Instructions for Copying

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**LIFE SCIENCE**

### Chapter 1 Ecology

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Complete the concept map on Earth’s land and water, using terms and phrases from your textbook.

- **Earth**
  - **Land Biomes**
    - **Tropical rain forests:** biomes found near the equator
    - **Deserts:**
    - **Grasslands:** biomes where grasses are the main plant life
    - **Taigas:**
    - **Tundras:**
    - **Deciduous forests:** biomes where leaves fall off many of the trees when winter comes
  - **Water Ecosystems**
    - **Fresh water**
      - **Ponds and lakes:** still water that contains little salt
      - **Streams and rivers:** moving water that contains little salt
    - **Salt water**
      - **Intertidal zone:**
      - **Neritic zone:**
      - **Bathyal zone:**
      - **Abyssal zone:** deepest part of the oceanic zone
      - **Estuaries:**
Living Things and Their Environments

Use your textbook to help you fill in the blanks.

What is an ecosystem?

1. In an ecosystem, living things work together in systems and depend on the same ____________________

2. Any living thing that is part of an ecosystem is a(n) ____________________

3. The nonliving parts of the ecosystem that help make life possible are ____________________

Why are sunlight and temperature important?

4. The amount of sunlight a location receives directly ____________________ the temperature in that location.

5. The ____________________ in an area affects the number and types of animals that can survive in a location.

6. The parts of Earth that receive the least direct sunlight are the North and South ____________________.

7. Seasonal variations in temperature cause some animals to ____________________.

Why is water important?

8. Water is the body’s main ____________________ vehicle, carrying nutrients and oxygen to various parts of the body.

9. Water helps regulate body temperature, cooling skin and carrying excess ____________________ away from your cells.

10. When a plant does not receive enough water, the leaves and stems become weak, and the plant ____________________.
Why is soil important?

11. Soil supplies plants with the water, ________________, and air that they need to grow.

12. As plant and animal remains break down, they form ________________, which adds nutrients to the soil.

13. The ________________ scale measures the acidity or alkalinity of soil.

What lives in an ecosystem?

14. The ________________ factors in an area influence what living things are found there.

15. Members of a(n) ________________ breed with one another, produce offspring, and compete for resources.

16. All the organisms of the same kind make up a population; two or more of these make up a(n) ________________.

How do organisms compete and survive in an ecosystem?

17. Organisms ________________ with one another for limited resources.

18. The role that a species plays in its community is its ________________.

19. Competition among species is reduced when different species obtain their ________________ in unique ways.

Critical Thinking

20. What part does a fox play in an ecosystem?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Vocabulary

Living Things and Their Environments

<table>
<thead>
<tr>
<th>acidity</th>
<th>ecosystem</th>
<th>minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>alkalinity</td>
<td>habitat</td>
<td>niche</td>
</tr>
<tr>
<td>ecology</td>
<td>humus</td>
<td>topsoil</td>
</tr>
</tbody>
</table>

Use the clues to fill in the crossword puzzle.

**ACROSS**
1. the material in soil formed by the breakdown of plant and animal remains
3. the place in which a population lives
8. the amount of base in a substance
9. the living and nonliving things in an area that interact with one another

**DOWN**
2. naturally occurring solid materials of Earth’s crust
4. the amount of acid in a substance
5. the upper layer of soil, which is made mostly of humus, minerals, water, and air
6. the study of organisms and how they interact in an ecosystem
7. the role of an organism in an ecosystem
A system is a group of things that form a unified whole. Living and nonliving things in an area interact with one another in a(n) _________________. The _________________ in this area form a(n) _________________. Several _________________ influence the number and kinds of living things that can survive in a(n) _________________. For example, in places with little rainfall, _________________ is sparse. If _________________ has occurred, there may not be enough fertile soil to support healthy plant growth. The kinds of plants that do grow are determined by the amount of _________________ or _________________ in the soil. Another factor is the _________________ of the region. As you can see, nonliving elements directly affect _________________. These factors influence the number and types of organisms in an ecosystem.
Meet Joel Cracraft

Read the Reading in Science feature in your textbook. Look for facts and opinions.

**Fact and Opinion**

Use the fact and opinion chart below to list two opinions and two related facts discussed in the article.

<table>
<thead>
<tr>
<th>Opinions</th>
<th>Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
</tbody>
</table>
Write About It
Fact and Opinion
1. What opinion does the writer express in this statement: “In its forests live some of the most spectacular and colorful birds in the world”?
2. “There are more than 90 kinds of birds of paradise on New Guinea.” Is this statement a fact or an opinion?

Planning and Organizing
1. What are the two adjectives the writer uses to describe the birds in the second sentence of the article?

2. What does the writer tell us about the birds in the second sentence of the second paragraph of the article?

Drafting
Now evaluate the two sentences you looked at in the questions above. Based only on the information in the sentence referenced in question 1, how does the author seem to feel about the birds?

Based only on the information in the sentence referenced in question 2, how does the writer feel about the birds?
Populations

Use your textbook to help you fill in the blanks.

How do populations survive?

1. A(n) ____________________________ is a(n) ____________________________ that limits how large a population can grow.

2. If populations grow too large, ____________________________ for resources causes some individuals to die.

How do limiting factors affect populations?

3. Abiotic factors affect how much ____________________________ an ecosystem can produce for the populations that live there.

4. Organisms such as cactuses survive by ____________________________ to conserve water in dry climates.

5. Animals need shelter to protect themselves from ____________________________ .

6. Populations must have enough ____________________________ to live and grow in order to meet their needs.

What are carrying capacity and biotic potential?

7. The largest number of individuals of one species that an ecosystem can support over time is its ____________________________ .

8. The highest rate of reproduction under ideal conditions is a population's ____________________________ .

9. A pattern that shows how larger populations grow more quickly is called ____________________________ .
How do populations interact?

10. A relationship between two kinds of organisms that lasts over time is called __________________ .

11. A symbiotic relationship in which one organism benefits at the expense of the other organism is __________________ .

12. In a relationship known as __________________ , one organism benefits from another organism without harming it.

13. In __________________ , both of the organisms involved benefit from their relationship.

How do population changes affect ecosystems?

14. Populations may decline because of __________________ and __________________ factors.

15. A change in the population of one __________________ can affect an entire ecosystem.

Critical Thinking

16. What effects could a rapidly growing population have on an ecosystem?

________________________

________________________

________________________

________________________

________________________

________________________
Populations

Use the clues to unscramble each word. Then unscramble the circled letters to answer the last question.

<table>
<thead>
<tr>
<th>limiting factor</th>
<th>carrying capacity</th>
<th>biotic potential</th>
<th>exponential growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>commensalism</td>
<td>parasitism</td>
<td>mutualism</td>
<td></td>
</tr>
</tbody>
</table>

1. COTIPOILABTENIT the highest rate of reproduction under ideal conditions
   
   __ __ __ __ [ ] __ __ __ __ __ __ __

2. AMUTUMLIS a relationship that benefits both participants
   
   __ __ __ __ __ __ [ ] __

3. MRIFILINTTACOG an environmental factor that limits how large a population can grow
   
   __ __ [ ] __ __ __ __ __ __ __ __

4. TPELONWIAGHTNEORX a pattern in which the larger a population gets, the faster it grows
   
   __ __ __ [ ] __ __ __ __ __ __ __

5. SCMOSMELINMA a relationship in which one organism benefits without harming the other
   
   __ __ __ __ __ __ [ ] [ ]

6. RGACPCYCNIYAITAR the largest number of individuals of one species that an ecosystem can support over time
   
   __ __ __ __ __ __ __ __ __ [ ] __

7. What do you call a relationship in which one species benefits at the expense of the other?
   
   __ __ __ __ __ __ __ __
Populations

Fill in the blanks.

carrying capacity  exponential growth  parasitism
competition  limiting factors  species
ecosystems  mutualism  symbiosis

In nature, populations expand until ________________ stop their growth. These factors can change over time, and different factors limit different ________________. Some factors are food, water, shelter, and space. If a population grows too large, some individuals may die because of ________________ for limited resources.

The largest number of individuals of a population that an ecosystem can support over time is called the ________________. If the carrying capacity is not reached, a population may experience ________________. This means that as a population grows larger, it also grows faster.

Some living organisms have relationships with other organisms over time called ________________. Some relationships benefit one organism but hurt the other; this is called ________________. When both organisms benefit, the relationship is called ________________.

A change in the population of just one species can affect an entire ________________. Changes may be caused by human or environmental factors.
Land Biomes

Use your textbook to help you fill in the blanks.

What are biomes?

1. A region that contains certain types of living things and has a particular climate is called a(n) __________________________.
2. A region’s climate is based partly on the amount of ______________ that the region receives.

What are tropical rain forests?

3. The climate of tropical rain forests is __________________________ and humid with a lot of rainfall.
4. The top level of vegetation in a tropical rain forest is called the ______________ layer.
5. Because the __________________________ shades the rain forest with a thick blanket of foliage, little sunlight reaches the lower two levels.
6. Tree trunks, shrubs, vines, and small plants make up the ______________.

What are deserts?

7. The four major desert types are determined by their temperature ranges and the amount of ______________ they receive.
8. Hot and dry deserts have extreme differences between their nighttime and daytime ______________ in the summer.
9. Cool winters and warm summers characterize ______________ deserts.
10. The Atacama Desert in Chile is Earth’s ___________________ desert.

What are grasslands and savannas?

11. Grasslands are often used for ___________________, since they have some of the world’s most fertile soils.

12. Savannas receive ___________________ rainfall than other grasslands, but natural fires occur during the dry season.

What are temperate deciduous forests?

13. In deciduous forests the leaves fall off many of the trees when ___________________ comes.

14. Deciduous forests are found in eastern North America, northeastern Asia, and western and central ___________________.

What are taigas and tundras?

15. A taiga is a cool ___________________ of cone-bearing evergreen trees.

16. A tundra is a very cold, dry biome that includes a frozen-soil layer called ___________________.

What lives in Earth’s coldest places?

17. There is no land near the North Pole, while snow and ice near the South Pole cover the continent of ___________________.

18. Earth’s largest land carnivore, the ___________________, can be found close to the North Pole.

19. What adaptations would an animal require to survive in a tundra?

__________________________________________________________
Land Biomes

Match the correct letter with the description.

1. _____ the average weather pattern of a region
2. _____ grassland that stays warm year-round with very wet summers and long, dry winters
3. _____ a very cold, dry biome that includes a layer of permanently frozen soil
4. _____ tending to fall off during a particular season
5. _____ biome located near the equator, where the Sun’s rays strike Earth’s surface most directly
6. _____ a cool forest of cone-bearing evergreen trees
7. _____ a region with a particular climate that contains certain types of plants and animals
8. _____ biomes in which grasses are the main plant life
Land Biomes

<table>
<thead>
<tr>
<th>conserve</th>
<th>grasslands</th>
<th>precipitation</th>
</tr>
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<tbody>
<tr>
<td>equator</td>
<td>permafrost</td>
<td>resting</td>
</tr>
<tr>
<td>evergreen</td>
<td>Pole</td>
<td>taiga</td>
</tr>
</tbody>
</table>

**Fill in the blanks.**

A biome is a region that has a particular climate. The climate in each biome is mainly determined by temperature and ________________.

For example, the rain forests located near the ________________ are hot and humid with a lot of rainfall. In contrast, the tundra near the North ________________ is cold and dry. Some plants and animals have adapted to the harsh conditions, but ________________ prevents trees and large plants from rooting.

The ________________ also has very cold winters, but it supports large forests of ________________ trees. One way animals adapt to desert conditions is by ________________ during the hot days and becoming active when the temperatures fall at night.

Desert plants are able to ________________ water. Rainfall is irregular and usually not plentiful in ________________, but like the deciduous forests, the soil is very rich and fertile, and the vegetation supports a variety of animals. All the organisms in a biome are adapted to live in the region’s weather conditions.
A Trip to a “New” Rain Forest

Read the Writing in Science feature in your textbook.

**Write About It**

**Personal Narrative** Write a personal narrative about a trip you made to a distinct environment, or ecosystem. It can be a desert, a tropical rain forest, or an ice-covered land. It can be the beach or the marshlands outside of town. Use the first-person point of view (I) to tell what you observed and what you did there.

**Getting Ideas**

Brainstorm a list of places about which to write. Then choose one. Fill in the sequence chart below. Write the things you did there in time order.

- **First**
- **Next**
- **Then**
- **Last**
Drafting
Write a sentence to begin your personal narrative. 
Tell where you went and why this place is special. 
Remember to use the pronoun /.

Now write your personal narrative. Use a separate piece of paper. Begin with the sentence you wrote above. Tell what you did and observed in time order. Do not forget to use details and describe your own feelings. Tell what this event meant to you.

Revising and Proofreading
Here are some sentences that Geraldo wrote. He forgot to use the first-person pronoun / to write about his experiences. Rewrite each sentence in the first person.

1. He was very careful not to touch the living coral.

2. He enjoyed floating in the warm, shallow water of the inner reefs.

Now revise and proofread your story.
Ask these questions:
▲ Have I told a story from my personal experience in the first-person point of view?
▲ Have I told what I did and observed there in time order?
▲ Have I corrected all grammar, spelling, capitalization, and punctuation errors?
Aquatic Ecosystems

Use your textbook to help you fill in the blanks.

What are freshwater ecosystems?

1. Freshwater ecosystems are found in and near bodies of water that contain little ___________________________.

2. Streams and rivers have __________________________ water, which makes them different from ponds and lakes.

3. Ponds may have many __________________________ because of their lush plant growth.

4. Lakes are __________________________ and __________________________ than ponds, so plants grow mostly in the shallow areas near the shore.

What are wetlands?

5. Marshes and bogs are examples of ___________________________.

6. Wetlands are home to many animals, many of which lay __________________________ and raise their __________________________ there.

7. People in the United States began working to __________________________ and __________________________ wetlands in the 1970s.

What are ocean ecosystems?

8. Water from the ocean is __________________________ by energy from the Sun, then the evaporated water rises and forms clouds, then it falls back to Earth as rain or snow.

9. Factors that affect ocean organisms include temperature, salt content, water pressure, tides, and the amount of __________________________ that penetrates the water.
Lesson Outline

10. During ____________________ tide, the intertidal zone of the ocean is covered by water.

11. The ____________________ zone extends from the low-tide line to the point where the ocean floor drops off.

12. Sharks, squid, and octopuses live in the ____________________ zone, the top level of the oceanic zone.

13. Organisms that live in the abyssal zone have adapted to the cold and ____________________ conditions.

What happens when fresh water meets salt water?

14. Estuaries are the parts of ____________________ where fresh water meets the sea.

15. The water in an estuary contains less salt than the water in the ____________________ .

16. The change in the ____________________ causes the amount of salt in the estuary to change.

17. About three-fourths of all the ____________________ caught in the United States each year spent part of their lives in estuaries.

Critical Thinking

18. Why might it be difficult for many plants and animals to live in estuaries?

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________
Aquatic Ecosystems

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. estuary</th>
<th>d. lake</th>
<th>f. pond</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. freshwater ecosystem</td>
<td>e. ocean</td>
<td>g. wetland</td>
</tr>
<tr>
<td>c. intertidal zone</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. __________ I am a small, shallow body of water and am often home to much animal and plant life. What am I?
2. __________ I am the part of a river where fresh water meets the sea. I am affected by the tides. What am I?
3. __________ I make up about 75 percent of Earth's surface. I am divided into regions with different conditions. What am I?
4. __________ I am an area in which water is near the surface of the soil much of the time. What am I?
5. __________ I exist in and around bodies of water that contain little salt. What am I?
6. __________ I am a large, deep body of water. My plant growth is limited to shallow areas along the shoreline. What am I?
7. __________ I am the shallowest part of the ocean between the high-tide line and the low-tide line. What am I?
Aquatic Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>estuaries</th>
<th>nutrients</th>
<th>runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>freshwater</td>
<td>plankton</td>
<td>wetland</td>
</tr>
<tr>
<td>neritic</td>
<td>ponds</td>
<td>young</td>
</tr>
</tbody>
</table>

Many different aquatic ecosystems exist on Earth. One type, called a(n) _________ ecosystem, is located near bodies of water with little salt. A great deal of plant and animal life may exist near small, shallow pools of water called _____________. Larger bodies of water, such as lakes, have life forms called _____________ near their surfaces. An ecosystem such as a bog, in which water is near the surface of the soil, is a(n) _____________. For many years, these areas were damaged by ____________ and other human activities, but people now are trying to protect these delicate ecosystems.

Water ecosystems called ____________ form where rivers enter the ocean. These water ecosystems have more salt than a river but less salt than an ocean. Oceans are divided into regions in much the same way that land is divided into biomes. The ____________ zone is richer in plant life than any other part of the ocean. This zone has complex food chains because of the large number of ____________ and the amount of sunlight in the water.

Estuaries are also important ____________ for many species of birds and fish. Many birds and animals raise their ____________ in estuaries.
Life in the Deep

Read the Writing in Science feature in your textbook.

Write About It

Expository Writing  Write a report telling how sunlight helps support your life. Engage your reader right away, and clearly state your purpose for writing. Introduce the main idea, and develop it with facts. Use supporting details and precise verbs, nouns, and adjectives to describe and explain your subject. Do print and online research. Summarize your findings at the end of the report.

Getting Ideas

Sometimes you choose your own topic to write about. Other times your teacher specifies the topic. Underline the topic in the assignment above. Now think about what you know about this topic, and gather information.

Write what you already know in the first column of the chart below. In the second column, write questions you have about the topic. This is the information you want to find out for your report. Then do some research to find answers to your questions. In the third column, write what you found out from your print and online research.

<table>
<thead>
<tr>
<th>Topic: How Sunlight Supports Your Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Already Know</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Drafting
A good report begins with a thesis statement that focuses the topic and tells readers what to expect. It gives important information about a topic. Circle the thesis statement that is a better way for Armando to begin his report.

I do not like to think about what the world would be like without sunlight.

Without sunlight the world as we know it would cease to exist.

Now write your first draft. Use a separate piece of paper. Begin with a strong thesis statement, introduce your main idea, explain your subject, and end with a summary of your findings.

Revising and Proofreading
Replace the underlined word in Armando’s sentence with a precise adjective. Rewrite the sentence on the lines below it.

