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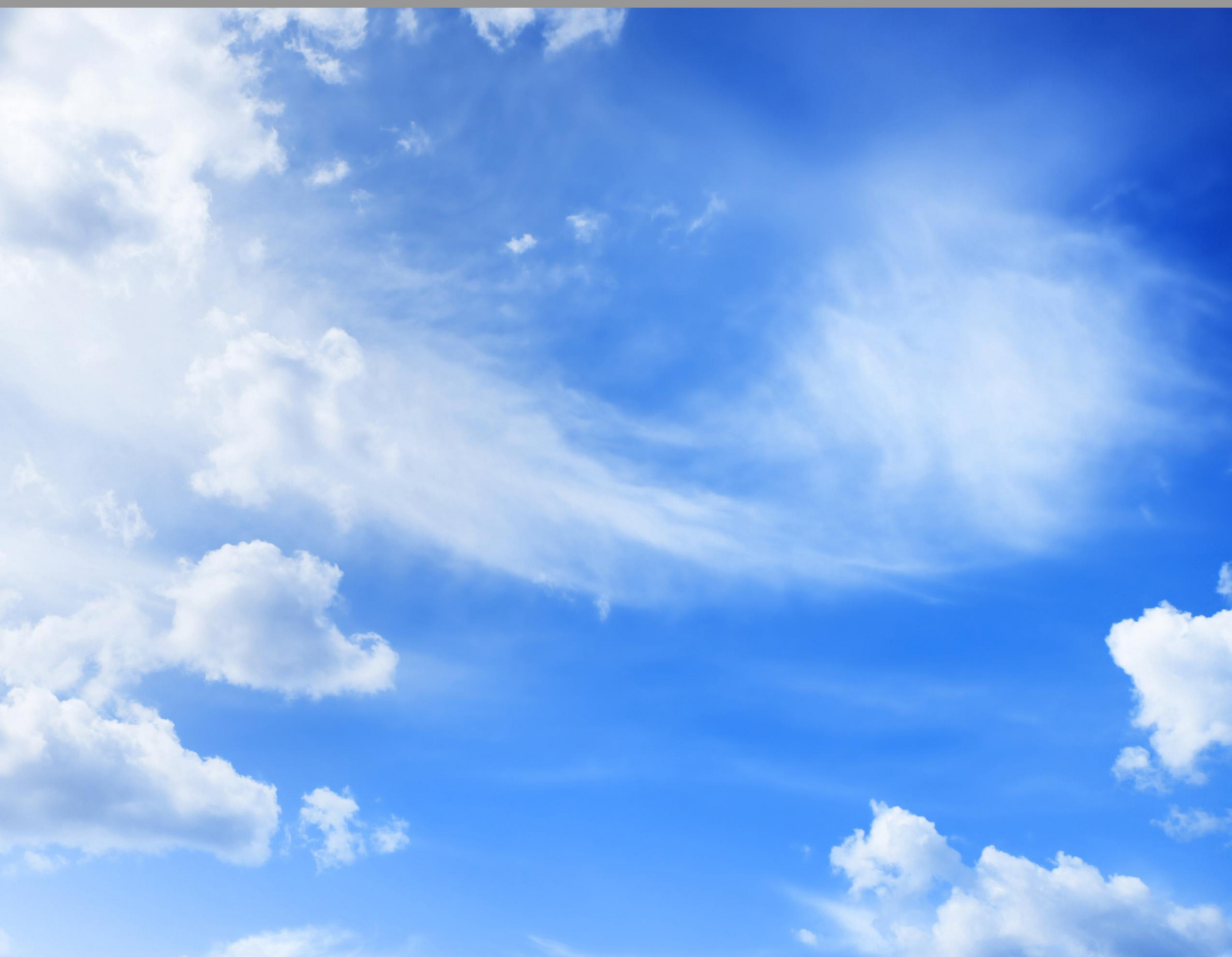
CK-12 Earth Science For High School Workbook



CK-12 Earth Science For High School Workbook

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Contents

CHAPTER 1 HS What is Earth Science? Worksheets

Chapter Outline

1.1 The Nature of Science

Lesson 1.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Science is both a way of gaining knowledge and a body of knowledge.

_____ 2. There is no place for imagination and creativity in science.

_____ 3. All science is based on evidence and logical thinking.

_____ 4. Any idea can be investigated through scientific inquiry.

_____ 5. Scientific investigations always follow the same sequence of steps.

_____ 6. A good experiment must have one factor that can be manipulated.

_____ 7. Data in the form of numbers is called qualitative data.

_____ 8. Taking many measurements and averaging the results may correct random errors in data.

_____ 9. If data from an experiment do not support a hypothesis, then the experiment is a failure.

_____ 10. A scientific theory is just an educated guess about why something occurs.

Lesson 1.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

The Importance of Community in Science

Although each scientist may perform experiments in her lab alone or with a few helpers, she will write up her results and present her work to the community of scientists in her field. Initially, she may present her data and conclusions at a scientific conference, where she can talk with other scientists and get feedback on her work. Using what she learns, she may go on to write a professional paper about her research and submit it to a scientific journal. Before the paper is accepted for publication, several scientists who are experts in the same field will review it. This is called peer review. These other scientists may suggest changes to the paper, and they will recommend whether or not the paper should be published. Once a paper is published, other scientists can learn about the work and may incorporate the results into their own research. Some scientists may try to replicate the experiment to see whether they get the same results. In this way, the knowledge base of science builds toward a greater understanding of nature.

