form the nine planets and their moons. Planets closest to the Sun formed from heavy, rocky material. Planets farther away were able to hold onto lighter gases and became much larger. Along with the planets and their moons, other smaller bodies formed, such as asteroids, comets, and meteoroids.

The paths, or orbits, of all these bodies are shaped like slightly flattened circles, called ellipses. The strong gravitational force of the Sun holds all the objects in the solar system in their orbits.
What Orbits the Sun?

B. Fill in the blanks to tell about moons, asteroids, comets, and meteors.

**Moons**
1. natural satellite
2. held in **gravitational pull** by their planets
3. some have **atmospheres and active volcanoes**
4. others show evidence of **ice and water**

**Asteroids**
1. small, rocky objects that orbit the Sun
2. most orbit in **an asteroid belt** between **Mars and Jupiter**
3. range widely in **shape and size**

**Comets**
1. made up of dust, ice, and frozen gas
2. contain a **solid center** called the nucleus
3. gases and dust released from the nucleus when close to **the Sun**, forming a **glowing region** called a coma
4. form a **tail** that can reach out millions of kilometers into space

**Meteors**
1. begin as chunks of rock and metal called meteoroids
2. enter Earth’s **atmosphere** and are heated by **friction with the air**
3. **burn up** as they fall to Earth, appearing as streaks of **light** in the night sky
What Orbits the Sun?

Vocabulary Skill: Sentence Context

Use a word from the box to complete each sentence. Use context clues to help you.

1. A(n) _______ meteor _______ is a chunk of matter that is heated by friction with air as it falls through Earth’s atmosphere.

2. A(n) _______ comet _______ is a small body made up of dust, ice, and frozen gases.

3. A(n) _______ planet _______ is a large body that revolves around the Sun.

4. A(n) _______ meteoroid _______ is a chunk of rock or metal that can sometimes fall into Earth’s atmosphere.

5. A(n) _______ asteroid _______ is a small, rocky object that orbits the Sun.

6. A(n) _______ galaxy _______ is a huge system of gas, dust, and stars.

7. The _______ solar system _______ is the Sun and all the bodies that travel around it.

Homework: Write a paragraph that includes five facts about the objects in the solar system.
What Orbits the Sun?

Glossary

- collided: bumped together violently
- orbit: to move around another object
- revolves: orbits around a central point
- rotates: turns around on an axis
- vaporize: to change from a liquid to a gas

Use the words in the box to complete each sentence about objects in the solar system.

1. The Moon _______ rotates _______ on its axis and _______ revolves _______ around Earth.

2. Some scientists believe that asteroids are remnants of several planets that _______ collided _______ and broke apart.

3. When a comet approaches the Sun, frozen solids in its nucleus _______ vaporize _______.

4. Meteors begin as meteoroids, which are bits of rock or metal that _______ orbit _______ the Sun.

Vocabulary Skill: Suffixes

The suffix -tion changes a word to noun form. For each word, write its noun form using -tion and then write a definition for the word. Use a dictionary to help you.

revolve: revolution; a complete circle made around a central point
rotate: rotation; a turning motion around an axis
What Are the Planets Like?

Main Idea The four planets closest to the Sun are called the inner planets. The remaining five planets are the outer planets.

- Mercury, Venus, Earth, and Mars are the inner planets. They are small and rocky and have few or no moons.
- Jupiter, Saturn, Uranus, Neptune, and Pluto are the outer planets. With the exception of Pluto, the outer planets are large and gaseous, and have many moons.
- Space probes can be used to explore regions of space that are too difficult or dangerous for humans to explore.

A. Write the letter of each description under the planet it describes.

Mercury  Venus  Earth  Mars  Jupiter  Saturn  Uranus  Neptune  Pluto

- a. a large planet best known for its rings of ice particles
- b. unlike other outer planets, this planet is small, rocky, and icy
- c. a planet with a thick atmosphere made mostly of carbon dioxide
- e. a planet with 11 moons and the coldest surface temperature
- f. the smallest inner planet, with surface temperatures that vary widely
- g. the only planet known to have liquid water
- h. a planet famous for its Great Red Spot
- i. a planet home to the largest volcano in the solar system
- j. a planet tilted sharply on its axis with a system of 11 rings
What Are the Planets Like?

B. Rewrite each statement comparing the inner and outer planets to make it true.

1. The inner planets are large and gaseous, while the outer planets are small and rocky.

   **The outer planets are large and gaseous, while the inner planets are small and rocky.**

2. The outer planets generally have fewer moons than the inner planets.

   **The outer planets generally have more moons than the inner planets.**

C. Complete the diagram to tell about the three types of spacecraft used by astronomers to explore space.

   - **Space shuttle:** takes equipment and people into space, experiments performed on board, can be used again and again
   - **Space station:** stays in space for long periods, astronauts and scientists live on board and perform experiments
   - **Space probe:** carries special instruments into different parts of space, can carry robots that are lowered to explore a planet’s surface
What Are the Planets Like?

inner planet   outer planet

Answer the questions to tell about inner planets and outer planets.

1. Which planets make up the inner planets?
   The inner planets are Mercury, Venus, Earth, and Mars.

2. What is the relative size of the inner planets?
   The inner planets are relatively small.

3. Of what substance are the inner planets mostly composed?
   The inner planets are mostly composed of rock.

4. Which planets make up the outer planets?
   The outer planets are Jupiter, Saturn, Uranus, Neptune, and Pluto.

5. What is the relative size of the outer planets?
   The outer planets are relatively large, with the exception of Pluto.

6. Of what substance are the outer planets mostly composed?
   The outer planets are mostly composed of gases, with the exception of Pluto.

Homework: Write one paragraph describing the characteristics of an inner planet and one paragraph describing an outer planet.
# What Are the Planets Like?

## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cratered</td>
<td>having a surface covered with shallow holes</td>
</tr>
<tr>
<td>dense</td>
<td>having relatively high density</td>
</tr>
<tr>
<td>erosion</td>
<td>the movement of rock material from one place to another</td>
</tr>
<tr>
<td>greenhouse effect</td>
<td>the trapping of the Sun’s radiation in a planet’s atmosphere</td>
</tr>
<tr>
<td>plane</td>
<td>a flat or level surface</td>
</tr>
<tr>
<td>velocities</td>
<td>speeds</td>
</tr>
</tbody>
</table>

Use words from the box to complete the chart about the planets.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>has a heavily ______ cratered surface, caused by collisions with other objects in space</td>
</tr>
<tr>
<td>Venus</td>
<td>atmosphere is 96 percent carbon dioxide, creating tremendous pressure and a strong ______ greenhouse effect ______</td>
</tr>
<tr>
<td>Mars</td>
<td>its surface shows sign of water ______ erosion ______, indicating that it may once have been more like Earth</td>
</tr>
<tr>
<td>Saturn</td>
<td>the least ______ dense ______ of any planet</td>
</tr>
<tr>
<td>Neptune</td>
<td>its winds reach ______ velocities ______ of 2,700 km/hr</td>
</tr>
<tr>
<td>Uranus</td>
<td>its axis is tilted so much that it is nearly parallel to the ______ plane ______ of its orbit</td>
</tr>
</tbody>
</table>

**Homework:** Write a paragraph that describes interesting characteristics of Earth, Jupiter, and Pluto.
What Keeps Planets in Their Orbits?

Main Idea The path of a planet around the Sun is caused by the gravitational attraction between the Sun and the planet.

- Gravitation causes objects to fall back to Earth. The strength of the gravitational force depends on the mass of the objects and the distance between them.
- The solar system formed from a cloud of dust and gas called a nebula.
- Planets orbit in curved paths because the forward motion of the planet is balanced by the downward pull of the Sun’s gravity.

A. Answer the following questions to tell about gravitational forces.

1. What is gravitation?
   Sample response: Gravitation is an attractive force between objects that have mass.

2. Why is gravitation an example of a non-contact force?
   Sample response: Gravitation acts on objects at a distance, without touching them.

3. What two factors affect gravitational force?
   Sample response: The masses of the objects and the distance between the objects affect the strength of gravitational force.

4. What effect does mass have on the strength of a gravitational force?
   Sample response: The greater the masses of the objects, the stronger the gravitational force is between them.

5. What effect does distance have on the strength of a gravitational force?
   Sample response: The smaller the distance between the objects, the stronger the gravitational force is between them.
What Keeps Planets in Their Orbits?

B. Complete the diagram to tell about the formation of the solar system.

The solar system began as a ______ cloud ______ of gas and dust called a ______ nebula ______. The force of ______ gravity ______ collapsed the center of this cloud into a star, which became ______ the Sun ______.

The inner planets formed near the Sun, where ______ temperatures ______ were very ______ hot ______. Lighter elements were ______ vaporized ______ by the intense heat, which is why the inner planets are composed mainly of ______ heavy elements ______.

The outer planets formed ______ farther ______ from the Sun, where temperatures were ______ cooler ______. They formed from ______ ice ______, gas, and dust. They grew in ______ mass ______ until even the light elements could not escape their ______ gravitational pull ______. This is why the outer planets are made mostly of light elements.

C. Complete the diagram to tell about the orbits of planets around the Sun.

1. A planet travels in an ______ elliptical ______ path around the Sun.

2. The ______ forward ______ motion of the planet balances the Sun's ______ gravitational pull ______ on it, so the planet follows a ______ curved ______ path around the Sun.

3. The planet ______ speeds up ______ as it nears the Sun and ______ slows down ______ when it is farther away.
What Keeps Planets in Their Orbits?

Place a check mark next to all the statements that are true about gravity.

1. It is an attractive force between objects that have mass. ✔
2. It is considered a contact force because it acts on objects directly. ☑
3. It is a force that causes an object to fall to the ground when dropped. ✔
4. It is generally the name for the attraction by Earth on objects at or near its surface. ✔
5. It affects the weight of an object. ✔
6. It causes objects to slow down as they fall. ☑
7. It played a large role in the formation of the solar system. ✔
8. It is a very weak force on the surface of Earth. ⊗

Homework: Imagine that you are standing on a balcony four stories above the ground holding a tennis ball. Using what you have learned in this lesson, write a paragraph that describes what happens to the ball when you drop it off the balcony.
What Keeps Planets in Their Orbits?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>attraction</td>
<td>the act or power of attracting</td>
</tr>
<tr>
<td>mass</td>
<td>a measure of the amount of matter in an object</td>
</tr>
<tr>
<td>proportional</td>
<td>corresponding in size or amount</td>
</tr>
<tr>
<td>resistance</td>
<td>a force that tends to oppose or slow motion</td>
</tr>
<tr>
<td>sensation</td>
<td>a feeling or awareness</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the following sentences.

1. Gravitation is a force between objects that have ________ mass ________.

2. Gravitational force is directly ________ proportional ________ to the product of the masses of the object.

3. The gravitational ________ attraction ________ by Earth on or near its surface is usually called gravity.

4. If you are falling, and your surroundings are falling at the same rate, you can experience a ________ sensation ________ called weightlessness.

5. Air ________ resistance ________, or drag, slows the acceleration of falling objects.

Homework: Use terms you have learned in this lesson to write a paragraph explaining why the planets in the solar system orbit the Sun.
What Are Atoms and Elements?

Main Idea All matter is made up of particles called atoms, the smallest units of elements. As new tools can picture, atoms often form well-ordered patterns, or arrays.

- An atom has at its center a nucleus, which is surrounded by moving electrons.
- An element has only one kind of atom. An element’s properties are determined by the way those atoms join together.
- While a few elements are found in pure form, most elements form compounds with other elements.

A. Complete the diagram by labeling the parts of an atom.

B. Complete each sentence to tell about matter.

1. All matter is made up of _______ elements _______.
2. Elements are made up of _______ only one kind of atom _______.
3. An atom is the _______ smallest particle _______ of an element.
4. The nucleus is the structure in _______ the center of an atom _______.
5. The nucleus contains two kinds of particles: _______ protons and neutrons _______.
6. Moving in the space around the nucleus are _______ electrons _______.