The Sun heats Earth, causing seawater to dry and form clouds.

Now revise and proofread your report. Ask these questions:

- Have I written a thesis statement?
- Does my introductory paragraph engage readers?
- Have I supported my ideas with facts and details?
- Have I used precise verbs, nouns, and adjectives?
- Have I used transition words to connect ideas?
- Have I ended with a conclusion that summarizes my ideas?
- Have I corrected all grammar, spelling, punctuation, and capitalization errors?
Ecology

Circle the letter of the best answer.

1. All of the abiotic and biotic factors in a given area form __________.
   A  a community
   B  an ecosystem
   C  a population
   D  a species

2. A low pH indicates that soil is __________.
   A  alkaline
   B  balanced
   C  spongy
   D  acidic

3. A community is made up of __________.
   A  environments
   B  populations
   C  water
   D  carbon

4. The largest number of individuals of one species that an ecosystem can support over time is its __________.
   A  carrying capacity
   B  biotic potential
   C  limiting factor
   D  population growth

5. When a larger population grows more quickly, as it gets bigger it experiences __________.
   A  overcrowding
   B  competition
   C  exponential growth
   D  parasitism

6. All biomes have specific __________.
   A  climates and pioneer communities
   B  climates and types of organisms
   C  ecosystems and successions
   D  species and overcrowding

Name __________________________ Date ________
7. When two organisms have a relationship from which both benefit, the relationship is called ________.
   A. commensalism
   B. competition
   C. mutualism
   D. parasitism

8. The bottom level of the rain forest is called the ________.
   A. understory
   B. canopy
   C. forest floor
   D. emergent layer

9. Deciduous trees conserve energy when their leaves ________.
   A. decay
   B. change color
   C. fall off
   D. remain green

10. The biome with the coldest climate is the ________.
    A. grassland
    B. deciduous forest
    C. taiga
    D. tundra

11. The ecosystem that covers most of Earth's surface is ________.
    A. grassland
    B. rain forest
    C. taiga
    D. ocean

12. Areas in which water is near the surface of the soil much of the time are called ________.
    A. estuaries
    B. wetlands
    C. lakes
    D. algae

13. The type of ecosystem that forms where a river flows into the ocean is called ________.
    A. an estuary
    B. an ocean
    C. a rain forest
    D. a wetland
## Energy and Matter in Ecosystems

Complete the concept map on ecosystems, using words and phrases from your textbook.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>A rabbit eats grass.</td>
<td>Energy is transferred from the______________________________________to the________________________________________.</td>
</tr>
<tr>
<td>A certain type of food becomes a(n)_______________________________.</td>
<td>The population of the organism that eats that food____________________.</td>
</tr>
<tr>
<td>____________ in the soil “fix” nitrogen from the air.</td>
<td>Nitrogen from the air is changed into a form that______________________can use.</td>
</tr>
<tr>
<td>Plants take in carbon dioxide and_______________________________.</td>
<td>The process of__________________________________________, creating __________________________.</td>
</tr>
</tbody>
</table>
Energy from the Sun

Use your textbook to help you fill in the blanks.

How is the Sun an important energy source?

1. Plants convert solar radiation into ________________ energy, which can be used by other organisms.

2. Solar radiation helped create fossil ________________ such as coal, oil, and natural gas.

3. Solar energy drives the water cycle and influences a region’s ___________________ and climate.

What is photosynthesis?

4. Chlorophyll is a green substance in plants that ________________ energy from sunlight.

5. Using sunlight, plants and other organisms convert water and ________________ into sugar, or food, and oxygen.

6. Oxygen, which is given off by plants as a(n) ________________ product during photosynthesis, enters the atmosphere.

What do roots and stems do?

7. Most roots hold plants in the soil and take in water and ________________ to feed the plants.

8. The stem of a plant transports ________________ and other substances between the roots and leaves.
What are leaves?

9. Simple leaves have one ________________, and compound leaves have two or more.

10. Water and minerals are brought through leaf blades by ________________.

11. Some leaves store ________________, and others are designed to protect the plant.

How does water move through plants?

12. Water is pushed upward into stems of small plants by ________________ built up in the roots.

13. Most plants need forces that pull water upward, such as capillary action and ________________.

14. Cabbage plants store food in their ________________.

What are microscopic organisms that make their own food?

15. Microscopic organisms are classified according to their ________________ structure and by what they eat.

16. Prokaryotes do not have a nucleus in each cell, but ________________ do have a nucleus in each cell.

17. Many ________________ are capable of producing their own food through photosynthesis.

Critical Thinking

18. How do the roots, stems, and leaves of a plant help the plant survive?

________________________________________

________________________________________

________________________________________
Energy from the Sun

Fill in the blanks.

1. The release of energy in plants and animals from food is called _______________.

2. Energy from the Sun that shines on Earth’s surface is called _______________.

3. A(n) _______________ holds a plant in the soil and takes in water and minerals to feed the plant.

4. The part of a plant that supports leaves and flowers is the _______________.

5. Nearly all plants are _______________, or organisms that are able to make their own food.

6. The green substance that absorbs energy from sunlight is _______________.

7. The process of making food by using sunlight is _______________.

8. The loss of water from the leaves of a plant is called _______________.

9. Organisms called _______________ have a simple cell structure without a nucleus in each cell.

Vocabulary

chlorophyll  respiration  stem
photosynthesis  root  transpiration
prokaryotes  solar radiation  producers

Name __________________________ Date ___________
Energy enters ecosystems as sunlight, which is used by plants to make food. First, water and minerals enter the __________________ of a plant. Pressure from the roots __________________ water into the stem. Capillary action and transpiration __________________ the water up into the __________________ . Tubes carry the materials to the __________________ in the leaves. The substance __________________ is located there. With exposure to __________________ and air, plants can then carry out photosynthesis. Photosynthesis __________________ sunlight and air into food for the plant.

Some microscopic organisms, such as __________________ can also perform photosynthesis.

A protist is a __________________ , which means that it has a __________________ in each cell.
Trouble on the Table

Read the Writing in Science feature in your textbook.

Write About It

**Explanatory Writing** Choose a GM food that you might find in your local grocery store. Write an explanation of why it has been genetically modified and what that might mean for consumers.

Getting Ideas

Choose a GM food. Think of reasons why people may choose to modify that food and the possible outcomes for consumers. Record your ideas in the graphic organizer below.
**Drafting**

Good explanatory writing gives clear details and addresses both sides of a controversial issue. Armando wrote two introductory statements. Circle the statement that is the better way for Armando to begin his report.

Genetically modifying food changes the way plants are supposed to be, so it can only cause negative consequences to people and the environment.

Modifying the genetic structure of plants can help scientists create better food, but some people are concerned that the benefits come with too many risks.

Now write your first draft. Use a separate piece of paper. Begin with a sentence that clearly explains both sides of the issue. Be sure to give specific reasons why scientists choose to modify food and to identify possible outcomes for consumers. Use cause-and-effect words and phrases such as *because*, *since*, and *as a result* to help readers understand the issue.

**Revising and Proofreading**

Now revise and proofread your essay. Ask these questions:

- Have I written an introduction that clearly explains the issues?
- Have I provided specific reasons and outcomes?
- Have I used cause-and-effect words to connect ideas?
- Have I corrected all grammar, spelling, punctuation, and capitalization errors?
Food Chains, Webs, and Pyramids

Use your textbook to help you fill in the blanks.

What are food chains?

1. The energy used by almost all living things originally comes from the ________________.

2. A model of the path that energy in ________________ takes as it moves from one organism to the next in an ecosystem is called a(n) ________________.

3. Organisms that make their own food through ________________ are called producers.

4. Living things that do not make their own food and must therefore eat other organisms are called ________________.

5. Organisms are ________________ if they eat producers, and they are ________________ if they eat primary consumers.

6. An organism that eats a secondary consumer is a(n) ________________.

7. An organism that breaks down the remains of other organisms is a(n) ________________.

What are food webs?

8. A model that shows how food chains overlap in an ecosystem is called a(n) ________________.

9. An animal that eats only producers is a(n) ________________.
LESSON Outline

10. Animals that eat other animals are ________________.

11. Humans are ________________, because they eat both producers and other consumers.

12. An animal that eats dead animals that it did not hunt and kill is called a(n) ________________.

What are ocean food chains like?

13. Chemosynthesis allows ________________ deep in the ocean to produce food.

14. The plankton known as ________________ can make food through photosynthesis.

15. Microscopic animals called ________________ feed on phytoplankton and are eaten by small fish and other animals.

What is an energy pyramid?

16. A model that shows how energy flows through a food chain is called a(n) ________________.

17. About ________________ percent of the energy from one level of an energy pyramid is available to consumers at the next level.

Critical Thinking

18. Explain the places occupied by grass, a rabbit, and a wolf in an energy pyramid.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Pdf Pass
Chapter 2 • Energy and Matter in Ecosystems
Reading and Writing

34
Food Chains, Webs, and Pyramids

Use the clues to unscramble each word. Then unscramble the circled letters to answer the last question.

<table>
<thead>
<tr>
<th>decomposer</th>
<th>food chain</th>
<th>predator</th>
<th>scavenger</th>
</tr>
</thead>
<tbody>
<tr>
<td>energy pyramid</td>
<td>food web</td>
<td>producer</td>
<td></td>
</tr>
</tbody>
</table>

1. YERPYDMEGNRIA  a model that shows how energy flows through a food chain
   ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. PATRODER  a living thing that hunts and kills other living things for food
   ☐ ☐ ☐ ☐ ☐ ☐

3. COOPREMEDS  an organism that breaks down the remains of dead organisms into simpler substances
   ☐ ☐ ☐ ☐ ☐ ☐ ☐

4. FCOHOADIN  a model of the path that the energy in food takes as it moves through an ecosystem
   ☐ ☐ ☐ ☐ ☐ ☐ ☐

5. GVSERNAEC  an animal that feeds on the remains of dead animals that it did not hunt or kill
   ☐ ☐ ☐ ☐ ☐ ☐

6. REDRUPCO  an organism that uses the Sun’s energy to make its own food through photosynthesis
   ☐ ☐ ☐ ☐ ☐ ☐

7. BOWDEFO  a model that shows how food chains overlap in an ecosystem
   ☐ ☐ ☐ ☐ ☐

8. What do you call an animal that eats animals that eat plants?
   a(n) ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Food Chains, Webs, and Pyramids

Fill in the blanks.

- consumers
- decomposers
- food chain
- producers
- food web
- primary consumers
- secondary consumers
- tertiary consumers
- scavenger

The Sun is the main source of energy for most living things. Living things that make their own food from the Sun’s energy are called ___________ . Animals that eat other living organisms are called ___________ . The energy flow from one organism to another is shown in a(n) ___________ . Food chains overlap in a(n) ___________ .

Animals that eat producers are ___________ . Primary consumers are food for ___________ . Secondary consumers are eaten by ___________ . An organism that eats dead animals that it did not hunt is a(n) ___________ . Dead animals are also broken down by ___________ . These relationships can be seen both on land and in the water.
Cycles in Ecosystems

Use your textbook to help you fill in the blanks.

How does Earth have enough air and water to keep us alive?

1. The air we breathe and the water we drink do not run out, because the planet is always __________________________ them.

2. Water can change from a solid to a liquid to a(n) __________________________ and back again.

3. The Sun causes __________________________ when it heats the water in oceans, lakes, rivers, ponds, and puddles.

4. A process called __________________________ makes the water that hits Earth's surface soak into the ground.

What is the carbon cycle?

5. There is not a lot of carbon in the __________________________, so it must be recycled.

6. The buildup of gases that leads to global warming is the __________________________ effect.

7. Carbon is stored in the air as carbon dioxide and in organic matter in the __________________________.

8. The shells of some marine organisms contain __________________________ carbon dioxide.

9. Living things use __________________________ to break apart molecules during respiration.
What is the nitrogen cycle?

10. Nitrogen is needed to make
    _______________ for
    the growth of muscles, skin, bones, blood, plant cell walls, and internal organs.

11. Lightning can change the nitrogen in the atmosphere into a(n)
    _______________ compound.

12. Nitrogen-fixing
    _______________ live in the roots of beans, peas, and peanuts and can extract nitrogen from the air.

13. Plants absorb nitrates and nitrites and then use them to make
    _______________.

14. Certain bacteria return the same amount of nitrogen to the air as
    other bacteria take away from the air, keeping the ecosystem in
    _______________.

How are plants recycled?

15. Certain kinds of food scraps or yard cuttings can be recycled through the process of
    _______________.

16. Dead plants and animals are broken down into useful materials such as minerals and rich soils by
    _______________.

Critical Thinking

17. How are bacteria important to the nitrogen cycle?

    _______________
    _______________
    _______________
    _______________
    _______________
Cycles in Ecosystems

<table>
<thead>
<tr>
<th>carbon cycle</th>
<th>evaporation</th>
<th>nitrogen cycle</th>
<th>carbon cycle</th>
<th>evaporation</th>
<th>nitrogen cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>composting</td>
<td>nitrates</td>
<td>precipitation</td>
<td>composting</td>
<td>nitrates</td>
<td>precipitation</td>
</tr>
<tr>
<td>condensation</td>
<td>nitrites</td>
<td>water cycle</td>
<td>condensation</td>
<td>nitrites</td>
<td>water cycle</td>
</tr>
</tbody>
</table>

Fill in the blanks.

1. The continuous trapping of nitrogen gas into compounds in the soil and the returning of nitrogen gas to the air is the _____________.

2. Any form of water that falls to Earth is _________________.

3. Plants absorb ________________ and ________________ and use them to make protein.

4. The process in which a liquid changes into a gas is _________________.

5. Through the ________________, carbon is recycled between the atmosphere and living things.

6. The continuous movement of water between Earth’s surface and the air is the _________________.

7. Organic matter is broken down by decomposers during ________________ so it can be used as a natural fertilizer for gardening or farming.

8. The process in which a gas changes into a liquid is known as _________________.

Name __________________________ Date ____________
Cycles in Ecosystems

<table>
<thead>
<tr>
<th>absorb</th>
<th>condensation</th>
<th>gas</th>
<th>precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon dioxide</td>
<td>decay</td>
<td>nitrates</td>
<td></td>
</tr>
<tr>
<td>collection</td>
<td>decomposers</td>
<td>nitric acid</td>
<td></td>
</tr>
</tbody>
</table>

Fill in the blanks.

If the planet did not recycle the air we breathe and the water we drink, they would run out. Water is stored as groundwater through ________________ . Water is then evaporated by the Sun, and the process of ________________ begins, forming clouds. Eventually the water returns to Earth as ________________ to start the process over again.

Carbon escapes into the air and ground when plants and animals ________________. Plants use the carbon from ________________ in photosynthesis. Animals eat the animals that eat plants that ________________ the nitrogen they need. Nitrogen-fixing bacteria extract nitrogen ________________ from the air. Other bacteria convert nitrogen into nitrites or ________________, substances plants can use to make proteins. Rainwater and lightning make another usable form of nitrogen called ________________ . Organic matter is broken down into nitrogen by ________________ . They return important substances back into nature.
Changes in Ecosystems

Use your textbook to help you fill in the blanks.

What changes affect the environment?

1. A predator is an example of a(n) ________________ because it controls the size or ________________ of a population.

2. Some limiting factors are living, or ________________, and some are nonliving, or ________________.

What happens after the environment changes?

3. Organisms that remain in a region must ________________ to ________________ change.

4. If a species’ numbers have declined to a level at which the species needs protection from becoming endangered, it is considered ________________.

5. When a species’ numbers have been so reduced that the species may become extinct, it is considered ________________.

6. When ________________ has occurred, a species no longer exists in the wild or in captivity.

7. The loss of any species affects the wide variety of life on Earth, which is called ________________.

What is succession?

8. The gradual replacement of one community by another is called ________________.
9. A community that is established in what was a lifeless area is called a(n) ________________ community.

10. A stable community in which succession has slowed down is called a(n) ________________ community.

11. Secondary succession can occur after a(n) ________________ such as a forest fire.

What is evidence of change over time?

12. Similar features in different organisms are called ________________ structures, and features that are similar but meet different needs are called ________________ structures.

13. Scientists can determine the degree to which different species are related by comparing their ________________.

How do environments change over time?

14. Changes to ecosystems can be caused by ________________ or by ________________.

Critical Thinking

15. How do forest fires affect a deciduous-forest ecosystem?

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Changes in Ecosystems

Fill in the blanks.

<table>
<thead>
<tr>
<th>biodiversity</th>
<th>extinction</th>
<th>succession</th>
</tr>
</thead>
<tbody>
<tr>
<td>climax community</td>
<td>limiting factor</td>
<td>threatened</td>
</tr>
<tr>
<td>endangered</td>
<td>pioneer community</td>
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</tbody>
</table>

1. A species that has decreased until it is almost endangered is considered ________________.

2. When a species no longer exists, it is called ________________.

3. The term used to describe the wide variety of life on Earth is ________________.

4. A species that may become extinct if its population decreases further is considered ________________.

5. A condition that controls the size or growth of a population is called a(n) ________________.

6. When a community has stabilized and succession has slowed down or stopped, it is a(n) ________________.

7. The gradual replacement of one community by another is called ________________.

8. The first species to establish themselves in a lifeless area form a(n) ________________.
Changes in Ecosystems

Ecosystems are constantly changing. The first community to populate an ecosystem is a(n) _________________. This community is gradually replaced by others in a process called _________________. A(n) ________________ occupies an ecosystem in which succession has slowed down.

To survive, organisms must adapt to changes in ________________, such as food and water, that control the size and growth of populations. If environmental changes cause a population to decrease, the population can become threatened or _________________. When a population no longer exists, it has undergone _________________. Changes in ecosystems over time can be studied by examining ________________, comparative and ________________ structures, and the ________________ of closely related species. These comparisons show scientists how different species are related to one another.
Meet Eleanor Sterling

Read the Reading in Science feature in your textbook.

**Cause and Effect**

The article mentioned several things that could cause damage to the reef. List them in the left column of the chart below. Then list a possible effect of each of these dangers in the right column of the chart.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reefs are damaged.</td>
<td>Organisms that live there are in danger.</td>
</tr>
</tbody>
</table>

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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Write About It

Cause and Effect
1. What factors cause damage to coral reefs?
2. How does damage to coral reefs affect the organisms that live in them?