The scientific community influences the quality and type of research that is done by scientists. For example, other scientists help determine which research projects receive funding. Most scientific research is expensive, so a scientist must write a research proposal to a funding agency, such as the National Science Foundation, requesting money to pay for equipment, supplies, and salaries. Scientific proposals are reviewed by other scientists in the field. In many fields, the funding rate is low and the money goes only to the most worthy research projects.

The scientific community monitors scientific integrity. During their scientific training, students learn how to conduct good scientific experiments. They learn not to fake, hide, or selectively report data. They also learn how to fairly evaluate data and the work of other scientists. Considering how much scientific research is done, there are very few incidents of scientific dishonesty. However, when such an incident occurs, it generally receives a lot of media attention. This may cause the public to mistrust scientists and scientific research in ways that are unfounded. Scientists who do not have scientific integrity are strongly condemned by the scientific community.

Questions

1. What is peer review, and why is it important?
2. How does the scientific community influence the quality and type of scientific research that is done?
3. How does the scientific community promote scientific integrity?

Lesson 1.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Which of the following is a valid science lab safety guideline?
   a. Do not eat or drink anything while in the lab.
   b. Wear a drawstring hoodie to protect yourself from chemicals.
   c. Wait to clean up any spills until you complete the lab procedure.
   d. Change the lab procedure if necessary to improve the experiment.
2. Which of the following is relevant to scientific inquiry?
   a. moral judgments
   b. personal opinions
   c. assumptions about nature
   d. none of the above
3. Which of the following ideas are basic to science?
   a. Rules of nature may be different elsewhere in the universe.
   b. Once accepted, scientific ideas are not subject to change.
   c. Natural events and processes have natural causes.
   d. all of the above
4. To be useful, a scientific hypothesis must
   a. be true.
   b. be testable.
   c. be very specific.
   d. apply in all situations.
5. Scientists may collect data by
   a. doing experiments.
   b. making observations.
   c. taking measurements.
   d. all of the above
6. In a good scientific experiment, the dependent variable depends on the
   a. experimental controls.
   b. independent variable.

c. experimental error.
d. none of the above

7. Assume that a scientist is measuring mass in an experiment. The balance she is using is not set at zero, so it always measures mass a little too high. What type of error does this cause in her data?
   a. random error
   b. observer error
   c. systematic error
   d. two of the above

Lesson 1.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. testable, plausible explanation for a scientific question

_____ 2. series of steps scientists use to investigate questions

_____ 3. factor that must remain the same in an experiment so it does not affect the outcome

_____ 4. factor in an experiment that the researcher changes

_____ 5. scientific explanation that is supported by many observations

_____ 6. factor measured as the outcome of an experiment

_____ 7. useful representation of a real system that is simpler than reality

Terms

a. hypothesis

b. theory

c. control

d. dependent variable

e. independent variable

f. model

g. scientific method

Lesson 1.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The scientific method typically begins with a(n) __________.
2. Before developing a hypothesis, a scientist typically undertakes __________.
3. A physical representation of a real object, such as a globe of the world, is a(n) __________ model.
4. If a hypothesis is tested and supported repeatedly, it may become a(n) __________.

5. A general idea about how something works is a(n) __________ model.
6. The scientific method typically ends with a(n) __________.
7. A set of equations that represents a real-world process is a(n) __________ model.

Lesson 1.1: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why models are used in science, and compare and contrast three different types of scientific models.

1.2 Earth Science and Its Branches

Lesson 1.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Earth science deals with Earth's lands, oceans, and atmosphere.

_____ 2. Most Earth scientists specialize in studying one aspect of the planet.

_____ 3. Seismologists forecast major storms to save lives and property.

_____ 4. Oceanography can be accurately defined as the hydrology of the oceans.

_____ 5. Meteorologists collect data using technologies such as radar and satellites.

_____ 6. All the branches of Earth science are connected.

_____ 7. A lunar geologist might study minerals and rocks under the oceans.

_____ 8. Climatologists are interested in long-term changes in the atmosphere.

_____ 9. Environmental science is the study of how the environment affects people.

_____ 10. Astronomy is defined as the study of the geology of other planets.

Lesson 1.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Introduction to Earth Science

Earth science consists of many branches of knowledge concerning planet Earth. It deals with any and all aspects of Earth: its lands, interior, atmosphere, and oceans. Earth is a very large and complex set of systems. Therefore, most Earth scientists focus on just one aspect of the planet.

The main branches of Earth science are geology, meteorology, climatology, oceanography, and environmental science. Each branch has a different focus. For example, geology focuses on Earth's solid materials and structures and the processes that create them. Geology, in turn, is divided into several branches, including mineralogy, planetary geology, marine geology, and seismology. Mineralogy, for example, is the study of the composition and structure of minerals. Seismology is the study of earthquakes and their causes. Because all of Earth's systems are interconnected, researchers in different branches of Earth science generally must work together to answer complex questions.