Study Guide
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What Are Atoms and Elements?

C. Complete the diagram about the organization of atoms.

Atoms can ______ arrange or join together ______ in different ways.

Each arrangement provides different ______ properties ______.

Examples of properties include ______ color, hardness, and density ______.

Some elements are found in ______ nature only by themselves ______.

Most elements form ______ compounds ______ by combining with other elements.

Many compounds are made of ______ molecules ______.

D. Put a check next to each description of a scanning tunneling microscope that is true.

_____ uses lenses and light to magnify images

_____ was invented before the electron microscope

✔  fits on a table top

✔  shows an individual atom

✔  shows how atoms group together in arrays

_____ tells scientists everything about atoms
What Are Atoms and Elements?

Write each word from the box next to its definition. Some words will be used more than once.

- **neutron**  a particle that lacks charge
- **compound**  a pure substance that is made up of two or more elements that are chemically combined
- **atom**  the smallest particle of an element
- **nucleus**  the structure in the center of an atom
- **electron**  a negatively charged particle
- **element**  a substance that cannot be broken apart chemically into other substances
- **proton**  a positively charged particle
- **nucleus**  contains two types of particles
- **element**  made up of only one kind of atom
- **electron**  moves in space around the nucleus
- **neutron**  has a mass that is about equal to the mass of a proton

**Vocabulary Skill:**
**Word Origins**

The word *neutron* is based on the Latin word *neuter*, which means “neither.” How can this information help you remember the meaning of *neutron*?

**Sample response:** A neutron has neither a positive nor negative charge.
What Are Atoms and Elements?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum</td>
<td>a very lightweight, silver-white metallic element</td>
</tr>
<tr>
<td>carbon</td>
<td>a very common nonmetallic element that occurs in combination with other elements in every living thing</td>
</tr>
<tr>
<td>copper</td>
<td>a tough, reddish–brown metallic element that resists rust</td>
</tr>
<tr>
<td>helium</td>
<td>a very light, colorless, odorless gas that will not burn</td>
</tr>
<tr>
<td>silver</td>
<td>a shiny, white, precious metallic element that conducts heat and electricity better than any other substance</td>
</tr>
</tbody>
</table>

Place each word from the box in the correct category in the chart. Then answer the question that follows.

| Metal       | Nonmetal       |
|-------------|                |
| aluminum    | carbon         |
| copper      | helium         |
| silver      |                |

The elements you sorted into different groups have different properties. What is the cause of these different properties?

Sample response: An element’s properties result from the atoms that make it up and the way these atoms join together.

Homework: Use toothpicks and balls made of molded clay to construct a model of either graphite or diamond (see page 290). Then write a description of the model.
What Is the Periodic Table?

Main Idea Scientists have identified more than 100 elements, including metals, semimetals, and nonmetals. The elements are organized in the periodic table.

- The first periodic table was created by Dmitri Mendeleyev.
- The properties of an element determine its placement on the periodic table.
- The standardized periodic table has three categories: metals, semimetals, and nonmetals.

A. Complete the diagram to tell about the history of the periodic table.

Around **450 B.C.**, the Greek philosopher Empedocles suggested that all matter is made up of four elements—**earth, air, fire, and water**.

In **the 1600s**, English chemist Robert Boyle argued that earth, air, fire, and water **could not be real elements**.

In **the 1700s**, French chemist Antoine-Laurent Lavoisier made one of the first modern **lists of chemical elements**.

In **1869**, Russian chemist Dmitri Mendeleyev developed a way to **arrange and classify the elements**.

The modern periodic table is a table in which the elements are arranged by **their properties**.
What Is the Periodic Table?

B. Rewrite each statement about the periodic table to make it true.

1. Elements are arranged alphabetically.
   
   **Elements are arranged in order of increasing atomic number.**

2. An element’s atomic number is determined by its temperature.
   
   **An element’s atomic number is determined by the number of protons in its nucleus.**

3. Chemical symbols are the first two letters in an element’s name.
   
   **Chemical symbols are abbreviations, sometimes from Latin or Greek.**

4. Each column is called a period and each row is called a group.
   
   **Each column is called a group and each row is called a period.**

C. Use information from the periodic table on pages 300 and 301 to complete the chart below.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Element</th>
<th>Number of Protons</th>
<th>Metal, Semimetal, or Nonmetal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td>Aluminum</td>
<td>13</td>
<td>metal</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury</td>
<td>80</td>
<td>metal</td>
</tr>
<tr>
<td>Ne</td>
<td>Neon</td>
<td>10</td>
<td>nonmetal</td>
</tr>
<tr>
<td>K</td>
<td>Potassium</td>
<td>19</td>
<td>metal</td>
</tr>
<tr>
<td>Si</td>
<td>Silicon</td>
<td>14</td>
<td>semimetal</td>
</tr>
<tr>
<td>Na</td>
<td>Sodium</td>
<td>11</td>
<td>metal</td>
</tr>
</tbody>
</table>
What Is the Periodic Table?

Use pages 300 and 301 in your book and the words from the box to complete the table.

<table>
<thead>
<tr>
<th>Chemical Symbol</th>
<th>Noble Gas</th>
<th>Periodic Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>Nonmetal</td>
<td>Semimetal</td>
</tr>
</tbody>
</table>

Vocabulary Skill: Prefixes

The prefix *non-* means “not” and the prefix *semi-* means “having some of the characteristics of.” Use this information to write your own definitions of *nonmetal* and *semimetal*.

Sample response: A *nonmetal* is not a metal and a *semimetal* is a material that has some characteristics of a metal.
What Is the Periodic Table?

Glossary

- **brittle**: breaks easily
- **conduct**: to transmit, to be a channel for
- **luster**: the ability to reflect light
- **mixture**: two or more substances combined together
- **react**: to act chemically
- **semiconductor**: a mineral substance that conducts electricity better than an insulator but not so well as a metal

Use a word from the box to complete each sentence about the properties of elements.