Planning and Organizing
Write a sentence that summarizes the factors threatening coral reefs.

Write a one-sentence summary of what Eleanor Sterling is doing in the Palmyra Atoll.

Drafting
Now explain how Eleanor Sterling’s work can be used to protect marine ecosystems all over the world.
Energy and Matter in Ecosystems

Circle the letter of the best answer.

1. Plants use sunlight to make food in a process called __________.
   A  solar radiation
   B  chloroplasts
   C  photosynthesis
   D  chlorophyll

2. The leaves and flowers of a plant are supported by __________.
   A  xylem
   B  stems
   C  roots
   D  phloem

3. Microscopic organisms that have a simple cell structure without a nucleus in each cell are called __________.
   A  prokaryotes
   B  cyanobacteria
   C  protists
   D  eukaryotes

4. The path that energy takes as it moves from one organism to another in an ecosystem is __________.
   A  a cycle
   B  an energy pyramid
   C  a food chain
   D  a food web

5. A model of the way that food chains overlap in an ecosystem is called __________.
   A  an energy pyramid
   B  a carbon cycle
   C  a food web
   D  an abiotic factor
7. The model that shows how much energy is passed from one organism to another is the ____________.
   A. energy pyramid
   B. food chain
   C. food web
   D. symbiotic relationship

8. The process by which a liquid changes to a gas is called ____________.
   A. collection
   B. precipitation
   C. condensation
   D. evaporation

9. A buildup of gases that raises temperature and leads to global warming is the ____________.
   A. nitrogen effect
   B. condensation cycle
   C. greenhouse effect
   D. carbon cycle

10. Energy for most things on Earth originally comes from ____________.
    A. the Sun
    B. a producer
    C. the ocean
    D. a community

11. When organic matter breaks down so that it can be used as a natural fertilizer, it is called ____________.
    A. composting
    B. decomposition
    C. fungus
    D. recycling

12. The population of a given species decreasing until the species no longer exists is called ____________.
    A. endangered
    B. extinction
    C. limited
    D. threatened

13. The first step in succession produces a ____________.
    A. climax community
    B. deciduous forest
    C. pioneer community
    D. secondary community
Frozen Frogs
Read the Literature feature in your textbook.

Write About It
Response to Literature  This article describes a frog during winter. What is the frog doing? What has happened to its body? Choose an animal to write about. Write an essay describing the process that this animal goes through to survive severe weather conditions, such as cold winters or hot summers.
# Exploring Space

Complete the concept map on exploring space by using words and phrases from your textbook.

## Observational Tools

A(n) ___________ is a special structure in which scientists can use telescopes and other tools.

Special telescopes detect invisible light that is part of the ___________.

A radio telescope is shaped like a giant ___________ to catch radio waves.

## Early Space Exploration

Powerful engines called ___________ can escape Earth’s gravity to travel to space.

The first artificial satellite in space was the Russian spacecraft ___________.

In ___________, Project Apollo reached the Moon.

## Modern Space Exploration

NASA designed a reusable spacecraft called a(n) ___________ to make traveling to space easier and more economical.

Astronauts can live aboard a(n) ___________ for long periods of time.

Space technology helps ___________ technology in other fields on Earth.
Seeing in Space

Use your textbook to help you fill in the blanks.

What is Astronomy?

1. Astronomy is the study of the ________________.
2. The first telescope ever made was probably a ________________ telescope.

How do we see in space?

3. Professional ________________ often use optical ________________ to observe space.
4. A special structure built to hold telescopes and other observational equipment is called a(n) ________________.
5. The ________________ orbits Earth and sends back images of distant galaxies.
6. The larger a telescope's lenses or mirrors, the more ________________ it can collect. What is electromagnetic radiation?
7. Energy transmitted from one point to another by electromagnetic waves is called ________________.
8. The electromagnetic ________________ contains both invisible and visible light.
9. Infrared telescopes detect ________________ produced by a newly forming star or planet.
10. X-ray telescopes give us information about ________________ and ________________.
11. Ultraviolet telescopes can contribute data that lend support to the ________________.

What is a radio telescope?

12. A ________________ studies radio waves emitted by stars and planets.

13. Because many radio waves are not blocked by Earth’s atmosphere, radio telescopes are not usually affected by ________________ conditions.

14. A radio telescope is generally shaped like a giant ________________.

Critical Thinking

15. Why might professional astronomers use many different types of telescopes to study space?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
# Seeing in Space

Match the correct letter with the description.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>a. electromagnetic radiation</td>
<td>d. invisible light</td>
<td>g. radio telescope</td>
</tr>
<tr>
<td>b. electromagnetic spectrum</td>
<td>e. observatory</td>
<td>h. reflecting telescope</td>
</tr>
<tr>
<td>c. <em>Hubble Space</em> <em>Telescope</em></td>
<td>f. radio wave</td>
<td></td>
</tr>
</tbody>
</table>

1. ______ I include things such as ultraviolet light, X rays, infrared waves, radar, and radio waves. What am I?
2. ______ I collect light by using lenses or mirrors. What am I?
3. ______ I am energy transmitted from one point to another by electromagnetic waves. What am I?
4. ______ I am a special structure built to hold telescopes and other observational equipment. What am I?
5. ______ I study radio waves emitted by stars and planets. What am I?
6. ______ I contain the full range of wavelengths, from very short to very long. I contain both invisible and visible light. What am I?
7. ______ I am part of the left end of the electromagnetic spectrum. I have a longer wavelength and lower energy than visible light. What am I?
8. ______ I orbit Earth and send back images of distant galaxies. I was first launched in 1990. What am I?
Certain scientists study space. These people are called ____________ . Astronomers work at places called ____________ where they have special equipment to study the sky. One kind of ____________ uses lenses and mirrors to capture light. Telescopes with bigger reflectors can capture more ____________ and show clearer images.

The Sun and other astronomical bodies give off not only ____________ light but also ____________ light. Both kinds of light are part of the ________________ . It is made up of all the ________________ . Astronomers can use ____________ telescopes to detect heat. They can also use ____________ to learn about supernovas and black holes.

One type of long electromagnetic wave is the radio wave. Special ____________ catch these waves to gather data about astronomical objects, such as sunspots, solar flares, and planets.
Early Space Exploration

Use your textbook to help you fill in the blanks.

How do we explore space?

1. A powerful engine that carries its own fuel source and does not require air to work is called a(n) _________________.

2. Rockets can be fueled by both solid and liquid _________________.

3. Unlike other rockets, an air-breathing rocket would not have to store ________________ on board.

4. One new rocket technology involves the use of _________________, an electrically charged, very highly heated gas.

What are satellites?

5. Any object, natural or artificial, that revolves around another object is called a(n) _________________.

6. The first ________________ satellite, named Sputnik, was put into orbit by the Soviet Union in 1957.

7. Weather satellites help forecasters predict the weather by gathering data about ________________, ________________, air ________________, and air ________________.

8. Communications satellites transmit ________________ and ________________ signals all over the world.

What are space probes?

9. Devices that use onboard instruments to get close-up views of celestial bodies are called _________________.

Chapter 3 • Exploring Space
Reading and Writing

Use with Lesson 2
Early Space Exploration
LESSON

10. Space probes do not carry ________________ and are often designed not to return to Earth.

11. In 1973, the space probe ________________ was launched to gather data about Mercury.

12. Two space probes called ________________ were launched in 2003 to search for evidence of water on the surface of Mars.

How did we get to the Moon?

13. In 1961, ________________ challenged scientists to send a person to the Moon.


15. In 1969, astronaut ________________ became the first person to step onto the Moon.

Critical Thinking

16. Why do space probes not have people on them?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
### Early Space Exploration

Fill in the blanks.

<table>
<thead>
<tr>
<th>artificial satellite</th>
<th>propellant</th>
<th>space junk</th>
</tr>
</thead>
<tbody>
<tr>
<td>plasma</td>
<td>rocket</td>
<td>space probe</td>
</tr>
<tr>
<td>Project Apollo</td>
<td>satellite</td>
<td></td>
</tr>
</tbody>
</table>

1. Pieces of human-made equipment that have fallen into disuse are called ____________________.

2. A powerful engine that carries its own fuel source and does not require air to work is a(n) ____________________.

3. The first mission to successfully take humans to the Moon was called ____________________.

4. An electrically charged, very highly heated gas used in rocket technology is ____________________.

5. Any object, natural or artificial, that revolves around another object is a(n) ____________________.

6. A device that uses onboard instruments to get close-up views of celestial bodies is called a(n) ____________________.

7. The solid or liquid fuel burned by a rocket is called ____________________.

8. An object built by humans that revolves around another object is called a(n) ____________________.
Early Space Exploration

Fill in the blanks.

<table>
<thead>
<tr>
<th>Galileo</th>
<th>Neil Armstrong</th>
<th>rockets</th>
<th>Sputnik</th>
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<tbody>
<tr>
<td>John F. Kennedy</td>
<td>planets</td>
<td>satellites</td>
<td>weather</td>
</tr>
<tr>
<td>Moon</td>
<td>propellant</td>
<td>space probes</td>
<td></td>
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</tbody>
</table>

Sending people and objects into space has helped people learn about the solar system. To travel to space, scientists learned how to build _________________. These engines use special fuel called _________________. Rockets can be used to launch objects such as _________________.

That orbit Earth. The Soviet Union launched _________________, the first artificial satellite, in 1957.

Today, people use satellites to predict the ________________and to gather information.

Scientists can send ________________ to get a closer look at far-off places. Space probes can take photographs of or even land on distant ________________. The space probe ________________ sent back the first close-up photograph of an asteroid. In 1961, President ________________ asked scientists to find a way to put people on the ________________. In 1969, astronaut ________________ became the first person to walk on the Moon.
Meet Mordecai-Mark Mac Low

Read the Reading in Science feature in your textbook. Look for clues in the article to help you draw conclusions about quasars.

Draw Conclusions

Use the graphic organizer to draw conclusions.

<table>
<thead>
<tr>
<th>Text Clues</th>
<th>Conclusions</th>
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<tbody>
<tr>
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</tbody>
</table>
Write About It

Draw Conclusions
1. Why do quasars look like faint points of light when they are viewed from Earth?
2. If scientists observe that a quasar is moving away from us, what can they conclude about its galaxy?

Planning and Organizing

Explain what Mordecai-Mark studies.

What did the scientists conclude about the brightness of quasars?

What did the scientists conclude about the movement of quasars?

Drafting

Now draw a conclusion about how information about quasars helps Mordecai-Mark understand how the universe is changing over time.
Modern Space Exploration

Use your textbook to help you fill in the blanks.

What is a space shuttle?
1. NASA thought it would be less ________________ and less ________________ to develop something that could be used over and over.
2. A reusable spacecraft that transports astronauts, satellites, and other materials to and from space is called a(n) ________________.
3. While in ________________, astronauts aboard the shuttle can perform many different tasks.
4. After a mission, the shuttle glides back to ________________ and lands like an airplane.

What is a space station?
5. An object in space that allows astronauts to stay and work for extended periods of time is called a(n) ________________.
6. In 1973, the United States launched the space station ________________.
7. In 1995, the United States and ________________ began cooperating on joint missions aboard Mir.
8. The relationship between Russia and the United States laid the groundwork for the ________________.

How do we explore Mars?
9. The Mars ________________ carried technology to study the surface of the planet, including a remote-controlled robot rover called ________________.
10. In 2004, twin rovers landed that provided clues about the role of ________________ on Mars.

What’s Next?

11. Future missions may involve more trips to the ________________ to investigate its properties.

How is space technology used?

12. Medical data gathered aboard the space shuttle or the International Space Station have led to better ways to treat and diagnose ________________ here on Earth.

13. GPS systems, ________________, and ________________ have all been made possible by work originally done for space exploration.

14. The same material designed to protect Skylab from solar radiation has since been used to create a thermal ________________ that can protect individuals in an emergency.

Critical Thinking

15. Why is it advantageous for astronauts to live on a space station rather than in a space shuttle?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Modern Space Exploration

Match the correct letter with the description.

1. I am an orbiting laboratory designed for long-term research projects. I am a joint venture of more than 15 countries. What am I?
   - a. booster rockets
   - b. International Space Station
   - c. liquid fuel tank

2. I am a project designed to develop advanced technology that will let NASA send smart spacecraft into the solar system. What am I?
   - d. New Millennium Program
   - e. Skylab

3. I am a space station launched by the United States in 1973. What am I?
   - f. space shuttle
   - g. space station

4. I am connected to the space shuttle at launch, but I later separate and fall back to Earth. I am not reused. What am I?

5. I am an object in space that allows astronauts to stay and work for extended periods of time. What am I?

6. I am a reusable spacecraft developed to transport astronauts, satellites, and other materials to and from space. What am I?

7. I hold solid fuel for the space shuttle. I am attached to the space shuttle at launch. What am I?
NASA determined that it would be useful to have a reusable spacecraft. They designed the ________________, which can travel to and from space over and over again. It is launched by using solid-fuel ________________ and an external _________________. Because the space shuttle was not designed for long missions, scientists developed a(n) _________________. In 1986, the Russians began building the space station _________________. After the United States and Russia worked together on Mir, many countries joined together to build the _________________.

During the 1990s, NASA began to study _________________ more closely. Space probes were sent to analyze rocks and soils and to look for signs of _________________. NASA developed the _________________ to improve space technology and reduce costs.

Advances in space technology have improved medicine, _________________, and other technologies on Earth.
Exploring Space

Circle the letter of the best answer.

1. A special structure built to hold telescopes and other observational equipment is a(n) ________________.
   A astronomer  B observatory  C reflector  D dome

2. The energy transmitted from one point to another by electromagnetic waves is called ________________.
   A ultraviolet light  B gamma ray  C electromagnetic spectrum  D electromagnetic radiation

3. Infrared telescopes detect ________________.
   A X rays  B heat  C visible light  D black holes

4. A device that studies radio waves emitted by stars and planets is a(n) ________________.
   A radio telescope  B X-ray telescope  C ultraviolet telescope  D optical telescope

5. A powerful engine that carries its own fuel source and does not require air to work is called a ________________.
   A propellant  B plasma  C rocket  D space probe

6. Any object, natural or artificial, that revolves around another object is a(n) ________________.
   A orbit  B satellite  C antenna  D planet

7. The first successful artificial satellite launched by the United States was called ________________.
   A Voyager I  B Mariner  C Sputnik  D Explorer I

8. Devices that use onboard instruments to get close-up views of celestial bodies are called ________________.
   A rovers  B satellites  C magnetic fields  D space probes
9. The first mission that successfully landed a person on the Moon was called ____________.
   A Project Apollo  B Magellan  C Project Mercury  D Voyager 2

10. A reusable spacecraft developed to transport astronauts, satellites, and other materials to and from space is a ____________.
    A cargo bay  C space shuttle  
    B liquid-fuel tank  D booster rocket

11. An object in space that allows astronauts to stay and work for extended periods of time is called a ____________.
    A cosmonaut  C space shuttle  
    B space station  D Shuttle-Mir Program

12. More than 15 countries have joined to design a laboratory for long-term research projects called ____________.
    A Mir  C Zarya Module  
    B Destiny  D International Space Station

13. In 1996, NASA landed a rover on Mars that was called ____________.
    A Pathfinder  C Spirit  
    B Global Surveyor  D Opportunity

14. A project designed by NASA to develop advanced technology controlled by onboard computer systems is called ____________.
    A Sojourner  C New Millennium Program  
    B Phoenix  D Lunar Prospector
The Solar System and Beyond

Complete the concept map on the universe and solar system, using words and phrases from your textbook.

**Our Moon**
- The appearance of the Moon seems to change each week, producing a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_ of the Moon.
- If the Moon comes between Earth and the Sun or the Earth comes between the Moon and the Sun, a(n) \_\_\_\_\_\_\_\_\_\_\_\_ occurs.

**Our Sun**
- The length of our year is the length of one \_\_\_\_\_\_\_\_\_\_\_\_ of Earth around the Sun.
- Our Sun is an average-sized, \_\_\_\_\_\_\_\_\_\_\_\_ star, but it will eventually become a red giant.

**Our Planet**
- Earth travels around the \_\_\_\_\_\_\_\_\_\_. Unlike other planets, Earth has liquid \_\_\_\_\_\_\_\_\_\_\_\_ on its surface.

**Our Galaxy**
- We can sometimes see our galaxy, the \_\_\_\_\_\_\_\_\_, in the night sky. Our galaxy has a \_\_\_\_\_\_\_\_\_\_\_\_ shape.
- Background radiation supports the \_\_\_\_\_\_\_\_\_\_\_\_ theory.

**Our Solar System**
- The inner planets are Mercury, \_\_\_\_\_\_\_\_\_, Earth, and Mars. The outer planets include Jupiter, \_\_\_\_\_\_\_\_\_, Uranus, and Neptune.
- The solar system also includes orbiting comets, asteroids, and \_\_\_\_\_\_\_\_\_.

Name ___________________________ Date ___________
The Earth-Sun System

Use your textbook to help you fill in the blanks.

What are Earth’s properties?

1. Earth moves in a circle around the ____________________.

2. The shape of Earth is ____________________ like a ball.

3. Earth is protected from harmful solar radiation by its ____________________.

4. The atmosphere absorbs the Sun’s ____________________ and contains ____________________ that organisms need to survive.

5. Unlike other planets, Earth has liquid ____________________ on its surface.

How can we prove that Earth rotates?

6. Earth makes one rotation on its ____________________ every 24 hours.

7. The Sun seems to rise in the east and travel west on its ____________________.

8. Earth ____________________ at a rate of about 360 degrees every 24 hours, or 15 degrees per hour.

9. Earth is divided into 24 vertical belts, each about 15 degrees wide in longitude, called ____________________.
What makes a year?

10. One complete _______________ of Earth around the Sun takes _______________ days.

11. In a hemisphere’s summer, that hemisphere is tilted _______________ the Sun and receives the Sun’s rays more directly; in winter, that hemisphere is tilted _______________ the Sun and receives the Sun’s rays at a lower angle.

12. Periods of the year characterized by particular weather conditions are _______________.

What are the parts of the Sun?