Questions

1. What is Earth science? Why does Earth science have many branches?
2. Identify the main branches of Earth science.
3. What is the focus of the branch of Earth science known as geology? How is geology divided into branches?

4. Why must scientists in different branches of Earth science generally work together to answer complex questions?

Lesson 1.2: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. The main branches of Earth science include
   a. geology.
   b. climatology.
   c. meteorology.
   d. all of the above
2. Which of the following questions would most likely be addressed by a geologist?
   a. How do hurricanes form?
   b. What causes ocean currents?
   c. What is the composition of rocks?
   d. How do human actions affect the climate?
3. A planetary geologist might study the
   a. minerals found inside Earth.
   b. composition of Earth's surface.
   c. minerals and rocks on Mars.
   d. all of the above
4. A marine geologist might study
   a. organisms that live in the ocean.
   b. movements of ocean water.
   c. rocks on the ocean floor.
   d. none of the above
5. If a student wants to learn more about tornadoes, she should take a class in
   a. seismology.
   b. climatology.
   c. meteorology.
   d. environmental science.
6. If an oil company wanted to hire a scientist to locate oil reserves in rocks under Earth's surface, the company would most likely hire a(n)
   a. paleontologist.
   b. hydrologist.
   c. geologist.
   d. ecologist.
7. Mineralogy is a branch of
   a. oceanography.
   b. astronomy.
   c. seismology.
   d. geology.

Lesson 1.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. study of fossils

_____ 2. study of Earth's solid materials and structures and the processes that create them

_____ 3. study of Earth's atmosphere

_____ 4. study of earthquakes and their causes

_____ 5. study of weather and weather patterns

_____ 6. broad science that deals with all aspects of planet Earth

_____ 7. study of the effects of people on the environment

Terms

a. geology

b. meteorology

c. climatology

d. paleontology

e. environmental science

f. Earth science

g. seismology

Lesson 1.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Scientists who study the composition and structure of minerals are called __________.
2. __________ are scientists you study the geology of other planets.
3. The study of water and its movements, distribution, and quality is __________.
4. The study of everything in the ocean environment is __________.
5. A(n) __________ studies ocean currents, waves, and tides.
6. A(n) __________ studies rocks and geologic processes of ocean basins.
7. A(n) __________ studies life in the oceans.

Lesson 1.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

What is a question that might be investigated by an environmental scientist? Identify another branch of Earth science that might be called upon to help answer the question. Explain your choice.

CHAPTER 2 HS Studying Earth's Surface Worksheets

Chapter Outline

2.1 Earth's Surface

Lesson 2.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Constructive forces can change a high mountain to a flat plateau.

_____ 2. A volcanic eruption can be a constructive or destructive force.

_____ 3. The ocean floor is a flat, featureless surface.

_____ 4. Mountains rise when continents collide.

_____ 5. A stream flowing down a mountainside is a constructive force.

_____ 6. Continental margins consist of oceanic crust.

_____ 7. Many ocean trenches are located around the edge of the Pacific Ocean.

_____ 8. Changes in Earth's surface always occur very slowly.

_____ 9. Old seafloor is destroyed at oceanic trenches.

_____ 10. The continental crust has been subject to destructive forces longer than the oceanic crust has.

Lesson 2.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Building up and Wearing Down Earth's Continental Landforms

Earth's continents are large land areas extending from high mountaintops to sea level. The oldest continental rocks are billions of years old, so the continents have had a lot of time for constructive and destructive forces to change them. Constructive forces cause physical features on Earth's surface, known as landforms, to build up. Destructive forces cause physical features to wear down.

Landforms often build up when Earth's crust deforms. This occurs when slabs of crust compress, pull apart, or slide past other slabs of crust. Crust deformation can result in the formation of hills, valleys, and other landforms. Mountains rise when continents collide and push up the crust. Volcanic mountains form when a slab of oceanic crust plunges beneath another slab of crust. This allows melted rock called magma to flow onto the surface, where it hardens to form solid rock. Over time, the hardened rock builds up to form a mountain. Landforms are also created when sediments are deposited. For example, a triangular deposit called a delta forms where a river or stream deposits sediments as it flows into a body of still water.

Volcanic eruptions are constructive forces when they cause mountains to form. However, explosive volcanic eruptions can be destructive forces if they blow apart mountains, leaving craters. Landforms are also worn down by the destructive forces of weathering and erosion. Water, wind, ice, and gravity are important agents of erosion. For example, water in streams and rivers flowing down mountainsides wears away rocks and creates valleys. Landslides are also destructive forces that wear away steep slopes.

Questions

1. What are continents and landforms?
2. Compare and contrast constructive and destructive forces.
3. How can volcanoes and rivers be both constructive and destructive forces?