1. One of the properties most metals have is _____luster______.
2. Copper wires are used to _____conduct______ electricity.
3. Brass is a _____mixture_____ of copper and zinc.
4. Under some circumstances silicon conducts electricity and at other times does not, so silicon is a _____semiconductor______.
5. Solid nonmetals are usually _____brittle______.
6. Oxygen can _____react______ with iron resulting in rust.

**Homework**: Choose an element from the periodic table. Write down everything you know about that element from the information on the periodic table.
Where Are Elements Found?

Main Idea Most things on Earth are made of only a few elements—far fewer than the more than 100 elements that scientists have discovered.

• Only eight elements make up almost 99 percent of Earth’s crust.
• A molecule is a group of two or more atoms that acts as a single unit.
• Carbon compounds are the main parts of all living things.

A. Complete the outline to tell about rare and common elements.

I. Most elements are quite rare on Earth.
   A. For example, all of the gold that has ever been mined is not much compared to the volume of Earth’s crust.

II. Other elements are rarer still.
   A. Many of the elements after uranium on the periodic table exist only in laboratories and only for a few fractions of a second.

III. Some elements are very common on Earth.
   A. Nearly 99 percent of Earth’s crust is made of only 8 elements: oxygen, silicon, aluminum, iron, calcium, sodium, potassium, and magnesium.
   B. Earth’s atmosphere is made of 2 elements: oxygen and nitrogen.

B. Place a check next to the elements found in living things.
   ✔ hydrogen  ✔ nitrogen  ✔ carbon
   ✔ oxygen  ✔ silicon  ✔ aluminum
   ✔ iron  ✔ calcium  ✔ uranium
Where Are Elements Found?

C. Rewrite each statement about molecules to make it true.

1. Very few compounds are made of molecules.
   
   Many compounds are made of molecules.

2. A molecule is a group of two or more compounds that are chemically joined and that act as a single unit.

   A molecule is a group of two or more atoms that are chemically joined and that act as a single unit.

3. Very few molecules can be made from only a few kinds of atoms.

   Many molecules can be made from only a few kinds of atoms.

D. Complete the chart to tell about carbon compounds.

<table>
<thead>
<tr>
<th>Carbon Compound</th>
<th>Purpose</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbohydrates</td>
<td>provide the body with energy</td>
<td>plant tissue, bread, pasta,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and cereal</td>
</tr>
<tr>
<td>proteins</td>
<td>help build muscle and other</td>
<td>meat, fish, soybeans, eggs,</td>
</tr>
<tr>
<td></td>
<td>body tissues</td>
<td>and dairy products</td>
</tr>
<tr>
<td>lipids</td>
<td>help the body store energy</td>
<td>butter, oils, cheese, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nuts</td>
</tr>
<tr>
<td>nucleic acids</td>
<td>help living things grow and</td>
<td>DNA</td>
</tr>
<tr>
<td></td>
<td>develop</td>
<td></td>
</tr>
</tbody>
</table>
Where Are Elements Found?

Complete the diagram to tell about molecules.

Vocabulary Skill: Synonyms

Synonyms are words that have similar meanings. For example, *component* and *ingredient* are synonyms for *element*. Think of a synonym for *compound* and use it in a sentence. If you substitute *compound* for the synonym, does it change the meaning of the sentence?

**Sample response:** Water is a *combination* of hydrogen and *oxygen*. Using the word *compound* doesn’t really change the meaning of the sentence, but it does make the sentence sound more scientific.
Where Are Elements Found?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrocarbon</td>
<td>any compound made of hydrogen and carbon</td>
</tr>
<tr>
<td>oxygen</td>
<td>a colorless, odorless gas that forms about one fifth of the air and about one third of water</td>
</tr>
<tr>
<td>plastic</td>
<td>a hydrocarbon</td>
</tr>
<tr>
<td>polymer</td>
<td>long chains of linked molecules</td>
</tr>
<tr>
<td>rare</td>
<td>seldom seen or found</td>
</tr>
<tr>
<td>sucrose</td>
<td>table sugar</td>
</tr>
</tbody>
</table>

Use the terms from the box to complete the puzzle about elements.

Across

1. DNA is an example of this  
2. 46% of Earth’s crust  
3. describes most of the elements  
4. a substance with a sweet taste

Down

1. an example of a hydrocarbon  
5. made of two elements: carbon and hydrogen

Homework: Using the analogy of letters and words you read about on page 311 in your textbook, write a paragraph explaining how many molecules can be made from only a few kinds of atoms.
What Are Compounds?

Main Idea Two or more elements can combine to form a compound. Compounds have different properties from the elements that make them up.

- The properties of a compound are different from the elements that make them up.
- Compounds are described using chemical formulas.
- Water is a unique compound that is found everywhere on Earth.

A. Complete the diagram to tell about compounds. Then answer the question that follows.

What is an important factor in all chemical reactions? Explain.

Sample response: Energy is an important factor in all chemical reactions. Either energy is required to break apart compounds into elements, or it is released when elements combine to form compounds.
What Are Compounds?

B. Complete the sentences to tell about chemical formulas.

1. $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ is the formula for sucrose. It indicates that every molecule of that compound has 12 atoms of carbon, 22 atoms of hydrogen, and 11 of oxygen.

2. $\text{CaCO}_3$ is the formula for calcium carbonate. It indicates that every molecule of that compound has one atom of calcium, one atom of carbon, and three atoms of oxygen.

3. $\text{Fe}_2\text{O}_3$ is the formula for iron oxide. It indicates that each molecule of that compound has 2 atoms of iron and 3 atoms of oxygen.

C. Complete the chart to tell about common compounds.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide</td>
<td>carbonated drinks</td>
</tr>
<tr>
<td>silicon dioxide</td>
<td>glass, sand</td>
</tr>
<tr>
<td>polymers</td>
<td>fats, proteins, carbohydrates, and plastics</td>
</tr>
</tbody>
</table>

D. Place a check by each statement that is true about water.

- ✓ Three-fourths of Earth’s surface is water.
- ✓ Three-fourths of the human body is water.
- ✓ While water is liquid at room temperature, most compounds are not.
- ✓ Water dissolves more substances than any other liquid.
- ✓ Water molecules look like a chain of atoms.
- ✓ Water molecules attract each other.
What Are Compounds?

chemical formula  chemical reaction

Use the descriptions below to complete each diagram.

a chemical change
a shorthand way to describe a compound
a process in which one or more substances are changed into one or more different substances
uses chemical symbols and numbers to show the makeup of a compound
a process that requires energy
used by scientists to identify chemical compounds

Homework: Observe a meal being prepared. Write a short paragraph describing one or more chemical reactions that you see taking place.
What Are Compounds?