13. Most solar energy is produced in the Sun’s _______________.

14. The _______________ is the surface of the Sun that we can see.

15. Bursts of heat called _______________ can disrupt satellite transmissions.

Critical Thinking

16. What three factors can explain changes in the shadows objects cast, time differences, and changes of season over the Earth?

________________________________________________________________________________
________________________________________________________________________________
The Earth-Sun System

Match the correct letter with the description.

| a. atmosphere | e. revolution |
| b. axis       | f. rotation   |
| c. corona     | g. standard time zone |
| d. international date line | h. sunspot |

1. _______ I am a dark spot on the Sun. I have a lower temperature than my surrounding areas. What am I?
2. _______ I am one complete trip around the Sun. What am I?
3. _______ I am a vertical belt, about 15 degrees wide in longitude, in which all locations have the same time. What am I?
4. _______ I am a blanket of air surrounding Earth. What am I?
5. _______ I am an imaginary line that runs from the North Pole to the South Pole through the center of Earth. What am I?
6. _______ I am a line at a longitude of 180 degrees. What am I?
7. _______ I am the outer layer of the Sun’s atmosphere. What am I?
8. _______ I am one complete spin of Earth on its axis. What am I?
The Earth-Sun System

Fill in the blanks.

axis  solar energy  revolution
gases  sunspots  time zones
magnetic field  Sun

Earth moves in a circle around the _________________.
The atmosphere contains ________________ that plants and
animals need to survive. Earth’s ________________ protects
the planet from solar radiation.

The Sun produces ________________ in its core. Some
areas of the Sun have a lower temperature than other parts.
These are called ________________.

Earth rotates about 360 degrees on its
______________ every 24 hours, or at a rate of 15 degrees
every hour. Earth is divided into 24 standard
______________ that are about 15 degrees wide in
longitude. It takes Earth 365.24 days to make one
______________, or one complete trip around the Sun.
The direction in which Earth tilts on its axis during this time
causes the seasons to change.
The Earth-Sun-Moon System

Use your textbook to help you fill in the blanks.

What is the Moon like?

1. Much of our information about the Moon came from data gathered by the ________________.  

2. Bowl-shaped depressions on the Moon's surface are ________________ that were formed by impacts from space objects.  

3. Maria, highlands, valleys, and ________________ are features on the Moon's surface.  

4. Small amounts of ________________ may be present on ________________ floors on the Moon.  

What causes the phases of the Moon?

5. The shape of the Moon that we see in the night sky is the ________________.  

6. Whichever side of the Moon faces the ________________ is the lighted side.  

7. When the Moon is directly between the Sun and Earth, its phase is the ________________, so we see none of its lighted side.  

8. During the ________________ phases, we see more and more of the lighted side of the Moon; during the ________________ phases, we see less and less of its lighted side.
What causes eclipses?

9. A lunar eclipse occurs when __________ blocks sunlight from reaching ________________.

10. During a lunar eclipse, the Moon passes directly through Earth’s ______________ at the time of the ________________.

11. A total solar eclipse can occur when Earth passes through the Moon’s shadow during the ________________ phase.

What causes the tides?

12. Waves come higher up on the shore at some times than at others because of the ________________.

13. Tides on Earth are the result of the pull of gravity between Earth and ________________.

14. When the Sun, Earth, and the Moon are all in a line, a(n) ________________ occurs.

15. When the gravitational pulls of the Sun and the Moon are at right angles, a(n) ________________ occurs.

Critical Thinking

16. How does the Moon affect Earth?

________________________________________

________________________________________

________________________________________

________________________________________
The Earth-Sun-Moon System

Match the correct letter with the description.

<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>a.</td>
<td>craters</td>
<td>d. maria</td>
</tr>
<tr>
<td>b.</td>
<td>gravity</td>
<td>e. phase</td>
</tr>
<tr>
<td>c.</td>
<td>lunar eclipse</td>
<td>f. solar eclipse</td>
</tr>
</tbody>
</table>

1. ______ the shape of the Moon we see in the night sky
2. ______ the force of attraction among all objects
3. ______ the type of phase that occurs when the lighted side of the Moon becomes more and more visible
4. ______ the bowl-shaped depressions on the Moon’s surface formed by impacts from space objects
5. ______ an event that occurs when Earth blocks sunlight from reaching the Moon
6. ______ the regular rise and fall of the water level along a shore
7. ______ the large, dark, flat surface areas on the Moon’s surface
8. ______ an event that occurs when Earth passes through the Moon’s shadow
9. ______ the type of phase that occurs when we see less and less of the Moon’s lighted side
The Earth-Sun-Moon System

Fill in the blanks.

<table>
<thead>
<tr>
<th>craters</th>
<th>lunar</th>
<th>shape</th>
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</thead>
<tbody>
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<td>maria</td>
<td>solar</td>
</tr>
<tr>
<td>gravity</td>
<td>phases</td>
<td>telescopes</td>
</tr>
</tbody>
</table>

Technology allows scientists to study the Moon in new ways. Apollo astronauts saw firsthand many features that before had been viewed only through ________________ . They inspected ________________ and saw ________________ , highlands, mountain ranges, and valleys.

As the Moon revolves around ________________ , it passes through ________________ and appears to change ________________ . If the Moon passes directly through Earth’s shadow, a(n) ________________ eclipse occurs. When Earth passes through the shadow of the Moon, a(n) ________________ eclipse occurs.

Tides are the result of the pull of ________________ between Earth and the Moon. The positions of Earth, the Moon, and the Sun can cause tides to be especially strong or weak.
The Solar System

Use your textbook to help you fill in the blanks.

What is the solar system?

1. A large body that orbits a star is a(n) ________________ , and a large object that orbits a planet is a(n) ________________ .

2. A star and all the planets, moons, and other bodies that orbit it make up a(n) ________________ .

3. The pull between a planet and the Sun is stronger when the planet has greater ________________ .

4. When a planet is far away from the Sun, the pull of gravity between them is ________________ .

5. The balance between gravity and inertia keeps planets on a curved pathway, or ________________ , around the Sun.

What is in the inner solar system?

6. The planets that are closest to the Sun, or the ________________ , are rocky and are similar in ________________ .

7. Inner planets have few ________________ and no ________________ .

8. Between the orbits of Mars and Jupiter are orbiting rocky or metallic objects called ________________ .
LESSON
Outline

What are the outer planets?

9. The planets beyond the asteroid belt are known collectively as the ________________.

10. Jupiter, Saturn, Uranus, and ________________ are also called the gas giants.

What are other objects in our solar system?

11. Sunlight evaporates the ice in a comet, and a(n) ________________ in the shape of a(n) ________________ forms, pointing away from the Sun.

12. Small, rocky objects called ________________ orbit the Sun throughout the solar system.

13. Meteoroids that enter Earth’s atmosphere are called ________________ ; if they strike Earth they are called ________________.

Critical Thinking

14. A new planet has been discovered. Its orbit is twice as long as Earth’s orbit. Where might this planet be located? Explain your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________
Write the correct answers on the lines provided, and circle the answers in the grid.

<table>
<thead>
<tr>
<th>comet</th>
<th>meteor</th>
<th>meteoroid</th>
<th>planet</th>
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<tbody>
<tr>
<td>inertia</td>
<td>meteorite</td>
<td>moon</td>
<td>solar system</td>
</tr>
</tbody>
</table>

1. _____________ a large body that orbits a star
2. _____________ a large object that orbits a planet
3. _____________ a star and all the planets, moons, and other bodies traveling around it
4. _____________ the tendency of a moving object to stay in motion
5. _____________ a ball of ice and rock that orbits the Sun
6. _____________ small, rocky objects that orbit the Sun
7. _____________ a meteoroid that enters Earth’s atmosphere
8. _____________ a meteor that strikes Earth’s surface
The Solar System

A solar system consists of a star that is orbited by planets, moons, and other objects. Planets are large bodies that orbit ____________, and moons orbit planets. The star that planet Earth orbits is the ______________.

Mercury, Venus, Earth, and Mars are called the ______________ planets. Their ______________ bring them closest to the Sun. They are similar in size, are mostly ______________, and have no rings. The outer planets are all ______________. The gas giants all have ______________ and moons. Their cores are small and ______________.

Other objects in our Solar System include asteroids, ______________, and comets. A meteoroid that is pulled by gravity into Earth’s atmosphere is a(n) ______________. If a meteor hits Earth’s surface, it is called a(n) ______________. A comet is a ball of ice and rock that orbits the Sun.
Is Pluto a Planet?

Read the Writing in Science feature in your textbook.

Write About It

Persuasive Writing  Recently the International Astronomical Union (IAU) decided to drop Pluto from the list of planets in our solar system. Write a letter to the editor of your local newspaper arguing either for or against this decision. Include facts that back up your opinion.

Getting Ideas

Fill in the chart below. In the top box, write your opinion about the IAU’s decision. In the bottom boxes, write reasons that support your opinion.
Drafting

Follow these directions to create a formal letter:

1. Write or type your complete address.
2. Write or type the date.
3. Write or type the name, organization, and address of the person to whom you are writing.
4. Write or type the salutation, or greeting. Put a colon at the end of it.
5. Write or type an introductory paragraph. Explain why you are writing, and give your opinion about the problem.
6. Explain the causes and effects of the problem to support your opinion.
7. In your last paragraph, tell what you want to happen.
8. Use a phrase, such as “Sincerely yours” or “Yours truly” to close the letter. Put a comma after these words.
9. Sign your name. If you are using a computer, type your name a few lines below the closing, and then sign your name above that after you have printed the letter.

Now write your first draft. Use a separate piece of paper. Follow the format of a formal letter.

Revising and Proofreading

Now revise and proofread your letter. Ask these questions:

- Have I clearly stated my opinion about the IAU’s decision in my first paragraph?
- Have I included convincing reasons and arguments to support that opinion?
- Have I followed the format of a formal letter?
- Have I corrected all grammar, spelling, capitalization, and punctuation errors?
Stars

Use your textbook to help you fill in the blanks.

What are stars?

1. Large, hot balls of gases that are held together by ______ and give off their own light are called ______.

2. Orion is a(n) ______ that can be seen in the winter night sky in the Northern Hemisphere.

3. When a star appears to shift positions as viewed from two places on Earth, this is called ______.

4. Scientists measure a star’s parallax and use ______ to calculate its distance from Earth.

5. Scientists measure distance in space in units called ______.

What are some properties of stars?

6. A star’s brightness, or ______, is dependent upon how much light it gives off and its distance from Earth.

7. Absolute magnitude measures how bright a star really is, and ______ measures how bright a star looks in the night sky.

8. The temperature on the surface of a star determines the star’s ______.

9. The largest stars are ______ and the smallest are ______.
10. The H-R diagram shows that most stars, including our Sun, are ___________ stars.

**How do stars develop?**

11. A star begins as a nebula, then heats up and becomes a protostar, then undergoes nuclear reactions, releases energy, and becomes a(n) ___________ star.

12. As a star expands, its surface cools and it turns red, and then the star becomes a(n) ___________ or a supergiant, depending on its mass.

13. A red giant releases energy and forms a layer of gases called a(n) ___________ , heats up to become a white dwarf, and then cools to become a(n) ___________.

14. When a supergiant collapses, it then explodes, becoming a(n) ___________ , which can become a neutron star or a(n) ___________.

**What kind of star is the Sun?**

15. The Sun is a(n) ___________ star that will become a(n) ___________.

**Critical Thinking**

16. What will happen to the large amount of hydrogen in the Sun over the next 5 billion years? Will the Sun be hotter or cooler than it is now?


Stars

Use the clues to unscramble each word. Then unscramble the circled letters to answer the last question.

black hole  light-year  nebula  star
constellation  magnitude  parallax  supernova

1. RAST  a large, hot ball of gases, held together by gravity, that gives off its own light
   ⊙   ⊙   ⊙   ⊙

2. LETCOSLOANINT  a group of stars that appear to form a pattern
   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙

3. LAPRAXAL  the apparent shift in an object’s position when viewed from two locations
   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙

4. TRHAGEIYL  the distance that light travels in one year
   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙

5. LEUBAN  a huge cloud of gas and dust in space
   ⊙   ⊙   ⊙   ⊙

6. VURANOSEP  an exploded star
   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙

7. KECLAOLHB  an object whose gravity is so strong that even light cannot escape from it
   ⊙   ⊙   ⊙   ⊙   ⊙

8. GADNIMUTE  the brightness of a star
   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙

9. How is a planetary nebula formed?
   by NUCLEAR  ⊙   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙
   in RED  ⊙   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙   ⊙
Stars

Fill in the blanks.

| black hole | light-years | nebula |
| color | magnitude | neutron star |
| gravity | main-sequence | supernova |

Groups of stars form patterns in the sky called constellations. A star is a large, hot ball of gases that is held together by gravity and gives off its own light.

Distances in space are measured in light-years.

The brightness of a star is its magnitude. You can tell the surface temperature of a star by its color. The Sun, like most stars, is a(n) main-sequence star.

A star develops from a cloud of dust and gas called a(n) nebula. A very large star, called a supergiant, may collapse and explode to become a(n) supernova and then a(n) neutron star.

When a very massive star collapses, it may end up as a(n) black hole. X-rays in space provide evidence of the existence of these collapsed stars.
Galaxies and Beyond

Use your textbook to help you fill in the blanks.

What are galaxies?

1. A _________________ is a group of star clusters held together by gravity, in the same way that planets orbit a star.

2. Galaxies differ in size, age, and ________________ .

3. A whirlpool-shaped galaxy is a(n) _________________ galaxy, a football-shaped galaxy is a(n) _________________ galaxy, and one with no regular shape is called a(n) ________________ galaxy.

4. Our home galaxy, the Milky Way, is a(n) ________________ galaxy.

What was the big bang?

5. Some of the light produced by the heated gases of stars is ________________ by the star’s atmosphere.

6. The light absorbed by a star’s atmosphere drops out of its light spectrum, forming dark ________________ .

7. When a galaxy is moving toward Earth, the light shining from that galaxy shifts toward the ________________ end of the spectrum.

8. When a galaxy is moving away from Earth, the light shining from that galaxy shifts toward the ________________ end of the spectrum.
9. The rapid expansion of the universe that sent matter in all directions is known as the _____________.

10. Billions of years after the big bang, dust and gas gathered into a(n) ________________ massive enough to rotate.

11. Gravity has caused space matter to collect into clumps, forming stars and _________________.

12. Radiation that is left over from the beginning moments of the universe and that comes from all directions in space is called ________________ radiation.

**How did Earth form?**

13. Over time the very young Earth became large enough that its ________________ could hold an atmosphere.

14. Earth’s early atmosphere of hydrogen and helium was replaced over time by water vapor, sulfur, ________________, and nitrogen, which were released by ________________.

15. When plants developed, ________________ appeared as a waste product of ________________.

**Critical Thinking**

16. How is the formation of Earth like the formation of the universe?

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

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## Galaxies and Beyond

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. absorption lines</th>
<th>e. galaxy</th>
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<tbody>
<tr>
<td>b. background radiation</td>
<td>f. Milky Way</td>
</tr>
<tr>
<td>c. big bang</td>
<td>g. spectrum</td>
</tr>
<tr>
<td>d. expansion redshift</td>
<td>h. spiral</td>
</tr>
</tbody>
</table>

1. ______ our home galaxy
2. ______ the beginning moment when the universe was very hot and dense
3. ______ when a galaxy is moving away from Earth, and its light shifts toward the red end of the spectrum
4. ______ dark lines that form when some of a star’s light is absorbed by the star’s atmosphere
5. ______ a band of colors in white light
6. ______ radiation left over from the beginning moments of the universe that comes from all directions in space
7. ______ a group of star clusters held together by gravity
8. ______ a type of galaxy that is shaped like a whirlpool
**Galaxies and Beyond**

Fill in the blanks.

<table>
<thead>
<tr>
<th>big bang</th>
<th>expanding</th>
<th>spectrum</th>
<th>stars</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>red</td>
<td>spiral</td>
<td></td>
</tr>
</tbody>
</table>

A group of star clusters held together by gravity is called a galaxy. A galaxy with lots of dust and arms wound tightly or loosely around a core is a(n) ___________ galaxy.

White light can be separated into a band of colors called a(n) ___________ . Absorption lines are shifted toward the ___________ end of the spectrum when galaxies are moving toward Earth. Absorption lines are shifted toward the ___________ end of the spectrum when galaxies are moving away from Earth. Scientists have found that most galaxies are moving away from Earth because the universe is ___________ .

The moment that the universe began to expand is called the ___________ . Gravity caused matter to clump together to form ___________ and galaxies. Some clumps also formed planets including Earth.
Colors of Stars

Read the Writing in Science feature in your textbook.

Write About It

Fictional Writing Write a science-fiction story about traveling to the Messier 82 galaxy. Describe some of the problems involved in long-distance space travel. What plans do the main characters make in order to allow people to travel such great distances? Use an appropriate point of view, and add dialogue to make your story come alive.

Getting Ideas

The main problem for your story is that M82 is about 12 million light years away from Earth. Write this main problem in the top box of the chart below. Then think about all the minor problems caused by this main problem. In the center box of the chart, write steps the characters in your story take to solve these problems. In the bottom box, write how the characters finally solve the problem.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Steps to Solution

<table>
<thead>
<tr>
<th>Steps to Solution</th>
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<tbody>
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Solution

<table>
<thead>
<tr>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Drafting

Write a sentence to begin your fictional narrative. Introduce your main character. Try to grab your readers’ attention so that they will want to read more.

Now write your first draft. Use a separate piece of paper. Begin with the sentence you wrote above. Tell what the main problem is and how the characters solve the problem. Tell the trials they face along the way. Use dialogue to bring the story to life.

Revising and Proofreading

Here is part of the story that Jasmine wrote. She used dialogue, but she forgot to include quotation marks. Read over the sentences below. Add quotation marks where necessary.

I know you are frightened, said Captain Shue, and you are wondering if you will ever see your families again. You are probably also wondering if you will survive. . . .

No one has ever traveled this far, interrupted Ensign Meggs.

We will succeed, said Captain Shue. Our scientists have thought through all the problems.

Now revise and proofread your story. Ask these questions:

► Have I centered my story on the problem of traveling to a galaxy 12 million light years away?
► Have I shown how the characters solved the problem?
► Have I included a beginning, middle, and end?
► Have I corrected all grammar, spelling, capitalization, and punctuation errors?
The Solar System and Beyond

Circle the letter of the best answer.