Lesson 2.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. How old are the oldest continental rocks?
   a. about half a million years old
   b. a few million years old
   c. 100 million years old
   d. billions of years old
2. Crustal deformation occurs when Earth's crust
   a. pulls apart.
   b. pushes together.
   c. slides past other crust.
   d. all of the above
3. Crustal deformation may result in the formation of
   a. hills.
   b. valleys.
   c. mountains.
   d. all of the above
4. Deltas form when
   a. oceanic crust plunges beneath continental crust.
   b. sediments are deposited.
   c. continents collide.
   d. volcanoes erupt.
5. The East African rift valley is forming where crust is
   a. compressed.
   b. pulled apart.
   c. pushed together.
   d. deposited by water.
6. The ocean basins are all younger than
   a. 180 million years old.
   b. 100 million years old.
   c. 80 million years old.
   d. 18 million years old.
7. New seafloor forms when

a. sediments are deposited.
b. volcanic activity occurs.
c. crust is uplifted.
d. none of the above

Lesson 2.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. mountain range that runs through much of the ocean basin

_____ 2. any force that wears down landforms

_____ 3. deep valley on the ocean floor

_____ 4. any force that causes landforms to grow

_____ 5. continental crust that extends downward to the seafloor

_____ 6. large land area that lies above sea level

_____ 7. physical feature of Earth's surface

Terms

a. constructive force

b. landform

c. continent

d. destructive force

e. mid-ocean ridge

f. ocean trench

g. continental margin

Lesson 2.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Earth's surface features result from constructive and __________ forces.
2. Weathering and erosion are examples of __________ forces.
3. If the eruption of a volcano creates a new mountain, it is an example of a(n) ___________ force.
4. If the eruption of a volcano blows up a mountain and leaves a crater, it is an example of a(n) __________ force.
5. Water, wind, ice, and gravity are important agents of __________, which is a destructive force.
6. A landslide is a(n) __________ force because it wears down a steep slope.

Lesson 2.1: Critical Writing

Name____________________ Class_______________ Date_________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

According to a well-known quote, "the only thing that does not change is change itself." How does this apply to planet Earth?

2.2 Where in the World Are You?

Lesson 2.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The direction called "northeast" is 90 degrees from north.

_____ 2. Earth's magnetic north pole is also called "true north."

_____ 3. Any location on Earth's surface can be located by its latitude and longitude.

_____ 4. The equator falls halfway between the north and south poles.

_____ 5. The international dateline is located at 120 degrees east longitude.

_____ 6. Another word that has the same meaning as relief is terrain.

_____ 7. To find a stationary object on Earth's surface, you must know its direction.

_____ 8. Elevation on Earth is always measured relative to sea level.

_____ 9. A compass needle always points toward 90 degrees north latitude.

_____ 10. The line called the prime meridian is perpendicular to the equator.

Lesson 2.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Describing Location

Any location on Earth's surface—or on a map of Earth's surface—can be described by latitude and longitude. Latitude and longitude are expressed in degrees. Each degree is divided into 60 minutes, and each minute is divided into 60 seconds.

Latitude is a measure of the distance north or south of the equator. The equator is the imaginary line that circles Earth halfway between the north and south poles. All lines of latitude circle the planet parallel to the equator. The latitude of the equator is 0 degrees. The latitude of the north pole is 90 degrees north, and the latitude of the south pole is 90 degrees south.

Longitude is a measure of the distance east or west of the prime meridian. The prime meridian is an imaginary line that is perpendicular to the equator. It circles the planet and passes through the north and south poles. It also passes through Greenwich, England. All lines of longitude circle the planet perpendicular to the equator and pass through both poles. The longitude of the prime meridian is 0 degrees. On the opposite side of Earth, the longitude of the international dateline is 180 degrees.

Another aspect of location is elevation. Elevation is the height of a place above or below sea level. It is always measured relative to sea level, which is the average height of the ocean's surface. It is also the midpoint between high and low tides. Sea level is the same everywhere on Earth. The elevation of surface features, or landforms, is called topography. Relief, or terrain, is the topography of all the major features of a region.

Questions

1. What is latitude? Describe the line of latitude that is 45 degrees north.
2. What is longitude? Describe the line of longitude that is 90 degrees east.
3. Define elevation, and explain how it is measured.

Lesson 2.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Which method of determining location is used to find the location of an earthquake?
   a. elevation
   b. triangulation
   c. street address
   d. latitude and longitude
2. How far is Earth's magnetic north pole from its geographic north pole?
   a. 11.5 degrees
   b. 22.5 degrees
   c. 45.0 degrees
   d. 90.0 degrees
3. Each degree of latitude or longitude is divided into
   a. 10 minutes.
   b. 30 minutes.
   c. 60 minutes.
   d. 90 minutes.
4. The line that is 0 degrees latitude is known as the
   a. international dateline.
   b. prime meridian.
   c. equator.
   d. none of the above
5. Which of the following locations could be in the United States?
   a. 120° east, 40° south
   b. 120° east, 40° north
   c. 120° west, 40° north
   d. 120° west, 40° south
6. Which statement about sea level is true?
   a. It varies throughout the day.
   b. It differs from place to place.
   c. It is the elevation of the ocean floor.
   d. It is halfway between high and low tides.
7. Which of the following is the best definition of topography?

a. elevation of landforms
b. distance from the equator
c. point of triangulation
d. direction on a map

Lesson 2.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. distance north or south of the equator

_____ 2. distance east or west of the prime meridian

_____ 3. height above or below sea level

_____ 4. position on Earth's surface

_____ 5. figure on a map that shows direction

_____ 6. device with a magnetic needle that is used to find direction

_____ 7. which way an object is moving

Terms

a. elevation

b. longitude

c. compass

d. direction

e. location

f. compass rose

g. latitude

Lesson 2.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. __________ means finding a location based on its distance from three other locations.
2. A compass needle points to Earth's __________ north pole.
3. Earth's __________ north pole is the point where Earth's axis intersects the surface in the Northern Hemisphere.
4. The line representing 0 degrees longitude is called the __________.
5. Lines of __________ are parallel to the equator.
6. The average height of the ocean's surface is referred to as __________.
7. __________ refers to the elevations of all the landforms in a region.