Glossary

- chemical property: how a substance reacts with other substances
- dissolve: to change from a solid or gas to a liquid
- elements: things that are made up of only one kind of element
- molecular compound: a compound made of molecules
- stable compound: a compound that does not chemically change very quickly or easily

Use words from the word box to complete the following sentences.

1. Water is a **molecular compound**.
2. Water is made up of two **elements**: hydrogen and oxygen.
3. Water has a unique **chemical property**: it is a liquid at room temperature.
4. Water is not considered a **stable compound**, because it can be chemically changed very quickly.
5. Water has the ability to **dissolve** many compounds.

Vocabulary Skill: Multiple-Meaning Words

The word *current* has more than one meaning. What is the meaning of *current* in this sentence?

Scientists proved that water was a compound when they broke it into other substances by passing an electric current through it.

**Sample response:** *Current* means the flow of electricity through a wire or other conductor.
What Are Some Properties of Compounds?

Main Idea Physical and chemical properties are characteristics used to describe, identify, and classify matter.

- A physical property can be observed without changing the matter. A chemical property is how a substance reacts with other substances.
- Solubility is the measure of how much of one substance can dissolve in another.
- The conductivity of a material is its ability to carry energy.

A. Classify each property in the box as either a physical property or a chemical property using the chart below.

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Chemical Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>boiling point</td>
<td>reactivity</td>
</tr>
<tr>
<td>color</td>
<td></td>
</tr>
<tr>
<td>conductivity</td>
<td>size</td>
</tr>
<tr>
<td>density</td>
<td>solubility</td>
</tr>
<tr>
<td>flexibility</td>
<td>state</td>
</tr>
<tr>
<td>melting point</td>
<td></td>
</tr>
<tr>
<td>odor</td>
<td></td>
</tr>
</tbody>
</table>

Study Guide
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What Are Some Properties of Compounds?

B. Complete the outline to describe physical properties.

I. Mass, volume, and density are physical properties.

A. Mass

1. Mass is a measure of **the amount of matter in an object or a material**.
2. Mass can be measured in **grams or kilograms**.

B. Volume

1. Volume is **the amount of space matter takes up**.
2. Volume can be measured in **cubic centimeters**.
3. Liquid volumes are measured in **liters or milliliters**.

C. Density

1. Density of a material is **its mass per unit volume**.

II. Another physical property is state of matter: solid, liquid, or gas.

A. The melting point is **the temperature at which a solid substance changes to a liquid**.
B. The boiling point is **the temperature at which a liquid changes to a gas**.

III. Solubility and conductivity are also physical properties.

A. Solubility

1. Solubility is the measure of **how much of one substance can dissolve in another**.

B. Conductivity

1. The conductivity of a material is **its ability to carry energy**.
2. Two types of conductivity are **electrical** and **thermal**.
What Are Some Properties of Compounds?

boiling point  conductivity  melting point  solubility
chemical property  density  physical property

Circle the term in parentheses that correctly completes each statement about the properties of matter.

1. The (boiling point, melting point) of a substance is the temperature at which it changes from a liquid to a gas.

2. The measure of how much of one substance can dissolve in another substance is called (density, solubility).

3. A characteristic that can be measured or detected by the senses is called a (chemical property, physical property).

4. The (density, conductivity) of a material is its ability to carry energy.

5. The temperature at which a solid substance changes to a liquid is called its (melting point, solubility).

6. A (chemical property, physical property) is the ability or tendency of a material to change its chemical makeup.

7. The (density, solubility) of a material is its mass per unit volume, or ratio of mass to volume.

Vocabulary Skill:
Word Parts

The suffix -ability means “able to” and the root solu- is derived from the Latin word solvere, meaning “loosen.” Explain how the word solubility is related to the meanings of its parts.

Sample response: How easily a substance is able to “loosen” is related to how easily it can be dissolved in another substance.
What Are Some Properties of Compounds?

Glossary

- **mass**: a measure of the amount of matter in an object
- **rigid**: have a definite shape and volume
- **state**: the physical condition of a material
- **thermal**: of or about heat
- **volume**: the amount of space a sample of matter takes up

Write each word from the box next to the clue it matches.

- **mass**: measured in grams or kilograms
- **state**: solid
- **volume**: measured in cubic centimeters for solids
- **rigid**: not changing
- **state**: gas
- **thermal**: warmed

**Homework**: Look around your home. Make a list of the ways plastic and rubber are used as electrical and thermal insulators. You may want to do some research on insulators in order to lengthen your list.
What Are Acids, Bases, and Salts?

Main Idea  Acids, bases, and salts are classes of compounds, each with characteristic properties. The strengths of acids and bases are measured with the pH scale.

- Acids release hydrogen ions and react easily with bases.
- Bases accept hydrogen ions and react easily with acids.
- Salts are formed when a strong acid reacts with a strong base.

A. Use the items below to complete the diagram to compare and contrast acids and bases.

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
</tr>
</thead>
<tbody>
<tr>
<td>accept hydrogen ions</td>
<td>react easily with acids</td>
</tr>
<tr>
<td>bleach</td>
<td>release hydrogen ions</td>
</tr>
<tr>
<td>react to litmus paper</td>
<td>turn blue litmus paper red</td>
</tr>
<tr>
<td>react easily with other substances</td>
<td>turn red litmus paper blue</td>
</tr>
<tr>
<td>react easily with bases</td>
<td>vinegar</td>
</tr>
</tbody>
</table>

D.9.3 Main Idea

- react easily with bases
- release hydrogen ions
- turn blue litmus paper red
- turn red litmus paper blue
- accept hydrogen ions
- bleach
- react easily with acids
- react easily with other substances
- react to litmus paper
- vinegar
What Are Acids, Bases, and Salts?