1. During a new moon, you face ________________.
   A one half of the lighted side of the Moon
   B all of the lighted side of the Moon
   C the dark side of the Moon
   D the waning crescent phase of the Moon

2. A star is hottest when it is ________________.
   A blue-white
   B orange
   C red
   D orange-yellow

3. Planets are kept in orbit by ________________.
   A nuclear fusion
   B gravity and inertia
   C redshift and blueshift
   D parallax

4. The Milky Way is an example of ________________.
   A a spiral galaxy
   B an irregular galaxy
   C an elliptical galaxy
   D a core galaxy

5. Earth completes one full rotation on its axis ________________.
   A every 15 degrees
   B every 24 hours
   C every 365 days
   D every 6 months

6. During nuclear reactions in main-sequence stars, ________________.
   A oxygen is released
   B helium atoms fuse to make hydrogen
   C hydrogen atoms fuse to make helium
   D carbon dioxide is released

7. One complete trip around the Sun is ________________.
   A a revolution
   B a month
   C a time zone
   D a rotation

8. The life of a star begins in ________________.
   A a black hole
   B a nebula
   C a white dwarf
   D an Oort cloud
9. All of the following are gas giants except
   ________________.
   A Jupiter
   B Neptune
   C Mercury
   D Saturn

10. According to the H-R diagram, the Sun in our solar system is a
    ________________.
    A main-sequence star
    B red giant
    C supergiant
    D white dwarf

11. The magnitude of a star is a measure of its
    ________________.
    A brightness
    B diameter
    C mass
    D temperature

12. When Earth blocks sunlight from reaching the Moon, the result is a
    ________________.
    A lunar eclipse
    B solar eclipse
    C spring tide
    D neap tide

13. Most rocky or metallic objects that orbit the Sun are found in the
    ________________.
    A Oort cloud
    B star nebula
    C Kuiper belt
    D asteroid belt

14. According to the big bang theory, the universe is
    ________________.
    A contracting
    B dying
    C expanding
    D shrinking

15. The four stages, in order, of the life of a massive star’s life cycle are
    ________________.
    A nebula, main-sequence star, supergiant, white dwarf
    B protostar, red giant, main-sequence star, neutron star
    C nebula, main-sequence star, supergiant, supernova
    D supergiant, pulsar, neutron star, supernova
Weather and Climate

Complete the concept map on weather and climate, using words and phrases from your textbook.

**Weather** is defined as the state of the [ ] at a given place and time. **Climate** is defined as the average [ ] of a region.

Climate varies with [ ] and it is affected by temperature convection currents in [ ], and [ ].

What affects weather?

- Weather is affected by the angle of the Sun’s rays as they hit Earth’s surface at different times of the year.
- Temperature, elevation, and air pressure cause air to move; this movement of air is called [ ].

How do we predict weather?

- Areas of high [ ] usually indicate fair weather; areas of low pressure usually indicate rain, clouds, and storms.
- Weather can change rapidly along the boundaries between regional air masses called [ ].
- Technology scientists use to predict weather includes weather maps, weather balloons, satellites, and [ ].

What is severe weather?

- The most common type of severe weather event is a(n) [ ].
- The most violent thunderstorms can cause spinning funnels of air called [ ].
- Large, swirling storms that start as tropical-ocean thunderstorms merging around a low-pressure center are called [ ].

The water cycle is the process by which ocean water evaporates, condenses, and then falls as [ ] in the form of rain, sleet, snow, or hail.
The Atmosphere and Weather

Use your textbook to help you fill in the blanks.

Where is the weather?

1. The layer of the atmosphere in which most weather takes place is the _______________.

2. Weather variables include temperature, wind, moisture, cloud cover, and _______________.

What affects air temperature?

3. The angle of insolation depends on three factors: ________________, time of year, and time of day.

4. The three different temperature scales are Fahrenheit, Celsius, and _______________.

What are convection currents?

5. Convection currents can occur in the air, in the ocean, and in the thick, molten rock of Earth’s _______________.

6. Plate tectonics and different types of weather are affected by _______________.

What causes ocean currents?

7. Density, which is affected by ________________ and temperature, influences the movements of ocean currents.

8. The water in ________________ currents moves much slower than the water in surface currents.

What is El Niño/Southern Oscillation?

9. When El Niño occurs, little water is pushed across the ________________, and the ocean stays warm.
LESSON 10.

There is a(n) ____________ in the ocean-atmosphere system in the Pacific Ocean when El Niño occurs.

What is air pressure?

11. Air moves from areas where air pressure is _________________ to areas where air pressure is _________________.

12. Warm air is _________________ and has a(n) _________________ air pressure than cooler air, so warm air rises above cooler air.

13. Wind speed is measured with a(n) _________________, and wind direction is measured with a(n) _________________.

What are global winds?

14. The Coriolis effect causes winds in the Northern Hemisphere to curve _________________.

15. Winds that blow toward the equator and are curved to the west by the Coriolis effect are called _________________.

Critical Thinking

16. When would average air pressure in the United States be lower: in summer or in winter? Explain your answer.
The Atmosphere and Weather

Match the correct letter with the description.

1. ______ wind that blows from the land toward the sea

2. ______ a circular pattern of rising air, sinking air, and winds, caused by unequal heating and cooling of a region’s air

3. ______ the layer of the atmosphere closest to Earth’s surface

4. ______ the force exerted on a given area by impacts of gas particles in constant motion

5. ______ the amount of the Sun’s energy that reaches Earth at a given time and place

6. ______ the layers of gases that surround Earth

7. ______ the shift in the direction of global winds caused by Earth’s rotation

8. ______ wind that blows from the sea toward the land

9. ______ a continuous flow of water along a definite path

a. air pressure  
b. atmosphere  
c. convection cell  
d. Coriolis effect  
e. insolation  
f. land breeze  
g. ocean current  
h. sea breeze  
i. troposphere
The Atmosphere and Weather

Fill in the blanks.

Two key factors that determine the weather are temperature and air pressure. Air temperature depends mostly on the angle of __________ ; as the angle __________ , the air becomes warmer. Angle of insolation varies with __________ , time of day, and season.

Air rises and falls in a pattern known as a(n) __________ . In the ocean, __________ currents move much more slowly than __________ currents do. Some currents, such as ENSO, can affect global __________ .

Air pressure varies with __________ . Air moves from areas of higher pressure to areas of __________ pressure. Higher air pressure at the __________ than at the __________ causes global convection cells.
Precipitation and Clouds

Use your textbook to help you fill in the blanks.

How does the water cycle affect weather?

1. Water _______________ leaves the surface of lakes, streams, and oceans through a process called _______________.

2. When air cools, water molecules lose energy and change into liquid form. This process is called _______________.

3. The higher the temperature is, the _______________ water vapor the air can hold.

4. A measure of the amount of water vapor in the air compared to the total amount that the air could hold at that temperature is called _______________.

What are the types of clouds?

5. There are three basic cloud types: _______________, stratus, and cirrus.

6. A cloud that produces precipitation has the suffix _______________ or the prefix _______________ added to its name.

7. The amount of shading in a circle representing a weather station indicates the amount of _______________ present.

What are the different types of precipitation?

8. Sleet forms when _______________ freeze before falling to Earth’s surface and turn to pellets of ice.
What is a thunderstorm?

9. Thunderstorms begin when intense heat causes warm, moist air to rise quickly and form ________________ clouds.

10. A buildup of an electric charge inside a cumulonimbus cloud can produce a huge spark called ________________.

11. On very hot days, powerful updrafts during thunderstorms can cause funnels of violent, swirling wind called ________________.

What are hurricanes?

12. Thunderstorms over tropical oceans can merge into one large storm called a(n) ________________.

13. At the center of these merging thunderstorms is a large region of ________________ pressure.

How can we predict severe storms?

14. To find and track developing storms, scientists use weather satellites, radar, and ________________ fitted with special equipment.

Critical Thinking

15. At what time of year do most thunderstorms and hurricanes occur in the United States? Explain your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Precipitation and Clouds

Use the clues to fill in the crossword puzzle.

Across
1. a cloud that has a wispy, featherlike shape
3. the actual amount of water vapor in the air
5. a cloud that appears in blanketlike layers
6. the changing of a gas into a liquid as heat is removed

Down
1. a billowy, puffy cloud that seems to rise from a flat bottom
2. the changing of a liquid into a gas
3. a large, swirling storm with low pressure at the center
4. a violent, whirling wind that moves across the ground in a narrow path
**Precipitation and Clouds**

Fill in the blanks.

<table>
<thead>
<tr>
<th>cirrus</th>
<th>hail</th>
<th>stratus</th>
</tr>
</thead>
<tbody>
<tr>
<td>condensation</td>
<td>hurricanes</td>
<td>thunderstorms</td>
</tr>
<tr>
<td>Doppler</td>
<td>precipitation</td>
<td>tornadoes</td>
</tr>
</tbody>
</table>

Water from the surface of Earth’s oceans evaporates into water vapor in the atmosphere. Then, through ______________ it forms clouds. The three main types of clouds are ______________, ______________, and cumulus clouds. Eventually the water in clouds becomes too heavy for the cloud to hold and falls as ______________. Different types of precipitation include rain, sleet, ______________, and snow.

Cumulonimbus clouds can develop into ______________ with strong winds and heavy rain. The most severe thunderstorms can spawn ______________ with violent, whirling winds. Thunderstorms over tropical waters can develop into ______________.

Technological advances include weather satellites and ______________ radar. These devices help scientists predict the size and speed of approaching storms.
Predicting Weather

Use your textbook to help you fill in the blanks.

What are highs and lows?

1. Isobars spaced closely together indicate __________________________ wind speeds.

2. Air always flows outward from the center of a high-pressure system, and in the Northern Hemisphere, rotates in a __________________________ direction around it.

3. In the Southern Hemisphere, the patterns of movement around high- and low-pressure systems are the __________________________ of those in the Northern Hemisphere.

4. An area of high pressure usually indicates __________________________ weather.

5. When the barometer drops suddenly, __________________________ is likely.

What are weather fronts?

6. Air masses that form over land tend to be __________________________, and air masses that form over water tend to be __________________________.

7. Air masses that form in the tropics tend to be __________________________, and air masses that form near the poles tend to be __________________________.

8. The boundary between two air masses is called a(n) __________________________.
9. When a cold front catches up to a warm front, cool air moves ________________ the warm front.

10. To interpret a weather map, first look for the ________________, and then look at the movements of fronts.

11. In the Northern Hemisphere, fronts rotate ________________ around an area of low pressure.

How is technology used to study weather?

12. Weather factors at ground level, such as temperature, wind direction, wind speed, and humidity, are measured at ________________.

13. Weather conditions at high altitudes in Earth's atmosphere are measured from ________________.

14. Large weather patterns are shown with images from ________________.

15. Areas of precipitation and indications of wind speed can be determined by a special kind of radar called ________________.

Critical Thinking

16. Explain how you could use data from ground weather stations to plot highs, lows, and front lines on a weather map.

__________________________

__________________________

__________________________

__________________________

__________________________

__________________________
Predicting Weather

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

1. ______ I am a large region of the atmosphere in which the air has similar properties throughout. What am I?
2. ______ I am the lines on a weather map that connect places with equal air pressure. What am I?
3. ______ I am the place where warm air moves in over a cold air mass. What am I?
4. ______ I am a tool used to predict weather by showing different fronts and areas of high and low pressure. What am I?
5. ______ I am the place where cold air moves in under a warm air mass. What am I?
6. ______ I am the boundary between two air masses. What am I?
7. ______ I am the place where a cold front catches up with a warm front, forming a wedge of warm air between two masses of cold air. What am I?
8. ______ I am a special type of radar used to detect precipitation and give an indication of wind speed. What am I?

a. air mass  b. cold front  c. Doppler radar
d. front  e. isobars  f. occluded front
g. warm front  h. weather map

Name ___________________________ Date ___________
Predicting Weather

Fill in the blanks.

<table>
<thead>
<tr>
<th>clear</th>
<th>counterclockwise</th>
<th>thunderstorms</th>
</tr>
</thead>
<tbody>
<tr>
<td>clockwise</td>
<td>forecasts</td>
<td>warm front</td>
</tr>
<tr>
<td>clouds</td>
<td>fronts</td>
<td>weather</td>
</tr>
<tr>
<td>cold front</td>
<td>precipitation</td>
<td>wind</td>
</tr>
</tbody>
</table>

To predict weather, scientists study how air moves. Air pressure causes ______________ and influences ______________. To make accurate ______________, scientists must locate low- and high-pressure systems. A high-pressure system usually produces ______________ skies. A low-pressure system usually produces ______________ and ______________. In the Northern Hemisphere, winds flow ______________ around a high and ______________ around a low.

Weather maps track the movements of highs, lows, and ______________. At a(n) ______________, cold air pushes warm air upward; sometimes ______________ develop. A warm air mass moves over a cold air mass at a(n) ______________. Expect light precipitation both before and during the passing of a warm front.
Wildfire Alert

Read the Reading in Science feature in your textbook. Look for the events in the article, and notice the sequence in which they occur.

Sequence

Use the graphic organizer to record the sequence of events in the article.

First

Next

Last
Write About It

Sequence
1. How do the Santa Ana winds affect vegetation before the outbreak of a wildfire?
2. What happens if the Santa Ana winds blow during a wildfire?

Planning and Organizing

Write a sentence that explains how the Santa Ana winds occur.

Write a sentence that explains how the Santa Ana winds affect vegetation.

Drafting

Now explain what happens when a wildfire starts.

Next, tell what happens when the Santa Ana winds blow during a wildfire.
Climate

Use your textbook to help you fill in the blanks.

What is climate?

1. The average weather pattern of a region is its _____________.

2. Climate is closely related to _____________, which is the distance north or south of the equator.

3. Tropical zones, located near the _____________, have ____________ climates.

4. At latitudes near the poles, winters are long and _____________, and summers are short and cool.

What affects climate?

5. The two main factors that determine climate are _____________ and _____________.

6. Areas with a continental climate often have hot summers, cold winters, and _____________ annual precipitation.

7. Areas near the ocean often have warm summers, mild winters, and _____________ annual precipitation.

8. Areas in the path of a(n) _____________ coming from the water usually receive a high amount of precipitation.
9. As winds push air up the windward side of a mountain, the air cools, so clouds and ____________ form.

10. The Alps in Europe protect the Mediterranean coast from cold air that blows from the ____________.

11. Erupting volcanoes send dust, ash, and gases into the atmosphere, blocking ____________ and cooling the air and land.

**Have climates changed over time?**

12. Every 11 years the Sun has more ____________ than usual, causing Earth’s average temperature to ____________.

13. Continents have changed positions over time because of ____________.

14. Fossil evidence indicates that ____________ once grew in what are now cold areas of Canada.

**Critical Thinking**

15. The latitude 40°N cuts through the middle of the United States. What factors influence the climate in the United States along that latitude?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Climate

Fill in the blanks.

1. Areas near the equator with hot, wet climates are ____________________.

2. Areas near the poles that have long, frigid winters and short, cool summers are ____________________.

3. Regions located within a large landmass have a(n) ____________________.

4. Regions near an ocean or other large body of water have a(n) ____________________.

5. The height of an area in relation to sea level is ____________________.

6. The leeward side of a mountain where air becomes dry is said to be in a(n) ____________________.

7. Cold periods of Earth’s history when the brightness of the Sun may have changed are called ____________________.

8. Dark areas that appear temporarily on the Sun’s surface are called ____________________.
Climate

Fill in the blanks.

<table>
<thead>
<tr>
<th>altitude</th>
<th>cooler</th>
<th>elevation</th>
<th>equator</th>
<th>latitude</th>
<th>precipitation</th>
<th>rain shadow</th>
<th>windward</th>
</tr>
</thead>
</table>

The average weather pattern of a place is called its climate. To determine a region’s climate, average ___________ and temperatures are measured over several years. Climates vary from place to place, mostly because of ___________. Areas near the ___________ are warmer and wetter than areas near the poles. Regions near water have milder winters and ___________ summers than inland areas at the same latitude.

Another factor that can affect the average temperature and precipitation of a region is ___________. Mountain top temperatures decrease as a mountain’s ___________ increases. The ___________ side of a mountain is wetter, and the leeward side is in a(n) ___________.

Chapter 5 • Weather and Climate

Use with Lesson 4

Climate
Underground Homes

Write About It

Expository Writing  Choose one of these topics to compare and contrast.

1. Compare and contrast the price of an energy-saving air conditioner or refrigerator to the savings in energy costs. How long would it take the appliance to save as much as it costs?

2. Compare and contrast two brands of refrigerators. Which is more energy efficient? Use energy-guide labels to make your comparison.

Getting Ideas

One way to organize a comparison-and-contrast essay is through a point-by-point analysis. An attribute of the first item is compared to the same attribute of the other item. Repeat this process for each attribute. Use the Internet and the energy-guide labels on appliances to gather information for the chart below. In the top row, list the names of the two items you are comparing. In the left-hand column, list the attributes of each item that you are using to make your comparison.

<table>
<thead>
<tr>
<th>Item</th>
<th>Item</th>
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<tbody>
<tr>
<td>Attribute</td>
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<tr>
<td>Attribute</td>
<td></td>
</tr>
<tr>
<td>Attribute</td>
<td></td>
</tr>
</tbody>
</table>
Drafting

A good comparison-and-contrast essay contains a thesis statement that states the main idea. It should list the items that you are comparing and contrasting and the basis on which they are being compared and contrasted. Circle the sentence that Lee should use to state his main idea about his energy-saving device.

1. In a point-by-point analysis, the TriStar Deluxe refrigerator proved to be more efficient than the Kitchen Pro.
2. I like the TriStar Deluxe refrigerator better than the Kitchen Pro.

Now write your first draft. Use a separate piece of paper. Using a point-by-point analysis, include an introduction that states the items that will be compared and contrasted. The body of your essay should include details from your point-by-point analysis.

Revising and Proofreading

Some words and phrases signal comparison—for example, as, likewise, similarly, and in comparison. Some words and phrases signal contrast—for example, although, but, and on the other hand.