Lesson 2.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast Earth's geographic and magnetic poles.

2.3 Modeling Earth's Surface

Lesson 2.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Locations on a globe are determined using rectangular coordinates.

_____ 2. A flat map is most accurate over a large area.

_____ 3. All compass directions are curved lines on a Mercator projection.

_____ 4. A conic projection best depicts the area where the cone touches the globe.

_____ 5. Gnomonic projections are often used to map the poles.

_____ 6. Mercator projections are no longer used.

_____ 7. Robinson projections are still commonly used.

_____ 8. Winkel Tripel projections are used by the National Geographic Society.

_____ 9. Locations on a map are determined using polar coordinates.

_____ 10. The oldest type of projection is a Mercator projection.

Lesson 2.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Map Projections

Earth's surface is curved, whereas maps are flat. To represent a curved surface on a flat map requires the use of some type of projection. There are several commonly used types of projections.

The oldest type of projection is a Mercator projection. Mercator projections are still commonly used today. A Mercator projection is made by wrapping a flat piece of paper around a globe at the equator to make a cylinder. The paper touches the globe at the equator, but the distance between the globe and paper increases toward the poles. The features of Earth's surface are projected outward onto the cylinder. When the cylinder is unrolled, the result is a flat Mercator projection. A Mercator projection is most accurate near the equator. Here, the shapes and sizes of features are correct. However, the features get stretched out near the poles. For example, on a Mercator projection Greenland is stretched out to look almost as big the United States.

Other types of projections include conic, gnomonic, Robinson, and Winkel Tripel projections.

- A conic projection uses a cone rather than a cylinder to project Earth's curved surface onto a flat map. It best depicts the area where the cone touches the globe. This area depends on the choice of the map maker.
- A gnomonic projection projects Earth surface onto a flat map from a single point. The projection is most accurate for features near that point. The poles are often mapped this way.

- A Robinson projection creates an elliptical rather than rectangular map. Lines of latitude are represented by straight lines, whereas lines of longitude are represented by curved lines. This projection has less distortion near the poles than a Mercator project.
- A Winkel Tripel projection uses mathematical formulas to create a flat map of Earth's curved surface. This type of projection is distorted at the edges. The National Geographic Society uses Winkel Tripel projections.

Questions

1. What are projections? Why are projections used to make maps of Earth's surface?
2. Describe how a Mercator projection is made. What is a disadvantage of Mercator projections?
3. List and briefly describe two other types of map projections.

Lesson 2.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Using a globe to represent Earth's surface avoids distortions of the
   a. sizes of continents.
   b. shapes of land masses.
   c. distances between places.
   d. all of the above
2. To find the shortest distance between two points on a globe, you find the length of the
   a. arc that connects them.
   b. meridian closest to them.
   c. straight line between them.
   d. none of the above
3. A radar map may be used to show
   a. topography.
   b. weather.
   c. climate.
   d. two of the above
4. A Mercator projection is most accurate at
   a. the poles.
   b. the equator.
   c. 45 degrees north.
   d. 45 degrees south.
5. A gnomonic projection is always centered on
   a. the equator.
   b. a single point.
   c. the north pole.
   d. the south pole.
6. Which statement about a Robinson projection is true?
   a. Scales along different lines of latitude are the same.
   b. Distances along each line of latitude are true to scale.

c. Distortion is greatest within 45 degrees of the equator.
d. There is more distortion near the poles than on a Mercator projection.

7. Which statement is true about all projections?

a. They are the most accurate way to represent Earth's surface.
b. They project Earth's curved surface onto a cylinder or cone.
c. They distort sizes and shapes of features at the edges.
d. They are most accurate near the equator.

Lesson 2.3: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. map that uses colors to show elevations of large areas

_____ 2. map that is created by projecting Earth's surface on a cylinder

_____ 3. map that shows terrain and vegetation

_____ 4. map that is created by projecting Earth's surface on a cone

_____ 5. map that shows elevations using contour lines

_____ 6. map that has an elliptical shape because only latitude lines are projected while meridians are curved

_____ 7. map that is created by projecting Earth's surface from a single point

Terms

a. Mercator projection

b. satellite-view map

c. conic projection

d. relief map

e. gnomonic projection

f. topographic map

g. Robinson projection

Lesson 2.3: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. A(n) __________ is the most accurate way to represent Earth's curved surface.
2. Any two-dimensional representation of Earth's surface is a(n) __________.
3. Any map that projects Earth's curved surface onto flat paper is a(n) __________.
4. A map that shows average temperatures and rainfall is a(n) __________ map.
5. A map that shows air masses, fronts, and storms is a(n) __________ map.