B. Rewrite each statement about acids and bases to make it true.

1. An acid typically receives hydrogen ions and a base typically releases hydrogen ions.

   **An acid typically releases hydrogen ions and a base** typically receives hydrogen ions.

2. Acids and bases can be identified by mixing them with water.

   **Acids and bases can be identified by using an acid-base indicator.**

3. Water is an example of an acid.

   **Water is an example of a neutral substance.**

4. A value called pH stands for parts of helium.

   **A value called pH stands for potential of hydrogen.**

5. Acids and bases have pH values of zero.

   **Acids have pH values less than 7. Bases have pH values greater than 7.**

C. Put a check next to each true statement about salts.

- ✔ typically made from a metal and a nonmetal
- ✔ have high melting points
- ✔ most dissolve slowly in water
- ✔ found in abundance in the ocean
- ✔ raise the melting point of water
- ✔ needed by the human body
## What Are Acids, Bases, and Salts?

<table>
<thead>
<tr>
<th>acid</th>
<th>base</th>
<th>indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>salt</td>
<td></td>
</tr>
</tbody>
</table>

Write each characteristic below in the appropriate column in the chart. Then answer the question that follows.

<table>
<thead>
<tr>
<th>detergents</th>
<th>fruit juices</th>
<th>pH values greater than 7</th>
<th>pH values less than 7</th>
<th>sodium chloride</th>
<th>used to digest food</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
<th>Salts</th>
</tr>
</thead>
<tbody>
<tr>
<td>fruit juices</td>
<td>detergents</td>
<td>potassium</td>
</tr>
<tr>
<td>pH values less than 7</td>
<td>pH values greater than 7</td>
<td>sodium chloride</td>
</tr>
<tr>
<td>used to digest food</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the purpose of an indicator?

**Sample response:** An indicator is used to identify acids and bases. It is a substance or material that changes color in the presence of an acid or a base.

### Vocabulary Skill: Word Derivations

What is the origin of the word *acid*? Use a dictionary to help you.

**Sample response:** *Acid* comes from the Latin word *acere*, meaning “to be sour.”
What Are Acids, Bases, and Salts?

Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>litmus paper</td>
<td>paper treated with litmus, a dye that changes color in the presence of acids or bases</td>
</tr>
<tr>
<td>neutral</td>
<td>neither one thing or the other</td>
</tr>
<tr>
<td>reaction</td>
<td>action in response to some influence or force</td>
</tr>
<tr>
<td>substance</td>
<td>a material of a particular kind or composition</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the diagram.

Litmus paper is used to determine whether a substance is an acid or a base.

It is called an acid-base indicator because its reaction indicates whether a substance is an acid or a base.

- Acids turn blue litmus paper red.
- Bases turn red litmus paper blue.
- Litmus paper will not change color in water because water is a neutral substance.

Homework: Draw a pH scale. Color the portion of the scale that would include acids red and label it. Color the portion of the scale that would include bases blue and label it. Indicate where on the scale the substance water would fit. Estimate the placement of specific acids and bases on the scale based on the descriptions of “weak” and “strong” found in this chapter.
What Are the Three States of Matter?

**Main Idea** Matter can exist in three familiar states: solids, liquids, and gases. These states are determined by the motion and arrangement of particles.

- The properties of a substance’s particles determine its state.
- Solids have a definite shape and volume and their particles are arranged very close together.
- Liquids have a definite volume, but no definite shape. Their particles are close together and can move about.
- Gases do not have a definite shape or volume. Their particles are spread far apart and are constantly moving.

**A. Use the descriptions from the box to complete the chart to tell about the states of matter.**

<table>
<thead>
<tr>
<th>Particle Arrangement</th>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>vibrate, but don’t move about</td>
<td>close together, but have space</td>
<td>can slip past one another</td>
<td>constantly bouncing off one another</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Particle Movement</th>
<th>Solid</th>
<th>Liquid</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>closely packed</td>
<td>specifically packed</td>
<td>close together, but have space</td>
<td>spread very far apart</td>
</tr>
<tr>
<td>can slip past each other</td>
<td>can slip past each other</td>
<td>can slip past one another</td>
<td>constantly bouncing off one another</td>
</tr>
<tr>
<td>closely packed</td>
<td>closely packed</td>
<td>close together, but have space</td>
<td>spread very far apart</td>
</tr>
<tr>
<td>vibrate, but don’t move about</td>
<td>vibrate, but don’t move about</td>
<td>can slip past one another</td>
<td>constantly bouncing off one another</td>
</tr>
</tbody>
</table>
What Are the Three States of Matter?

B. Write the name of the state of matter that matches the description.

_____ solid _____ matter that has a definite volume and a definite shape

_____ liquid _____ matter that has a definite volume, but no definite shape

_____ gas _____ matter that does not have a definite shape or volume

C. Arrange the three states of matter—solid, liquid, and gas—from least compressible to most compressible.

Least Compressible

Most Compressible

solid ____________ gas ____________

liquid ____________

D. Write the terms helium, oil, and wood in the diagram. Then complete the sentence that follows to explain your reasoning.

Least Compressible

Most Compressible

wood ____________ helium ____________

oil ____________

The most compressible state of matter is gas because its particles can move freely about.
What Are the Three States of Matter?

Place a check in the appropriate column to tell about the properties of each state of matter.

<table>
<thead>
<tr>
<th>Matter</th>
<th>Definite Shape</th>
<th>No Definite Shape</th>
<th>Definite Volume</th>
<th>No Definite Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>✔️</td>
<td></td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td>✔️</td>
<td></td>
<td>✔️</td>
</tr>
</tbody>
</table>

Vocabulary Skill: Word Origins

Gas is a coined, or invented, word. Use a dictionary to identify the origin of this word.