Now revise and proofread your essay. Ask these questions:

► Have I written a thesis statement about the energy-saving devices?
► Have I explained how the two items are similar and how they are different?
► Have I balanced the information equally for each item?
► Have I used signal words effectively?
► Have I ended with a conclusion based on the evidence presented?
► Have I corrected all grammar, spelling, punctuation, and capitalization errors?
Weather and Climate

Circle the letter of the best answer.

1. A tool used to measure air pressure is called __________.
   A a weather vane
   B an anemometer
   C a barometer
   D a thermometer

2. The most abundant gas in the atmosphere is __________.
   A nitrogen
   B carbon dioxide
   C water vapor
   D hydrogen

3. The lowest layer of the atmosphere is the __________.
   A stratosphere
   B thermosphere
   C ionosphere
   D troposphere

4. Humidity is __________.
   A the weight of the air
   B the amount of water vapor in the air
   C precipitation
   D how hot or cold the air is

5. The process by which a liquid changes into a gas is called __________.
   A condensation
   B freezing
   C evaporation
   D melting

6. Dew forms on grass when water __________.
   A condenses
   B evaporates
   C melts
   D freezes

7. Wispy clouds that form high in the sky are called __________.
   A cumulus clouds
   B stratus clouds
   C fog
   D cirrus clouds

8. An air mass that forms over tropical ocean water will be __________.
   A warm and dry
   B cold and dry
   C warm and moist
   D cold and moist
9. A cold air mass pushing under a warm air mass is called _______.
   A a warm front
   B a cold front
   C a stationary front
   D an occluded front

10. Fronts in the United States tend to move from _______.
     A west to east
     B east to west
     C north to south
     D south to north

11. The most violent thunderstorms can produce _______.
     A tornadoes
     B lightning
     C winter storms
     D hurricanes

12. Global winds are caused by _______.
     A temperature differences between high and low latitudes
     B temperature differences between high and low altitudes
     C ocean currents
     D mountain ranges

13. In general, areas of low pressure are associated with _______.
     A fair weather
     B cloudy skies
     C severe storms
     D rain and clouds

14. Earth receives the most direct rays from the Sun at _______.
     A the North Pole
     B the South Pole
     C the equator
     D the prime meridian

15. The measure of the weight of air pressing down on an area is called _______.
     A air pressure
     B temperature
     C precipitation
     D humidity

16. The type of front most likely to bring light, steady rain or snow to an area is _______.
     A a cold front
     B a warm front
     C a stationary front
     D an occluded front
Strong Storms
Read the Literature feature in your textbook.

Write About It
Response to Literature  This article describes the damage caused by severe rainstorms in Los Angeles. Research additional information about damage caused by severe rainstorms. Write a report about the effects of severe rainstorms. Include facts and details from this article and from your research.
Energy and Forces

Complete the concept map on forces, work, and motion, using words and phrases from your textbook.

**Force**
Definition: any push or ____________ on an object

**Energy**
Definition: the ability to cause change or do ______________

**Work**
Definition: a(n) ______________ moving an object through a(n) ______________

**Power**
Definition: The amount of work done per unit of ______________

**Forms of Energy**
1. Forms of energy include light, ______________, sound, ______________, and nuclear energy.
2. All moving objects have ______________ energy.
3. Energy that is stored is called ______________ energy.

**Characteristics of Motion**
1. speed: ______________
2. velocity: ______________
3. acceleration: ______________
Forces and Motion

Use your textbook to help you fill in the blanks.

What is motion?

1. Using distance and __________________ can help you identify the position of something.

2. When you ride in a car and the trees and buildings appear to you to move backward, you are observing _______ motion.

What are speed, velocity, and acceleration?

3. When you describe how fast something is moving, you are describing its _________________.

4. The ________________ speed of a moving object is the total distance traveled divided by the total amount of time.

5. If you know both the speed of an object and the direction in which it is moving, then you know the object’s _________________.

6. Like velocity, acceleration also has both ________________ and direction.

What is a force?

7. Forces can cause a moving object to _________________.

8. Weight is an example of a(n) ________________ force.
What are some forces?

9. Examples of forces are __________________, gravity, and magnetism.

10. A device used to measure force is a __________________ scale, and the unit of measurement of force is the __________________.

11. The three types of friction are static friction, __________________ friction, and rolling friction.

12. When molecules bump into a moving object and slow it down, __________________ force occurs.

How do forces affect each other?

13. Balanced forces are __________________ in strength and __________________ in direction.

What is inertia?

14. According to Newton’s first law of motion, the only way an object’s velocity can be changed is by applying an unbalanced __________________ force to it.

Critical Thinking

15. Describe two ways that forces and motion are at work as you make the trip from your house to school.

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
Forces and Motion

Use the clues to fill in the crossword puzzle.

Across
1. any push or pull on an object
2. a description of a moving object’s speed and direction
3. the length between two places
4. an object’s location compared to other things

Down
1. a change in the velocity of an object
2. a force that opposes the motion of an object
3. the distance that an object moves in a particular span of time
4. a change in an object’s position compared to a fixed object
Forces and Motion

Fill in the blanks.

<table>
<thead>
<tr>
<th>accelerate</th>
<th>friction</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>direction</td>
<td>inertia</td>
<td>velocity</td>
</tr>
<tr>
<td>force</td>
<td>speed</td>
<td></td>
</tr>
</tbody>
</table>

An object is in motion when it changes its position in relation to a fixed object. The position of an object can be determined using its distance and ________ in relation to another object. How fast an object moves is described as its ________. The speed and direction of an object describe its ________. Acceleration is a change in an object’s velocity over ________.

Any push or pull on an object is called a _________. A force can cause a moving object to _________. A force that opposes the motion of an object is called _________. An object’s tendency to keep moving at the same speed and in the same direction is called _________. This means that even though the car you are riding in stops suddenly, your body keeps moving forward until your seat belt stops you.
The Nature of Energy

Use your textbook to help you fill in the blanks.

What is energy?

1. The ability to cause change is called ________________.

2. When changes occur, energy ________________ from one place to another.

3. Change does not always involve motion because it comes in many ________________.

4. Some forms of energy include light, ________________, sound, ________________, and nuclear energy.

What are kinetic energy and potential energy?

5. All moving objects have ________________ energy because of their motion.

6. Energy that is stored is called ________________.

7. As a roller coaster goes down a hill, its potential energy ________________ and its kinetic energy ________________.

8. Kinetic energy can also be changed into ________________ energy.

What are the three forms of potential energy?

9. Energy stored in chemical bonds is ________________.

10. Some objects have energy because of their ________________ or physical properties.
11. The energy stored by something that can stretch or compress, such as a rubber band or a spring, is called ____________________.

12. The ____________________ of an object depends on the object’s mass and height above the ground.

How can potential energy be changed?

13. Objects with the same mass at different ____________________ have different gravitational potential energies.

14. A roller coaster with higher gravitational potential energy will have more ____________________ energy when it reaches the bottom of a hill.

Critical Thinking

15. Describe the different kinds of energy that a bowling ball may have when used.

__________________________

__________________________

__________________________

__________________________
The Nature of Energy

Match the correct letter with the description.

1. ______ I am a type of energy such as light, heat, sound, electricity, or nuclear energy. What am I?
2. ______ I am stored energy. I have the ability to cause change. What am I?
3. ______ I am energy stored in chemical bonds. What am I?
4. ______ I am the ability to cause change. What am I?
5. ______ I am the energy that a moving object has because of its motion. What am I?
6. ______ I am the energy stored by something that can stretch or compress. What am I?
7. ______ I am the energy stored by objects due to their position above Earth's surface. What am I?

a. chemical potential energy   e. gravitational potential energy
b. elastic potential energy     f. kinetic energy
c. energy                      g. potential energy
d. form of energy
The Nature of Energy

Fill in the blanks.

<table>
<thead>
<tr>
<th>chemical potential energy</th>
<th>elastic potential energy</th>
<th>increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>composition</td>
<td>forms</td>
<td>kinetic energy</td>
</tr>
<tr>
<td>decrease</td>
<td>gravitational potential energy</td>
<td>potential</td>
</tr>
</tbody>
</table>

Changes occur all the time. The ability to cause change is called ________________ . Energy comes in many ________________ , so you cannot always see the energy causing change. If an object is moving, it has ________________ . Objects that are not moving might be storing ________________ energy. If an object with potential energy moved, its potential energy would ________________ , but its kinetic energy would ________________ .

Potential energy comes from an object’s ________________ , shape, or position. Food has ________________ that your body releases when you eat. Rubber bands and springs store ________________ . Objects that can fall, slide, or roll have energy called ________________ . Potential energy can be ________________ depending on factors such as mass and height above ground.
Work, Energy, and Power

Use your textbook to help you fill in the blanks.

What is work?

1. Scientists define work as what is necessary for a(n) _______________ to move an object through a distance.

2. Work is equal to the force of a push or pull multiplied by the _______________ the object is moved.

3. When you multiply a force that is expressed in newtons by a distance expressed in meters, the answer is expressed in newton-meters, or _______________.

4. When an object is lifted at a constant speed, the force is equal to the _______________ of the object.

How does energy change form?

5. The ability to do work is _______________.

6. A rock located high above the ground and a stretched rubber band are two examples of objects with potential _______________.

7. All forms of energy have a(n) _______________, a means of transfer, and a receiver.
Where does energy go?

8. When you ride a bicycle, your body’s potential energy changes into _________________ energy as you pedal.

9. The __________________________ states that energy can never be created or destroyed.

10. The Sun’s energy is generated through a process called __________________________.

How do we use energy?

11. Plants use light energy from the Sun to build molecules of sugar, which store _________________ energy.

12. As a car moves, its engine changes the chemical energy of fuel into _________________ energy.

What is power?

13. Power is the amount of _________________ done divided by time.

14. Work is expressed in joules per second, or _________________.

Critical Thinking

15. Follow the chain of energy from a plant to a person riding a skateboard. Explain what type of energy is being used at each step.

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________
Work, Energy, and Power

Match the correct letter with the description.

| a. energy                  | f. power          | j. law of conservation of energy |
| b. joule                  | g. thermal energy | k. energy transformation         |
| c. kinetic energy         | h. watt           |                               |
| d. nuclear fusion         | i. work           |                               |
| e. potential energy       |                   |                               |

1. _______ the amount of work done per unit of time
2. _______ the unit used to measure work, equal to one newton-meter
3. _______ energy that is stored
4. _______ what is necessary for a force to move an object
5. _______ the ability to do work
6. _______ the energy of motion
7. _______ the standard unit of power, equal to one joule per second
8. _______ the heat energy in an object
9. _______ the process by which the Sun and other stars convert a tiny amount of mass into an enormous amount of energy
10. _______ matter can neither be created or destroyed
11. _______ when one form of energy is converted to another form of energy
12. _______ the power created when atoms are split
Work, Energy, and Power

Fill in the blanks.

<table>
<thead>
<tr>
<th>change</th>
<th>distance</th>
<th>force</th>
<th>potential</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>conservation</td>
<td>divide</td>
<td>kinetic</td>
<td>processed</td>
<td>work</td>
</tr>
</tbody>
</table>

Energy cannot be created or destroyed, but it is constantly changing forms. As you lift an object in the air, you are applying a(n) _______________ to counteract gravity.

To calculate the work done, you multiply this force by the _______________ the object moves. To calculate the power used, take the amount of _______________ and _______________ it by the _______________ used to do that work.

According to the law of _______________ of energy, energy cannot be created or destroyed. However, it can _______________ from one form to another. Plants such as wheat and corn are _______________ to make cereal. If you eat this cereal, your body changes the chemical energy to _______________ energy. Once you become active and begin to move around, your body changes the potential energy to _______________ energy.
Museum Mail Call

Read the Reading in Science feature in your textbook. Look for clues you can combine with your own knowledge to make accurate inferences.

**Infer**

Use the graphic organizer to make inferences about what you read concerning energy conservation.

<table>
<thead>
<tr>
<th>Clues</th>
<th>What I Know</th>
<th>What I Infer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Write About It

Infer

1. Which washing machine do you think uses more energy: one washing clothes in cold water or one using hot water? Why?

2. How does sealing air leaks around windows save energy?

Planning and Organizing

1. Explain whether you think cold water or warm water would require more energy to produce. Give reasons for your explanation.

   _______________________________________________________
   _______________________________________________________
   _______________________________________________________
   _______________________________________________________

2. Describe how sealing windows would save energy.

   _______________________________________________________
   _______________________________________________________
   _______________________________________________________
   _______________________________________________________
   _______________________________________________________

Drafting

Now, using your explanations from above, write a summary of what you can do to help save energy around your house.

   _______________________________________________________
   _______________________________________________________
   _______________________________________________________
   _______________________________________________________

Energy and Forces

Circle the letter of the best answer.

1. A change in an object’s position compared to the position of another object is called ________.
   A force
   B motion
   C speed
   D distance

2. The distance that an object moves, divided by the time it takes to move, is the object’s ________.
   A position
   B apparent motion
   C acceleration
   D speed

3. A description of a moving object’s speed and direction is its ________.
   A velocity
   B average speed
   C lift
   D thrust

4. A change in the velocity of an object over time is called ________.
   A continuous force
   B inertia
   C acceleration
   D speed

5. Anything that pushes or pulls an object is a ________.
   A mass
   B weight
   C thrust
   D force

6. A negative force that opposes the motion of an object is called ________.
   A friction
   B universal gravitation
   C inertia
   D effort force
7. Something that is capable of causing change has __________ .
   A  heat
   B  motion
   C  energy
   D  electricity

8. The energy of motion is called __________ .
   A  potential energy
   B  stored energy
   C  thermal energy
   D  kinetic energy

9. The energy stored in bonds between atoms is called __________ .
   A  energy of position
   B  chemical potential energy
   C  elastic potential energy
   D  gravitational potential energy

10. Two objects with the same mass at different heights have different __________ .
    A  stored energies
    B  kinetic energies
    C  chemical potential energies
    D  gravitational potential energies

11. The application of force to move an object through a distance is called __________ .
    A  joules
    B  work
    C  power
    D  effort

12. Friction can convert kinetic energy to __________ .
    A  A thermal energy
    B  kinetic energy
    C  potential energy
    D  conservation of energy

13. The process by which the Sun and other stars generate energy is called __________ .
    A  friction
    B  air resistance
    C  nuclear fusion
    D  nuclear power

14. The amount of work done per unit of time is called __________ .
    A  power
    B  energy
    C  effort
    D  force
Exploring Energy

Complete the concept map on sound, light, heat, and electricity and magnetism, using words and phrases from your textbook.

**Sound**
- Sound is a wave consisting of compressions and ____________________.
- Properties of sound include pitch (how high or low) and ____________________ (how loud or quiet).

**Waves**
- Waves are disturbances that transfer ____________________ from one point to another.
- Waves are measured by their wavelength, amplitude, and ____________________.
- Waves are classified by the type of ____________________ they cause in a medium.

**Heat**
- Heat is the flow of thermal ____________________ from one substance to another.
- Heat can travel by ____________________, convection, or radiation.

**Light**
- Light is a form of energy that travels in straight lines called ____________________.
- Objects can let light pass through them, can absorb light, can bend light, or can ____________________ light.

**Electricity**
- Electricity refers to the movement and ____________________ of the energy of charged atomic particles.
- A current-carrying wire also has a magnetic field and can ____________________ metal objects.
Waves and Sound

Use your textbook to help you fill in the blanks.

How do waves work?

1. Waves are disturbances that transfer __________ from one point to another.
2. Waves that travel through a medium and cause matter to move up and down are called __________ waves.
3. Waves that cause matter to move back and forth are called __________ waves.
4. Every wave has a point of greatest compression, called a __________, and a point of least compression, called a(n) __________.

How can you measure waves?

5. The distance between wave crests or troughs is called __________.
6. The number of wave crests that pass a point in one unit of time is a wave’s __________.

How does sound travel?

7. A sound wave is a(n) __________ wave produced by vibrations in matter.
8. When sound waves travel from one type of medium to another, the waves refract, or change __________.
What are properties of sound?

9. The highness or lowness, or the _____________, of a sound depends on the frequency of the sound waves.

10. The pitch of a sound changes when the source or the listener is in motion because of the _____________.

11. The motion of two or more waves passing through the same medium at the same time is called _____________.

How do we hear music?

12. Guitars and violins are examples of _____________ instruments.

13. We hear sounds because sound waves strike our _____________ and cause them to vibrate.

14. A pleasant combination of sounds is called _____________, and an unpleasant combination of sounds is called _____________.

Critical Thinking

15. How does sound travel from a piano to make music?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Waves and Sound

Match the correct letter with the description.

1. _______ when the direction of a wave changes because of a change in medium

2. _______ a measure of how many wave crests or troughs pass a given point in one unit of time

3. _______ when the pitch of a sound changes because the source or the listener is in motion

4. _______ the amount of time it takes for a wave to complete one full cycle

5. _______ the distance between wave crests or troughs

6. _______ an area in a sound wave where particles of matter are spread apart

7. _______ an area in a sound wave where particles of matter are pushed together

8. _______ the height of a wave from its trough or crest to its midpoint, which is also a measure of the wave’s intensity

9. _______ how waves bounce off an object and change their direction of travel

- a. amplitude
- b. compression
- c. Doppler effect
- d. frequency
- e. period
- f. rarefaction
- g. reflection
- h. refraction
- i. wavelength
Waves and Sound

Fill in the blanks.

<table>
<thead>
<tr>
<th>compressions</th>
<th>intensity</th>
<th>pitch</th>
<th>spread apart</th>
</tr>
</thead>
<tbody>
<tr>
<td>frequency</td>
<td>medium</td>
<td>rarefactions</td>
<td>wavelength</td>
</tr>
</tbody>
</table>

Sound is a type of wave called a compressional wave. Sound waves cause the particles making up a(n) ________ to squeeze together and then ________. The places in a sound wave where the particles are close together are called ________. The places where the particles are spread apart are called ________.

Sound waves have a(n) ________, which is the distance from one crest, or point of greatest compression, to the next. Sound waves also have a(n) ________, which is the number of compressions that pass a point in one second. The frequency of a sound wave determines its ________. The amplitude of a sound wave is a measure of the wave’s ________. The loudness of sound is measured in a unit called the decibel.
Properties of Light

Use your textbook to help you fill in the blanks.

How does light travel?