6. A map that shows the types and locations of rocks in an area is a(n) __________ map.
7. A(n) __________ projection uses mathematical formulas to represent Earth's curved surface in two dimensions.

Lesson 2.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain the pros and cons of using a globe to represent Earth's surface.

2.4 Topographic Maps

Lesson 2.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Each contour line on a topographic map represents a specific elevation.

_____ 2. Every other contour line is labeled.

_____ 3. The contour interval is a horizontal distance.

_____ 4. If land is almost flat, contour lines will be close together.

_____ 5. The innermost concentric hatched loop on a topographic map encloses the lowest point of a depression.

_____ 6. Contour lines can be used to determine the direction that a stream is flowing.

_____ 7. Contour lines on a bathymetric map represent distance from shore.

_____ 8. Topographic maps show three dimensions of Earth's surface.

_____ 9. The horizontal distance between adjacent contour lines is constant.

_____ 10. On a bathymetric map, the lowest-numbered contour lines represent the deepest ocean floor.

Lesson 2.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Reading Topographic Maps

A topographic map uses contour lines to show the three-dimensional shape of the land. Contour lines reveal the locations of hills, valleys, and other surface features. To read a topographic map, you should know that:

- Each contour line represents a specific elevation and connects all the points that have that elevation. Every fifth contour line is bolded and labeled with its elevation.
- Contour lines run next to each other but never intersect.
- Adjacent contour lines are separated by a constant difference in elevation, called the contour interval. The map legend gives the contour interval.
- Closely-spaced contour lines indicate a steep slope. They show that the elevation changes quickly over a short horizontal distance. Contour lines that seem to touch indicate a very steep rise, such as a cliff or canyon wall. Broadly spaced contour lines, in contrast, indicate a gentle slope.
- Contour lines that form concentric closed loops indicate hills. Smaller loops represent higher elevations.
- Hatched concentric loops indicate depressions. Hatch marks are short, perpendicular lines inside a loop. Smaller hatched loops represent lower elevations.

- A group of V-shaped contour lines indicates a stream valley. The narrow part of the Vs point uphill. Water always flows from higher to lower elevations, so the Vs also tell you the direction the water is flowing.

Questions

1. What do contour lines represent?
2. What can you learn from the spacing of contour lines?
3. How can you identify hills and depressions on a topographic map?
4. Explain how contour lines show the location and direction of streams.

Lesson 2.4: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The distance between adjacent contour lines indicates
   a. slope.
   b. rock depth.
   c. horizontal distance.
   d. none of the above
2. If you could walk along a contour line, you would be walking
   a. up and down hill.
   b. down a gentle slope.
   c. continuously upward.
   d. always at the same elevation.
3. Contour lines can be used to reveal the locations of
   a. hills.
   b. valleys.
   c. level areas.
   d. all of the above
4. V-shaped contour lines always point
   a. north.
   b. uphill.
   c. downhill.
   d. two of the above
5. On a contour map, a cliff is represented by contour lines that
   a. seem to touch.
   b. actually intersect.
   c. are equally spaced.
   d. are perpendicular.
6. The smallest closed contour line of a hill represents the
   a. top of the hill.
   b. lowest elevation.
   c. bottom of the hill.
   d. two of the above

7. What could you learn from a bathymetric map?
    a. depth of ocean water
    b. types of rocks on the ocean floor
    c. locations of mountains on the ocean floor
    d. two of the above

Lesson 2.4: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. landform represented by contour lines that form closed loops

_____ 2. type of map that shows depths below sea level

_____ 3. difference in elevation between adjacent contour lines

_____ 4. type of map that shows rock units and other rock features

_____ 5. line representing elevation

_____ 6. type of map that shows terrain

_____ 7. landform represented by hatched contour lines that form closed loops

Terms

a. bathymetric map

b. contour interval

c. contour line

d. geologic map

e. topographic map

f. depression

g. hill

Lesson 2.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. A contour line connects points that have the same __________.
2. Closely spaced contour lines represent a __________ slope.
3. The scale of a topographic map represents __________ distance.
4. A group of V-shaped contour lines represents a(n) __________.
5. Higher-numbered contour lines on a bathymetric map represent greater __________.
6. Structural features such as folds and faults are shown on a __________ map.
7. A geologic map represents different rock units with different __________.

Lesson 2.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how a bathymetric map would show a ridge, a trench, and a flat plain on the ocean floor.

2.5 Using Satellites and Computers

Lesson 2.5: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Satellites are useful for monitoring global changes.