Sample response: About 400 years ago, a scientist needed a word to describe water vapor. Because he knew that water vapor was so changeable, he thought of the word chaos, which means “complete confusion or complete disorder.” He used the sound of the word chaos to coin or invent a new word, gas.
What Are the Three States of Matter?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>attraction</td>
<td>act or power of gathering</td>
</tr>
<tr>
<td>fluid</td>
<td>any substance whose particles can flow freely</td>
</tr>
<tr>
<td>state</td>
<td>physical form</td>
</tr>
<tr>
<td>tension</td>
<td>a stretched condition</td>
</tr>
</tbody>
</table>

Use the words from the box to complete the sentences about the states of matter.

1. A solid is one ________ state ________ of matter.

2. Water is a ________ fluid ________, and flows easily at room temperature.

3. Surface ________ tension ________, a force of attraction among the particles at the surface of a liquid, is a property of liquids.

4. In a solid, the small forces of ________ attraction ________ between particles keeps them from moving from place to place.

Homework: Complete a chart like the one shown with examples of each of the states of matter.

<table>
<thead>
<tr>
<th>States of Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
What Are Mixtures and Solutions?

Main Idea In a mixture, the parts keep their physical properties. These properties can be used to separate the mixture. Mixtures that are evenly mixed at the atomic or molecular level are called solutions.

- Mixtures are physical combinations of two or more substances in which the substances are not chemically combined.
- Solutions are mixtures in which the particles are evenly mixed at the atomic or molecular level.
- Solutions can be separated by making use of the different properties of the mixed materials.
- Alloys are solutions of two or more metals or of a metal and another solid.

A. Fill in the blanks to complete the description of a mixture.

- A physical combination of __**two or more substances**__
- The substances are not __**chemically combined**__
- Each substance keeps its __**original properties**__
- It cannot be represented by a __**chemical formula**__
What Are Mixtures and Solutions?

B. Rewrite each statement about mixtures to make it true.

1. In a heterogeneous mixture, two or more substances are evenly mixed.
   
   In a homogeneous mixture, two or more substances are evenly mixed.

2. In a homogeneous mixture, two or more substances are distributed unevenly.
   
   In a heterogeneous mixture, two or more substances are distributed unevenly.

3. In a solution, particles do not mix at the atomic or molecular level.
   
   In a solution, particles mix at the atomic or molecular level.

4. The methods of separating a solution include filtering and condensation.
   
   The methods of separating a solution include evaporation, and boiling.

C. Complete the chart to tell about alloys and their uses.

<table>
<thead>
<tr>
<th>Alloy</th>
<th>A Mixture of</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>bronze</td>
<td>copper, tin</td>
<td>tools, weapons, sculptures</td>
</tr>
<tr>
<td>steel</td>
<td>iron, carbon, and other solids</td>
<td>nails, chains, tools, support beams</td>
</tr>
<tr>
<td>brass</td>
<td>copper, zinc</td>
<td>musical instruments</td>
</tr>
<tr>
<td>sterling silver</td>
<td>silver, copper</td>
<td>jewelry</td>
</tr>
</tbody>
</table>
What Are Mixtures and Solutions?

mixture solution

A. Use the words from the box to complete each sentence to tell about mixtures and solutions.

1. A _____ solution _____ is a homogeneous mixture of two or more substances that are evenly distributed.

2. A _____ mixture _____ is a physical combination of two or more substances.

B. Classify each of the following items as a mixture or a solution.

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>air</td>
<td>air</td>
</tr>
<tr>
<td>salad</td>
<td>pink lemonade</td>
</tr>
<tr>
<td>soda water</td>
<td>sand and pebbles</td>
</tr>
<tr>
<td>birdseed</td>
<td>salt water</td>
</tr>
<tr>
<td>vegetable soup</td>
<td>soda water</td>
</tr>
</tbody>
</table>

Vocabulary Skill: Root Words

Genus is a Latin word meaning “type” or “kind.” The prefix hetero- means “different” and the prefix homo- means “the same.” Using this information, write a definition for each word.

Sample response: Heterogeneous means “made up of different kinds of things”, while homogeneous means “made up of the same things.”
What Are Mixtures and Solutions?

Glossary

<table>
<thead>
<tr>
<th>solute</th>
<th>a substance being dissolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>solvent</td>
<td>a substance that dissolves the solute</td>
</tr>
</tbody>
</table>

Identify the solution, the solute, and the solvent to complete the following descriptions.

1. Sugar cane juice is made up of water and sugar.
   
   A. The solution is _______ sugar cane juice _______.
   
   B. The solvent is _______ water _______.
   
   C. The solute is _______ sugar _______.

2. Salt water is made up of salt and water.
   
   A. Salt water is the _______ solution _______.
   
   B. Water is the _______ solvent _______.
   
   C. Salt is the _______ solute _______.

3. Acid rain is made up of water and acids or other chemicals.
   
   A. The solution is _______ acid rain _______.
   
   B. The solvent is _______ water _______.
   
   C. The solute is _______ acids or other chemicals _______.

Homework: Write a paragraph describing how you can separate a solution of salt water.
How Does Matter Change?

Main Idea A chemical change involves a change in the identity of matter, whereas a physical change does not.

- Most solids will expand when heated and contract when cooled.
- A solid changes to a liquid when heated to its melting point, and a liquid changes to a solid when cooled to its freezing point.
- Vaporization, condensation, sublimation, and deposition are all physical changes.

A. Complete each sentence to tell about changes in matter.

1. A change of size, shape, or state of matter is a(n) ____ physical change ____.

2. The increase in the size of a substance due to a change in temperature is called ____ thermal expansion ____.

3. When a solid undergoes ____ thermal contraction ____, it takes up less space due to cooling.

4. Although heating or cooling may change the volume of matter, the ____ mass ____ will stay the same.

5. Vaporization is the change of state from a ____ liquid ____ to a ____ gas ____.

6. Slow or gradual vaporization is called ____ evaporation ____.

7. ____ Condensation ____ is a change of state from a gas to a liquid.