1. Light travels in a straight line called a(n) _________________.

2. Light waves can travel through empty space without needing a solid, liquid, or gas _________________.

3. Rays of light pass through a(n) ________________ object with almost no disturbance.

4. Some rays of light pass through a(n) ________________ object, and some light rays are blocked or bent in different directions.

5. Rays of light are reflected or absorbed by a(n) ________________ object.

How does light interact with mirrors?

6. Light rays that bounce off a(n) ________________ can form an image of an object.

7. If you raise your left hand in front of a mirror, in your ________________ it appears that your ________________ hand is raised.

8. When light rays strike a dull or rough surface, they do not form a(n) _________________.

9. Concave mirrors curve inward, convex mirrors curve outward, and ________________ mirrors are flat.
10. The type of mirror that is used to gather light inside a telescope is the ________________ mirror.

How does light interact with lenses?

11. A convex lens is ____________________ in the middle than at its edges; a concave lens is ____________________ in the middle than at its edges.

12. The point at which the light rays passing through a lens meet is called the ________________.

13. An image that is formed by a concave lens is ____________________ and smaller than the actual object.

How do we correct vision?

14. If your eye shape is even slightly off, your vision may be ____________________.

15. Nearsightedness causes light rays from distant objects to be focused in front of the ________________.

Critical Thinking

16. How do sunglasses work to protect your eyes?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
Properties of Light

Use the clues to fill in the crossword puzzle.

<table>
<thead>
<tr>
<th>concave</th>
<th>lens</th>
<th>absorption</th>
<th>law of reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>convex</td>
<td>mirror</td>
<td>refraction</td>
<td></td>
</tr>
</tbody>
</table>

**Down**

1. the angle between an incoming light ray and a reflected light ray, from a surface, is equal

2. the process of taking in radiant energy

**Across**

1. transparent material with at least one curved surface

3. a surface that curves inward

4. when the direction of a wave changes due to a change in medium

5. an object with a polished surface that forms reflected images

6. a surface that curves outward
Properties of Light

Fill in the blanks.

<table>
<thead>
<tr>
<th>concave</th>
<th>opaque</th>
<th>translucent</th>
</tr>
</thead>
<tbody>
<tr>
<td>convex</td>
<td>reflect</td>
<td>transparent</td>
</tr>
<tr>
<td>mirror</td>
<td>retina</td>
<td></td>
</tr>
</tbody>
</table>

Light travels in waves that spread out as they move away from their source. When an object lets light pass right through it, the object is described as _______________.

When an object lets some light through but also blocks or bends some of the light away, it is described as ________________.

Objects that do not allow any light to pass through them are described as ________________.

An object with a polished surface that forms reflected images is called a(n) _________________. When light hits a dull or rough surface, it may still ________________, but it will not form an image. When light passes through a(n) ________________ lens, the light rays are refracted together. When light passes through a(n) ________________ lens, the light rays are refracted apart. Light rays entering the eye are supposed to focus on the ________________.
Seeing in Infrared

Read the Reading in Science feature in your textbook. Look for information you can compare and contrast.

**Compare and Contrast**
Use the graphic organizer to compare and contrast topics in the article.
Write About It

Compare and Contrast

1. How is infrared radiation different from visible radiation?

2. What do the bolometer, night-vision goggles, and the Spitzer Space Telescope have in common?

Planning and Organizing

Write additional details for each of the following terms:

infrared radiation:

visible radiation:

bolometer:

night-vision goggles:

_Spitzer Space Telescope:_

Drafting

Now explain the differences between infrared radiation and visible radiation.

Next, explain the similarities between the bolometer, night-vision goggles, and the Spitzer Space Telescope.
Heat

Use your textbook to help you fill in the blanks.

What is heat?

1. Heat is a form of ________________ energy caused by the movement of the molecules that make up all matter.

2. The amount of energy needed to raise the temperature of 1 gram of water by 1°C is called a(n) ________________.

3. As heat flows into a substance, the kinetic energy of the ________________ in the substance increases.

How does heat travel?

4. Heat energy can move in three ways: by conduction, by convection, and by ________________.

5. Conduction is the movement of energy when two materials ________________ and energy flows from one material to the other.

6. Conductors are materials that ________________ heat and distribute it evenly throughout an object.

7. Because most liquids and gases become less dense when heated, ________________ occurs.

How do we use heat?

8. In a hot-water heating system, water is used to transfer energy from a(n) ________________ to the air in a room.
9. In a forced-air heating system, a room is heated by _______ alone.

10. Heating systems turn on and off automatically because they are controlled by a(n) _______ switch.

11. Gasoline is the fuel that is burned in the engine of a car, but it is _______ energy that actually makes the engine move.

**How is temperature measured?**

12. Temperature, which is a measure of the average kinetic energy of a substance’s molecules, is measured with _______.

13. The rate at which a substance warms up upon absorbing heat is a(n) _______ property of matter.

14. The amount of energy needed to raise the temperature of 1 gram of a substance by 1°C is the substance’s _______.

**Critical Thinking**

15. What do you think would happen if you were to put an inflated balloon in the freezer?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Heat

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. conduction</th>
<th>e. radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. convection</td>
<td>f. specific heat</td>
</tr>
<tr>
<td>c. heat</td>
<td>g. temperature</td>
</tr>
<tr>
<td>d. insulation</td>
<td>h. thermal expansion</td>
</tr>
</tbody>
</table>

1. _______ I am the measurement of the average kinetic energy of the molecules of a substance. What am I?
2. _______ I am the transfer of energy by electromagnetic waves. What am I?
3. _______ I tell how much energy is needed to raise the temperature of 1 gram of a substance by 1°C. What am I?
4. _______ I am the flow of thermal energy from one substance to another. What am I?
5. _______ I am a material that absorbs some heat, but I do not transfer it very well. What am I?
6. _______ I am the movement of energy through direct contact. What am I?
7. _______ I am the transfer of energy by the flow of a liquid or a gas. What am I?
8. _______ I am an increase in volume that is caused by an increase in temperature. What am I?
Heat

Fill in the blanks.

boiler  heat  kinetic  pistons  speed
expand  hot air  molecules  radiation  thermostat

Heat is a form of kinetic energy. It is caused by the movement of the ___________ that make up all matter.

Temperature is the measure of the average ___________ energy of the molecules in a substance.

When the average ___________ of molecules rises, the temperature also increases.

Heat can be transferred from one object to another by conduction, convection, or ___________. Buildings heated by a hot-water system use hot water to transfer energy from a(n) ___________ to the air in a room.

Forced-air systems use ___________ to heat the air in a room. These systems are typically controlled by ___________ switches.

Cars also operate by ___________ energy. When gasoline is burned, heat causes gases to ___________ and push on ___________ that turn a crankshaft. This propels the vehicle forward.
Electricity and Magnetism

Use your textbook to help you fill in the blanks.

What is electricity?

1. Atoms are made up of ________________, neutrons, and electrons.

2. When an atom loses an electron, it becomes ________________ charged, and the atom that gains an electron becomes ________________ charged.

3. The buildup of a positive or negative electric charge on a material’s surface is called ________________.

How can electricity jump?

4. A rapid movement of electrons that corrects an imbalance of charges is called a(n) ________________.

5. A charged object can cause a(n) ________________ in another object.

6. Conductors allow an electric charge to flow easily, and ________________ do not.

How can electricity flow?

7. A simple circuit consists of an electrical ________________, a device such as a lamp, and connecting wires.

8. A switch is used to control the flow of ________________ in a circuit.

9. Direct current flows in one direction; alternating current is transmitted when current changes direction, moving back and forth at regular ________________.
What are some kinds of circuits?

10. Electricity can follow only one path through a __________ circuit, but it can follow __________ paths through a parallel circuit.

What are magnets?

11. Iron, ___________, and cobalt form strong magnets.

12. A current-carrying wire has a(n) ___________ and can pick up certain metal objects, just as a common magnet can.

How do we use generators?

13. A generator converts ________________ into electricity.

14. A transformer that increases voltage so that current electricity can be sent over long distances more efficiently is used in a(n) ________________.

What are some tips on using electricity?

15. You can save fuel and save money by ________________ energy.

Critical Thinking

16. How can you use a magnet to find which direction is north?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
Electricity and Magnetism

Fill in the blanks.

- current electricity
- magnetic field
- static electricity
- electricity
- parallel circuit
- series circuit
- electromagnet

1. The buildup of a positive or negative electric charge on a material’s surface is called ________________.

2. The invisible area where the forces of magnetic attraction or repulsion can be detected is called a(n) ________________.

3. The flow of electrons through a circuit is called ________________.

4. A circuit in which there is only one path along which current electricity can flow is called a(n) ________________.

5. A circuit in which there are multiple paths along which current electricity can flow is called a(n) ________________.

6. The movement and transfer of the energy of charged atomic particles is described as ________________.

7. A device that is magnetized by current electricity is called a(n) ________________.
Electricity and Magnetism

Fill in the blanks.

<table>
<thead>
<tr>
<th>circuit</th>
<th>insulation</th>
<th>running water</th>
</tr>
</thead>
<tbody>
<tr>
<td>circuit breakers</td>
<td>open</td>
<td></td>
</tr>
<tr>
<td>closed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>power plant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Many things happen when you turn on a light in your house. The light switch is part of a(n) _______________. When the switch is turned on, the circuit is _______________, and electricity flows through wires to the light bulb. When the switch is turned off, the circuit is _______________, and electricity does not flow.

The electricity in a home comes from an electric _______________, where generators use fossil fuels, nuclear power, or _______________ to produce electricity.

Because electricity is extremely dangerous, wires are covered with plastic that serves as _______________. To prevent a circuit from being overloaded by too much current, fuses or _______________ are used to stop the flow of electricity. It is important to use electricity safely and to conserve energy.
Exploring Energy

Circle the letter of the best answer.

1. The height of a wave is called ___________.
   A. wavelength
   B. amplitude
   C. rarefaction
   D. compression

2. An example of a compression wave is ___________.
   A. a transverse wave
   B. a gamma ray
   C. a reflection
   D. a sound wave

3. Sounds that have a high pitch also have a high ___________.
   A. frequency
   B. volume
   C. rhythm
   D. crest

4. When the direction of a wave changes because of a change in medium, it is called ___________.
   A. reflection
   B. refraction
   C. the Doppler effect
   D. constructive interference

5. Matter that allows light to pass through with almost no disturbance is described as ___________.
   A. opaque
   B. translucent
   C. transparent
   D. concave

6. An item that forms images by reflection is called ___________.
   A. a prism
   B. a lens
   C. a bulb
   D. a mirror

7. The type of lens that curves inward and is thinner in the middle is described as ___________.
   A. concave
   B. convex
   C. opaque
   D. reverse
8. A measure of the average kinetic energy of the particles in a substance is __________.
   A temperature  
   B specific heat  
   C thermal energy  
   D electric energy

9. The unit most commonly used to measure heat is the __________.
   A decibel  
   B hertz  
   C volt  
   D calorie

10. The transfer of energy by currents of a liquid or gas is called __________.
    A convection  
    B conduction  
    C radiation  
    D expansion

11. The amount of energy needed to raise the temperature of 1 gram of a substance by 1°C is __________.
    A temperature  
    B compression stroke  
    C thermal expansion  
    D specific heat

12. A buildup of electric charge on a material’s surface is called __________.
    A current electricity  
    B static electricity  
    C voltage  
    D insulation

13. When a charged object is placed near a neutral object, the result is __________.
    A an induced charge  
    B a magnetic field  
    C a parallel circuit  
    D an electromagnet

14. A device that is magnetized by current electricity is called __________.
    A a generator  
    B an electromagnet  
    C a series circuit  
    D a parallel circuit
Out of Sight

**Write About It**

**Response to Literature** This article compares the ways in which different animals see. What role does light play in sight? Think about how things look during the day and at night. Write a brief essay about an indoor or outdoor scene, comparing how it looks to you during the day and at night.
What is technology?

Use your textbook to help you fill in the blanks.

Ways People Move

1. Technology is how humans adapt ________________ to meet certain ________________ and ________________.

2. ________________ has been around since the beginning of time, when people used ________________ from nature to create things such as homes, furniture, and paper.

3. The ________________ industry has led to the development of other industries, such as oil refineries, highway construction, and car repair shops.

Science and Technology

4. ________________ and ________________ depend on each other because people who design things must understand certain scientific concepts.

5. Two of the concepts that transportation designers must understand are ________________ and ________________.

6. With the invention of the ________________ in 3500 B.C., moving things from place to place became much easier.

7. By 2000 B.C., people were using ________________, which were two-wheeled carts pulled by horses.

Critical Thinking

8. What forms of technology did you use today? How did they help meet your needs and wants?

______________________________
What is technology?

Match the correct letter with the description.

<table>
<thead>
<tr>
<th>a. design</th>
<th>c. mass transit</th>
<th>e. technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. industrialization</td>
<td>d. properties</td>
<td></td>
</tr>
</tbody>
</table>

1. ______ physical aspects of materials chosen for the design of a product
2. ______ systems designed to transport large numbers of people
3. ______ technological advances that led to the development of companies that design, develop, manufacture, and sell new products
4. ______ the means by which humans adapt nature to meet their needs and wants
5. ______ the process of imagining how to shape materials from nature into useful products
What is technology?

Fill in the blanks.

<table>
<thead>
<tr>
<th>technology</th>
<th>science</th>
<th>materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>mass transit</td>
<td>industrialization</td>
<td>transportation</td>
</tr>
<tr>
<td>wheel</td>
<td>steam engine</td>
<td>properties</td>
</tr>
</tbody>
</table>

_______________ is the way people adapt nature to meet their needs and wants. The first humans shaped Earth's materials into tools and other necessities. These discoveries and those that followed led to ________________.

Technology and ________________ are dependent on each other. People who work in technology must understand the ________________ of certain ________________ to know which of them will work best in a product.

One example of technology at work is the development of the ________________ industry. People needed a way to move easily from place to place, so in 3500 B.C. they began using the ________________. Many years later, scientists developed a ________________ that worked by turning wood and coal into energy. Today, people use ________________, such as trains and buses, to get from place to place.
Right on Track!

Read the Writing in Science feature in your textbook.

Write About It
Expository Writing Use the Internet to identify what problems mass transit systems are designed to address. Write a plan to develop or improve a system near you. Find real-life examples to help you predict how much time, materials, and money it would take. Then draw a picture or make a model.

Getting Ideas
In the left column, list specific problems that mass transit would alleviate. In the right column, indicate how each problem would be addressed by mass transit.

<table>
<thead>
<tr>
<th>Problem</th>
<th>How Mass Transit Solves the Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>driving time</td>
<td>less travel time because of less road congestion or no road congestion if you are on a train</td>
</tr>
</tbody>
</table>

Write About It

Expository Writing Use the Internet to identify what problems mass transit systems are designed to address. Write a plan to develop or improve a system near you. Find real-life examples to help you predict how much time, materials, and money it would take. Then draw a picture or make a model.
Drafting
Explanatory writing informs or explains. It is very important to understand your subject clearly before you try to explain it to someone else. An effective introduction to an explanatory piece of writing should state the object, problem, or challenge to be addressed. Write several sentences in the space below that best describe the topic you will be discussing in your explanatory writing. Use the graphic organizer on the previous page as a guide.

Now, begin your first draft. Begin with your introductory sentences to help readers understand some important details about the challenge or problem to be addressed. In a second paragraph, describe how you plan to address those problems by designing a new mass transit system or improving upon one that already exists where you live. Finally, give details as to how much time, the type of materials, and how much money would be required to make the changes you have suggested.

Revising and Proofreading
Explanatory writing involves supporting statements with details. For each statement you make about problems solved by mass transit systems, be sure to include reasons or examples to help the reader better understand your subject.

Now revise and proofread your writing. Ask these questions:

- Have I written about each of problems I identified in the Getting Ideas section?
- Have I clearly organized the information gathered about costs, materials, and so on, and presented it in an easily understandable way?
- Would a map, table, or drawing of the plan and associated information help the reader understand the proposal better?
The Design of Things

Use your textbook to help you fill in the blanks.

1. A ________________ is a person who makes a detailed plan to turn an idea into reality.

2. An ________________ designs and builds technological solutions and usually specializes in one area.

Improving Old Ideas

3. The development of air travel is one example of how ________________ improves old ideas.

The Design Process

4. The ________________ is a step-by-step procedure that includes drawing plans, building models, and conducting tests.

5. The final step in the design process is the production of a ________________, which is a full-scale working version of the product.

More Is Less?

6. The invention of ________________ helped computer technology develop from the 30-ton ENIAC to smaller, portable devices.

Critical Thinking

7. Suppose that you want to improve a toaster oven. Where would you begin? Which steps would you take?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
The Design of Things

Use the clues to unscramble each word. Then unscramble the circled letters to answer the last question.

<table>
<thead>
<tr>
<th>Word</th>
<th>Unscrambled Word</th>
<th>Clue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. MTCAIESCH</td>
<td>a detailed drawing that shows the parts of a designed object</td>
<td></td>
</tr>
<tr>
<td>2. NINTAOOCSTR</td>
<td>obstacle to overcome when designing a product or process</td>
<td></td>
</tr>
<tr>
<td>3. GESNID OCRSEPS</td>
<td>identifying a problem and listing ideas for a solution</td>
<td></td>
</tr>
<tr>
<td>4. RGENIEEN</td>
<td>individual classified according to the kinds of designs that he or she makes: civil, mechanical, aerospace, biomedical, agricultural</td>
<td></td>
</tr>
<tr>
<td>5. DLEMO</td>
<td>built with specified materials according to design; item helps people visualize what the finished object will look like</td>
<td></td>
</tr>
<tr>
<td>6. TYOTEPROP</td>
<td>full-sized model that can be tested</td>
<td></td>
</tr>
<tr>
<td>7. OTSRISNTRA</td>
<td>conducts electricity faster than vacuum tubes do</td>
<td></td>
</tr>
<tr>
<td>8. What kind of engineer designs machines and parts?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LESSON Vocabulary

Name ___________________________ Date ____________
The Design of Things

Fill in the blanks.

transistors engineers solutions
schematic improving model
prototype designers ENIAC

A large part of modern technology depends upon _________ on old ideas. One example of an improvement of an old idea is the development of the computer. In 1945, a computer called _________ was built. It weighed nearly 30 tons! However, because of the invention of small devices called _________, computers have become much smaller and more powerful.