_____ 2. A geostationary satellite circles Earth from pole to pole.

_____ 3. Communications satellites have polar orbits.

_____ 4. A satellite in a polar orbit circles Earth at the same speed that Earth rotates.

_____ 5. Satellites can be used to measure temperatures of the land and oceans.

_____ 6. Satellites can be used to locate a person's exact location on Earth's surface.

_____ 7. GPS was first developed for military purposes.

_____ 8. A GPS receiver uses triangulation to determine its own location.

_____ 9. A polar orbit is closer to Earth's surface than a geostationary orbit.

_____ 10. Satellites can detect changes in sea level.

Lesson 2.5: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

GPS and GIS

GPS, or Global Positioning System, is a system for locating exact positions on Earth's surface. It was originally developed by the U.S. military to help soldiers locate their positions on battlefields. The system is now widely used throughout the world. GPS is based on a network of more than two dozen satellites that constantly orbit Earth. A GPS receiver on the surface uses information from the satellites to determine is own position. The receiver detects radio signals from at least four nearby GPS satellites. There are precise clocks on each satellite and in the receiver. The receiver measures the time it takes for the radio signals from each satellite to reach it. It uses these times, together with the constant speed of radio waves, to calculate its distance from each satellite. Then the receiver uses the four distances to triangulate its exact location on Earth's surface.

A related technology is Geographic Information Systems, or GIS. GIS uses exact geographic locations from GPS receivers, along with any type of spatial information, to create maps and images. The spatial information might be numbers of people, types of plants or soils, presence of groundwater, or levels of rainfall. Geologists use GIS to make maps of natural resource distributions, among many other uses.

Questions

1. What is GPS?

2. How does a GPS receiver determine its exact location?
3. What is GIS? How does it use GPS?

Lesson 2.5: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Satellites are used for
   a. navigation.
   b. communications.
   c. storm tracking.
   d. all of the above
2. Of the following uses, a satellite in a polar orbit is most likely to be used for
   a. monitoring weather changes in a given area.
   b. observing how weather is changing globally.
   c. relaying communications signals.
   d. two of the above
3. Which U.S. government agencies gather data with satellites?
   a. National Aeronautics and Space Administration
   b. National Oceanographic and Atmospheric Administration
   c. United States Geological Survey
   d. all of the above
4. Which type of signals does a GPS receiver receive from satellites?
   a. microwave
   b. radio
   c. magnetic
   d. light
5. Which information does a GPS receiver use to determine its distance from a satellite?
   a. speed of radio waves
   b. time to receive signals
   c. strength of magnetic field
   d. two of the above
6. A GPS receiver determines its own location based on its
   a. location relative to the magnetic poles.
   b. distance to four satellites.
   c. latitude and longitude.
   d. speed and distance.
7. GIS uses GPS and spatial information to
   a. navigate satellites.
   b. make maps and images.
   c. gather weather data.
   d. predict climate change.

Lesson 2.5: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. system of satellites used to locate positions on Earth's surface

_____ 2. type of satellite orbit that remains at an altitude of several hundred kilometers above Earth's surface

_____ 3. system that links GPS data with any type of spatial information to create maps and images

_____ 4. small object that orbits a larger object

_____ 5. type of satellite orbit that remains at an altitude of 36,000 kilometers above Earth's surface

Terms

a. satellite

b. GPS

c. GIS

d. geostationary orbit

e. polar orbit

Lesson 2.5: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The type of orbit that keeps a satellite over the same place on Earth's surface is a(n) __________ orbit.
2. A satellite with the type of orbit in question 1 revolves around Earth once every __________ hours.
3. The type of orbit that allows a satellite to see all of Earth's surface in less than a day is a(n) __________ orbit.
4. A satellite with the type of orbit in question 3 revolves around Earth once every __________ hours.
5. Using GPS to pinpoint a location requires signals from at least __________ GPS satellites.
6. Most maps are made today by __________.
7. Geologists use __________ Systems to make maps of natural resource distributions.

Lesson 2.5: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast geostationary and polar satellite orbits and their uses.

Chapter 3 HS Earth's Minerals Worksheets

Chapter Outline

3.1 Matter Matters

Lesson 3.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Electrons orbit the nucleus of an atom.

_____ 2. An electron cloud is a region where electrons are likely to be.

_____ 3. All subatomic particles are about the same size.

_____ 4. The mass of an atom is the combined masses of its protons and neutrons.

_____ 5. Isotopes of a given element differ in their numbers of electrons.

_____ 6. Carbon-13 is an ion of the element carbon.

_____ 7. Hydrogen bonds are relatively weak bonds.

_____ 8. The oxygen side of a water molecule has a slightly positive charge.

_____ 9. In covalent bonds, atoms always share electrons equally.

_____ 10. The non-metallic ion in an ionic bond is negatively charged.

Lesson 3.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Elements, Atoms, and Isotopes

A chemical element is a substance that cannot be made into simpler substances by ordinary chemical means. Examples of elements include hydrogen, oxygen, carbon, and iron. The smallest unit of a chemical element is an atom. An atom has all the properties of the element.

Atoms, in turn, consist of smaller particles, called subatomic particles. At the center of an atom is a nucleus (plural, nuclei). The nucleus consists of subatomic particles called protons and neutrons. Protons have a positive electrical charge. Neutrons are about the same size as protons but have no electrical charge. In other words, they are electrically neutral. Electrons are tiny subatomic particles that have a negative electrical charge. They are not found in the nucleus. They orbit the nucleus at various energy levels in a region known as the electron cloud.