8. The process of changing directly from a solid to a gas is called ____ sublimation ____.

9. The opposite of sublimation is ____ deposition ____.
How Does Matter Change?

B. Rewrite each statement about physical changes to make it true.

1. A solid begins to change to a liquid at its freezing point.

   **A solid begins to change to a liquid at its melting point.**

2. When energy is removed from a liquid, the liquid will begin to melt.

   **When energy is removed from a liquid, the liquid will begin to freeze.**

3. The melting point and freezing point for any substance is 0°C.

   **The melting point and freezing point for any substance are the same temperature.**

C. Use the diagram below to answer the following questions about the changes in matter.

   ![Energy and States of Matter Diagram]

1. What happens when energy is removed from a liquid?

   **A solid forms when energy is removed from a liquid.**

2. What happens in vaporization?

   **Gas forms when energy is added to a liquid.**

3. What happens in sublimation?

   **Gas forms when energy is added to a solid.**

4. What happens in deposition?

   **A solid forms when energy is removed from a gas.**
How Does Matter Change?

condensation  evaporation
sublimation  vaporization

A. Use the words from the box to complete each sentence about physical changes to matter.

1. _____Vaporization_____ is the change of state from a liquid to a gas.
2. _____Condensation_____ is the change of state from a gas to a liquid.
3. Slow or gradual vaporization is called _____evaporation_____.
4. The process of changing from a solid to a gas is called _____sublimation_____.

B. Write each word from the box next to the statement that describes it.

_____condensation_____ water droplets forming on the outside of a glass of ice water
_____vaporization_____ water being heated in a tea kettle
_____sublimation_____ a solid changes directly into a gas
_____evaporation_____ there is less water in a fish tank after a week

Vocabulary Skill: Antonyms

Antonyms are words with opposite meanings. Find a pair of antonyms in the lesson.

Sample responses: expansion/contraction, deposition/sublimation, vaporization/condensation
How Does Matter Change?

Glossary

contraction  the act or process of making smaller
expansion  the act or process of making larger
thermal  of or relating to heat
vibrate  to move back and forth rapidly

Use the words from the box to complete the diagram to tell about physical changes. Then answer the question that follows.

Why do engineers add expansion joints to bridges in order to make them safer?

Sample response: Thermal expansion and contraction can put a strain on bridges. Scientists use expansion joints, space between the metal parts, that allows the bridge to change length.

Homework: Write a short paragraph explaining why ice floats. Try to use as many words from the box in your answer as you can.
What Happens in a Chemical Reaction?

Main Idea A chemical change involves making and breaking chemical bonds to form new substances. Chemical changes can either absorb or release energy.

• A chemical change results in one or more new substances.
• Matter is neither created nor destroyed in chemical and physical changes.
• Energy is always involved in a chemical reaction.

A. Circle the items that are examples of chemical changes.

bananas ripening
dry ice sublimating into carbon dioxide gas
burning natural gas on a stove
frost forming on grass
lichens growing on rocks
liquid water freezing into ice
burning wood in a campfire
rust forming on a bicycle chain

B. Put a check next to the items that are signs of a chemical change.

✔ change in color
✔ the release of heat
_____ decrease of matter
✔ growth of living organism
_____ increase of matter
✔ release of light
What Happens in a Chemical Reaction?

C. Rewrite each statement about chemical reactions to make it true.

1. A chemical change is a change in matter that results in a change in color.
   A chemical change is a change in matter that results in new substances being formed.

2. In any sample of matter, forces called reactants hold the atoms or molecules together.
   In any sample of matter, forces called chemical bonds hold the atoms or molecules together.

3. Scientists use ratios to describe the reactants and products of a chemical reaction.
   Scientists use chemical equations to describe the reactants and products of a chemical reaction.

D. Circle the choice that best completes each sentence about the conservation of matter.

1. In a physical change, the amount of matter (increases, stays the same, decreases).

2. In a chemical change, the amount of matter (increases, stays the same, decreases).

3. Regardless of the kind of change, matter is (created, conserved, destroyed).

4. The mass of materials before a chemical change is (less than, equal to, more than) the mass afterwards.

5. In a chemical reaction, the total mass of the reactants is (less than, equal to, greater than) the total mass of the products.
What Happens in a Chemical Reaction?

A. Use the words from the box to complete each sentence to tell about products and reactants.

1. When a substance enters into and is altered through the course of a chemical change, it is called a __**reactant**__.

2. A substance that results from a chemical change is called a __**product**__.

B. Label the reactants and products in the following chemical equations.

   iron + oxygen  →  rust

   __**reactants**__  __**product**__

   2H₂O  →  2H₂ + O₂

   __**reactant**__  __**products**__

C. Using chemical formulas, write a chemical equation for the following chemical reaction. Six molecules of water and six molecules of carbon dioxide are the reactants. One molecule of sugar and six molecules of oxygen are the products.

   6H₂O + 6CO₂  →  C₆H₁₂O₆ + 6O₂

Homework: Choose one of the locations listed below. Then write a paragraph describing at least three chemical reactions that could occur at that location.

- a kitchen
- a campsite
- a science laboratory
What Happens in a Chemical Reaction?

Glossary

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>breaking</td>
<td>coming apart</td>
</tr>
<tr>
<td>created</td>
<td>brought into being; made</td>
</tr>
<tr>
<td>decays</td>
<td>rots</td>
</tr>
<tr>
<td>destroyed</td>
<td>done away with</td>
</tr>
<tr>
<td>forming</td>
<td>taking shape</td>
</tr>
<tr>
<td>ripens</td>
<td>matures; develops</td>
</tr>
</tbody>
</table>

Use the words in the box to complete the sentences about chemical changes.

1. In any sample of matter, forces called chemical bonds hold the atoms or molecules together. Chemical changes involve _____breaking_____ existing bonds and _____forming_____ new ones.

2. Fruit changes chemically when it either _____ripened_____ or _____decays_____. You can use a scale to prove mass is conserved when matter changes.

3. When matter changes, mass is neither _____created_____ nor _____destroyed_____.

Vocabulary Skill: Antonyms

Antonyms are words with opposite meanings. Write the three pairs of antonyms from the box above.

- created/destroyed
- ripens/decays
- breaking/forming