Many people work on a product as it goes through the design process. _________ take an idea and draw up a detailed plan to turn it into reality. _________ use math and science to design and construct technological solutions.

The first step in the design process involves finding _________ to a problem. After a designer or an engineer chooses the best solution, he or she makes a _________ that shows all of the product’s parts and how they work. From the schematic, a _________ of the product is built. The final step is the building of a _________ that can be tested.
Designing Safer Cars

Read the Writing in Science feature in your textbook.

Write About It

Expository Writing  Create a survey that asks drivers what problems they have. Give it to people who drive and use their responses to come up with ideas to solve a specific need. Research the solutions to get an idea of possible constraints, such as time, money, and materials. Then draw a schematic of the best solution.

Getting Ideas

To design a safer car, you must know about the dangers that drivers face. Write Problems Facing Drivers in the Main Idea column. In the Details column, identify the kinds of road hazards or dangerous situations that drivers may encounter.

<table>
<thead>
<tr>
<th>Main Idea</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers Face Many Problems</td>
<td></td>
</tr>
</tbody>
</table>

Drafting

Whether the questions in a survey are answered thoughtfully depends on how well the questions in the survey are written. Most problems related to hazardous driving conditions concern road conditions or drivers’ behavior. In the space below, write one question for your survey related to hazardous road conditions. To ensure a detailed answer from the person taking the survey, make sure that your question cannot be answered with yes or no.
Now write the first draft of your survey. Use a separate sheet of paper. Include several questions that each describe various conditions related to road-related and driver-related driving hazards.

**Revising and Proofreading**

Make sure that you have about the same number of questions that relate to road conditions as questions that relate to driver behaviors. Identify the following descriptive phrases as relating more directly to road or driver.

1. staying awake
2. potholes
3. deer
4. sharp curves

Now revise and proofread your writing. Ask these questions:

- Have I described the driver and road condition hazards clearly?
- Do my questions cover a variety of situations?
- Are my questions addressing situations that can be corrected by an improved car design?
Technology in Communications

Use your textbook to help you fill in the blanks.

1. ________________ is the exchange of ideas and information through speaking, writing, and the use of signs and symbols.

2. The discovery of ________________ allowed people to communicate more easily over long distances.

3. First came the ________________ , followed by the telephone, radio, and television.

4. A group of separate parts called a ________________ work together to make communication possible, including satellites and computers.

5. Some technologies, such as the system of computers and files called the ________________ , use wireless systems to send signals.

6. The communication process has four steps, which are input, ________________ , output, and ________________ .

Critical Thinking

7. How might the world be different without the advancements in communication technology during the last century? Include at least three ways in your answer.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Technology in Communications

Match the correct letter with the description.

<table>
<thead>
<tr>
<th></th>
<th>a. communication</th>
<th>c. fiber optics</th>
<th>e. Internet</th>
<th>g. process</th>
</tr>
</thead>
<tbody>
<tr>
<td>b.</td>
<td>feedback</td>
<td>d. input</td>
<td>f. output</td>
<td>h. system</td>
</tr>
</tbody>
</table>

1. ______ the exchange of ideas and information
2. ______ a huge system of interconnected computers and files
3. ______ an initial signal or information that starts a process
4. ______ a group of separate parts that work together to do something
5. ______ hardware that sends signals using light
6. ______ a signal, information, or response that returns to the source
7. ______ a series of steps or changes starting with input and ending with feedback
8. ______ a signal or information that results from processing
Technology in Communications

Fill in the blanks.

feedback communication output system
process pixels digital
wireless input Internet

The telephone and the computer are forms of ______________ technology. They help you exchange ideas and information with others.

When you communicate with someone using a computer or other device, you’re part of a ______________ , or group of parts that work together. A communications system includes four steps. The first step is ______________ , or the e-mail message you send. The computer itself is the ______________ because it sends the message over the ______________ . When your friend receives the message on his or her computer, that is considered ______________ . When your friend responds, he or she is providing ______________ .

Once the telegraph transmitted messages across electrical wires. Now, because of ______________ technology, you can use your computer without any wires at all!

Just a few years ago, cameras needed film to preserve pictures. Today, ______________ cameras store the images on a memory card. What you see are actually millions of tiny ______________ that form a picture. Now that’s technology!
That Colorful TV
Read the Writing in Science feature in your textbook.

Write About It
Expository Writing  Research more about the history of the television. Write a report using the details you find in your research. Then make a time line to identify how television has impacted society at various times.

Getting Ideas
Television technology, broadcasting, and programming have changed drastically since the introduction of television. In the graphic organizer below, place these events in chronological order. *Chronological order* is the order in which certain events happened.

- Coaxial cable was invented, allowing more information to be delivered to each television.
- Television was introduced at the World’s Fair.
- People began to purchase televisions for their homes.
- Color television was introduced.

First

Next

Next

Last
Drafting
Expository writing, or exposition, is a type of writing that is used to explain, describe, give information, or inform. The writer cannot assume that the reader has any prior knowledge or understanding of the topic. The introductory sentence of an expository report should clearly state the topic that will be addressed. Circle the sentence below that is the better introductory sentence for your report.

1. Television has a long and interesting history; it has come a long way since the early beginnings in the 1950s.

2. The history of television shows a fascinating relationship between advances in technology and the effects of that technology on society.

Now write your first draft on a separate sheet of paper. Use your introductory sentence and the information in the sequencing graphic organizer as a basic outline. In your report, mention each piece of information from the graphic organizer, and describe how that advancement in television technology affected society. Use your final report to help you construct a time line of television history.

Revising and Proofreading
Expository writing can be organized in a number of different ways. Your report should not only show events in a chronological order, but it should also show cause and effect relationships—what changes did television technology cause for society?

Revise and proofread your narrative. Ask these questions:

► Have I discussed events in a logical or chronological order?

► Have I provided enough detail to show the relationship between television and society?

► Could my report be understood by someone with no prior knowledge or understanding of this topic?
Technology in Medicine

Use your textbook to help you fill in the blanks.

1. Medical technology was used by our prehistoric ancestors, who used ___________ to meet human medical needs.

Modern Medicine

2. Modern medicine began in the country of ___________, where the first pharmacists prepared and dispensed medicine.

3. ___________ discovered a vaccine for smallpox by injecting cowpox microbes into a young boy.

Modern Medical Techniques

4. ___________ and ___________ show a three-dimensional view of the inside of the body.

Getting Down to Genes

5. ___________ is a science that studies how characteristics are passed from generation to generation.

Bio-basics for Solutions

6. The use of ___________ includes altering the genes of plants and creating pesticides from naturally occurring bacteria.

Critical Thinking

7. What are some of the risks of genetic engineering? What are some benefits?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
Technology in Medicine

Use the clues to fill in the crossword puzzle.

<table>
<thead>
<tr>
<th>Pharmacist</th>
<th>Vaccine</th>
<th>Genetics</th>
<th>Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait</td>
<td>Genetic</td>
<td>Laser</td>
<td>Prosthesis</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Across
3. injection of a weakened microorganism
5. scientists’ work with genes to control physical traits
6. person who prepares and gives out medicine
8. tool that focuses intense light waves

Down
1. how traits are passed from one generation to the next
2. science that uses living things to make products
4. observable physical feature or characteristic
7. artificial limb
Technology in Medicine

Fill in the blanks.

prosthesis  vaccine  biotechnology
pharmacists  lasers  robotic

Medicine of long ago was nothing like it is today. It wasn’t until ancient Egypt, when the first ___________ began preparing medicines, that medical technology really began.

In 1796, Edward Jenner developed a ___________ that protected people from the deadly smallpox disease. Today, doctors do not even need to use their hands to perform surgery! They can control a ___________ arm or hand that can do work for them. Some surgeons use ___________ that use strong light waves to make cuts in human skin. A ___________ is an artificial limb that works like a real one.

In the field of ___________, scientists are studying how to use living things in products that will make life better for people. Experts argue about the risks and benefits of this field. While the products may help people in the short run, they could have unknown effects.
Spare Body Parts
Read the Writing in Science feature in your textbook.

Write About It
Explanatory Writing Research some more information about prosthetic limbs. Write a report about how technology is improving the lives of people with prosthetics. Include specific examples, and detail what materials are being used.

Getting Ideas
Use the table below to help organize your thoughts before you begin your research. In the first column, list what you already know about prosthetic limbs. In the second column, write questions that you have about the topic. Then use print and online resources to learn more about prosthetic limbs. Finally, in the last column, write what you learned from your research.

<table>
<thead>
<tr>
<th>Topic: How Prosthetics Improve People’s Lives</th>
</tr>
</thead>
<tbody>
<tr>
<td>What I Already Know</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Expository writing explains how something works. It is important to engage your readers so that they will be interested in the topic and want to read more about it. One way to engage your readers is to write a good thesis statement. A thesis statement comes at the beginning of a report and “hooks” your readers by telling them what to expect and by giving information about the topic. Helen wants to write a report about the use and benefits of MRI machines. Tell which thesis statement below would be best.

1. MRI machines use magnetic technology to take three-dimensional pictures of the inside of the human body, allowing doctors to see injuries and diseased areas in detail.

2. MRI machines provide the best pictures of the inside of the human body.

Now write your first draft. Use a separate sheet of paper. Engage your readers with a powerful and informative thesis statement. Use the body of your report to develop details that explain the statement further.

Revising and Proofreading

Make the following sentence more specific by using historical facts and examples.

Documented cases of the use of artificial limbs date back many years.

Now revise and proofread your report. Ask these questions:

- Have I written an effective thesis statement that engages my readers?
- Have I covered important landmarks in the development of prosthetic limbs?
- Have I given examples of people who led productive lives with prosthetic limbs?
- Have I corrected all grammar, spelling, punctuation, and capitalization errors?
- Does my paper have a clear introduction, body, and conclusion?
Technology of the Future

Use your textbook to help you fill in the blanks.

1. Nanotechnology uses the smallest building blocks of _______ to create or improve aspects of everyday life.

2. Scientists from Britain and the United States discovered a _______ when they used a laser to vaporize graphite.

3. A carbon nanotube is stronger than steel and can easily conduct both _______ and _______.

4. With the invention of the Atomic Force Microscope, scientists are now able to manipulate _______ and _______.

Nanotechnology Now

5. Socks treated with _______ can resist germs that cause odor and can also keep feet dry and comfortable.

6. In medicine, nanodevices are being used to diagnose and treat _______.

A Look Ahead

7. In the future, NASA hopes to use nanotechnology to create a _______ that will reach nearly 62,000 miles into space.

8. Nanomaterials used in _______ will enable them to drive, hop, fly, and burrow as they explore moons and planets.

Critical Thinking

What advancements in technology would you like to see in the future? Explain.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Technology of the Future

Fill in the Blanks.

<table>
<thead>
<tr>
<th>Atomic Force Microscope</th>
<th>manotechnology</th>
<th>space elevator</th>
</tr>
</thead>
<tbody>
<tr>
<td>fullerene</td>
<td>carbon nanotuber</td>
<td></td>
</tr>
</tbody>
</table>

1. A form of carbon that has atoms bonded together forming a hollow sphere is called a ________.

2. The new tool developed to help scientists see and manipulate atoms and molecules is a(n) ________.

3. The use of the tiniest building blocks of matter to make or improve aspects of everyday life is ________.

4. A rolled up sheet of carbon atoms arranged in hexagonal rings is known as ________.

5. A nanotube ribbon anchored to an offshore sea platform, propelled upward by a laser beam, is the design envisioned for a(n) ________.
Technology of the Future

Fill in the blanks.

<table>
<thead>
<tr>
<th>fullerene</th>
<th>atoms</th>
<th>carbon nanotube</th>
</tr>
</thead>
<tbody>
<tr>
<td>molecules</td>
<td>manofilters</td>
<td>rover</td>
</tr>
<tr>
<td>conductor</td>
<td>nanotechnology</td>
<td>chloroplasts</td>
</tr>
</tbody>
</table>

Scientists are always thinking about the future and making new discoveries. One of these discoveries is the field of ________________, in which the smallest building blocks of matter are used to make or improve things.

Nanotechnology began in 1985, when scientists vaporized graphite and found hollow ________________ made up of 60 carbon ________________. The atoms were connected to form a hollow sphere with 20 hexagons and 12 pentagons that looked like a soccer ball. This structure, which scientists called a ________________, is very strong.

A short time later, another scientist discovered the ________________, which is stronger than steel. It is also a very good ________________ of heat and electricity.

Nanomaterials have many uses. In Paris, ________________ are being used to clean river water to make it drinkable. NASA scientists plan to use nanomaterial ________________. Someday, cell phones may use solar power by using spinach ________________.
Nanotechnology Scores

Read the Writing in Science feature in your textbook.

Write About It

Persuasive Writing

Do some research to find out when different sports started using nano-equipment. Write a persuasive report in which you argue in favor of nano-equipment or against its use. Consider questions such as these: should there be special rules if nano-equipment is used in a game? Is it fair to give today’s players an advantage? What would be the impact on records and statistics?

Getting Ideas

A piece of effective persuasive writing includes several reasons that support an opinion. If your argument is well-supported, it is more likely that your readers will agree with you. Use the graphic organizer below to develop ideas for your paper on the use of nano-equipment in sports. Write your opinion statement in the top box. Then write reasons that support this opinion in the bottom boxes. You may add boxes if needed.
Drafting
Indicate with yes or no those opinions that are supported by reasons and those that are not.

1. ______ Nanotechnology has greatly improved performance of many participants in some athletic events.
2. ______ Nanotechnology may have unforeseen negative consequences because of new uses for special substances that haven’t been tested.
3. ______ Users of nano-equipment have a competitive advantage over opponents.

Now write your first draft. Begin with a sentence that creates interest. Use the reasons from your organizer to describe why you are for or against the use of athletic nano-equipment.

Revising and Proofreading
Juan’s persuasive paper on composting contains six errors in capitalization, spelling, and punctuation. Correct the errors.

When your family has finished eating dinner, what do you do with the table scraps. You probably give them to your dog or throw them away. What you may not no is that leftover food can actually improve your soil! Putting leftover food in a place in which it can decompose is called composting. Composting can leading to better plant growth without fertilizers that can harm animals.

Now revise and proofread your writing. Ask these questions:

- Have I given at least three reasons for each of my opinions?
- Are my arguments clearly stated, and are they convincing?
- Have I found and corrected all errors?
- Did I save my most powerful argument for last?
Exploring the Impact of Technology on Society

Use your textbook to help you fill in the blanks.

1. Technology has had both positive and negative _______________ on society.

2. Most kinds of technology involve a _______________ of _______________ of some sort, usually in the form of cost or safety.

Using Technology Responsibly

3. _______________ make sure that people use technology in ways that it is meant to be used.

It’s Not Easy!

4. It is difficult to find the perfect technological _______________ because there is always a trade-off.

Similar Systems, Different Technologies

5. In the fourth century, _______________ relied on a system of _______________ for drinking water.

6. New York City uses two large underground _______________ to bring water from collection areas into the city.

Critical Thinking

7. What are some ethics that your parents and your school have put in place for computer use?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
Exploring the Impact of Technology on Society

Fill in the blanks.

| aqueduct | impact | trade-off |
| ethics   | reservoir |

1. Something you have to give up in order to get what you want is known as a(n) ________________.

2. Above-ground stone channel that carried water ________________.

3. A large body of water that holds water delivered for use somewhere else is called a ________________.

4. The affect of one thing on another is a(n) ________________.

5. Rules made to protect people or the environment from harmful impacts are known as ________________.
Technology of the Future

Fill in the blanks.

| ethics | aqueducts | safety |
| tunnels | cost | trade-off |
| impacts | watersheds |

Technology has had many ______________________, or effects, on society, both positive and negative. ______________________ help avoid abuses of technology.

Technology also comes with many ______________________. This means that in order to enjoy the benefits of technology, we sometimes have to give up something. Some examples of trade-offs are ______________________ and ______________________. Think about the packaging that your favorite snacks come in. The packaging is convenient, but it fills landfills.

You know that technology has been around since prehistoric times. Rome and New York City used very similar technology for getting water—thousand of years apart! Around the fourth century B.C.E., Rome began using ______________________ to bring in drinking from other places. More recently, New York City began tapping ______________________ and bringing that water into the city via underground ______________________.
Write About It

Expository Writing: Do some research about satellites and how they work. How are they part of a system? What other uses do they have for society? What about their trade-offs? Write a compare and contrast report of your findings in which you evaluate the good and the bad. Do you think satellites are worth the trade-offs?

Getting Ideas

In your paper, you need to compare and contrast the advantages and disadvantages of using satellites. When comparing and contrasting, it often helps to organize your ideas in a Venn diagram. A Venn diagram has two overlapping circles. The differences between two objects or ideas are listed in each circle. Similarities are listed in the area where the circles overlap. Use the Venn diagram below to show the advantages, disadvantages, and trade-offs of satellite technology.

Advantages of Satellite Technology
- location of stranded motorists
- tracking wildlife
- migration for study purposes

Disadvantages of Satellite Technology
- violation of people’s privacy
- decaying satellites crash to Earth

Trade Offs
- decreased information security
Drafting
Expository writing provides detailed information about a topic. It includes many facts about the chosen subject. It is important to decide which facts are necessary to include in your paper and which are not. Sophie wrote a paper on the pros and cons of a type of satellite technology called GPS. She included the following statements. Decide whether they are necessary facts. Write yes or no next to each statement.

1. GPS stands for Global Positioning System. ________
2. My mother’s car has GPS, but my father’s does not. ________
3. GPS is made up of 24 different satellites that were first put into orbit by the U.S. Department of Defense. ________
4. You can buy a GPS at most local electronics stores. ________

Now write your first draft. Use a separate sheet of paper. Expository writing contains three main parts: introduction, body, and conclusion. Make sure that your paper follows this pattern.

Revising and Proofreading
Now revise and proofread your writing. Ask these questions.
► Have you listed both advantages and disadvantages?
► Have you included trade-offs?
► Does your paper contain an introduction, body, and conclusion?
► Does your paper include necessary, rather than unnecessary, details?
► Have you found and corrected all spelling, capitalization, and punctuation errors?