Because electrons are minuscule compared with protons and neutrons, they contribute virtually nothing to the mass of an atom. Instead, the mass of an atom depends almost completely on the number of protons and neutrons in its nucleus. In fact, atomic mass is calculated as the number of protons plus the number of neutrons in an atom.

The number of protons in the nucleus of an atom determines what element the atom is. That's because each element has a unique number of protons in the nuclei of its atoms. However, atoms of a given element can differ in their numbers of neutrons. Atoms of an element with different numbers of neutrons are called isotopes. For example, atoms of carbon always have 6 protons, but they may have 6, 7, or 8 neutrons. This means that there are three isotopes of carbon: carbon-12 (6 protons + 6 neutrons), carbon-13 (6 protons + 7 neutrons), and carbon-14 (6 protons + 8 neutrons).

Questions

1. Relate atoms to elements.
2. Describe the structure of atoms.
3. What are isotopes? Give an example.

Lesson 3.1: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. Particles that make up atoms include
   a. protons.
   b. neutrons.
   c. electrons.
   d. all of the above
2. Which statement about neutrons is false?
   a. Neutrons have no electrical charge.
   b. Neutrons are about the same size as protons.
   c. Neutrons are located in the nucleus of an atom.
   d. The number of neutrons is the same in all atoms of an element.
3. An ion always has
   a. a positive or negative electrical charge.
   b. the same number of electrons as protons.
   c. the same number of electrons as neutrons.
   d. none of the above
4. A carbon atom with 8 neutrons is the isotope called
   a. carbon-11.
   b. carbon-12.
   c. carbon-13.
   d. carbon-14.
5. In ionic bonds, atoms of a metal
   a. give up electrons.
   b. receive electrons.
   c. accept electrons.
   d. share electrons.
6. Hydrogen bonds are
   a. intermolecular.
   b. covalent.
   c. ionic.
   d. polar.

7. Molecules of water are
    a. covalent.
    b. polar.
    c. ionic.
    d. two of the above

Lesson 3.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. center of an atom

_____ 2. chemical bond in which electrons are transferred between atoms

_____ 3. atom of an element with a different number of neutrons

_____ 4. chemical bond in which electrons are shared between atoms

_____ 5. particle that results when an atoms gains or loses electron(s)

_____ 6. bond between oppositely charged ends of two different molecules

_____ 7. smallest particle of a compound that still has the properties of that compound

Terms

a. covalent bond

b. hydrogen bond

c. ion

d. ionic bond

e. isotope

f. molecule

g. nucleus

Lesson 3.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. A substance that cannot be broken down to simpler substances by ordinary chemical means is called a(n) ___________.
2. The smallest particle of an element that has the properties of that element is known as a(n) __________.
3. A(n) __________ is a subatomic particle with a positive electrical charge.
4. A(n) __________ is a subatomic particle with a negative electrical charge.
5. A molecule that has slightly negative and positive ends is known as a(n) __________ molecule.
6. The number of protons plus neutrons in an atom is its ___________.
7. The sum of the masses of all the atoms in a molecule is the __________.

Lesson 3.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast ionic and covalent bonds.

3.2 Minerals and Mineral Groups

Lesson 3.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The mineral silver contains silver and carbon atoms.

_____ 2. A mineral has a specific chemical composition.

_____ 3. Minerals are identified on the basis of their physical properties.

_____ 4. Silicate minerals make up over 90 percent of Earth's crust.

_____ 5. Most minerals belong to the native elements group.

_____ 6. Carbonates consist only of carbon and oxygen.

_____ 7. Table salt is an example of a halide mineral.

_____ 8. Phosphate minerals are similar in structure to silicate minerals.

_____ 9. Gypsum is a common sulfide mineral.

_____ 10. Pyrite, or "fool's gold," is a common sulfate mineral.

Lesson 3.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

What Is a Mineral?

To be classified as a mineral, a substance must be a crystalline solid. It also must be inorganic and form through natural processes. In addition, it must have a definite chemical composition. Each of these properties is described next.

A crystalline solid is a substance that forms crystals. A crystal is a solid structure in which atoms or ions are arranged in a regular, repeating pattern. A given mineral always forms crystals with the same pattern of atoms or ions.

An inorganic substance is a substance that is not made by living things. (Organic substances, such as carbohydrates and proteins, are made by living things.) Both diamond and coal consist mainly of carbon. Diamond is a mineral, but coal is not. Coal looks like a mineral, but it is organic. It is a rock made of once-living things.

Minerals are made by natural processes that occur on or under Earth's surface. For example, diamond is created deep in Earth's crust when carbon is put under extreme pressure. Artificial "diamonds" can be made in a lab, by placing carbon under high pressure. However, artificial "diamonds" are not really minerals.

Some minerals, including gold and diamond, are made of single elements. But most minerals are chemical compounds that are made of two or more elements. Different minerals may contain many of the same elements. Elements commonly found in minerals include oxygen, silicon, and calcium. However, each mineral has a specific chemical composition. For example, halite is made of equal numbers of sodium and chloride ions. Quartz is always made of one silicon atom for every two oxygen atoms.

Questions

1. What is a mineral?
2. Describe a crystalline solid.
3. Contrast organic and inorganic substances.
4. Diamond and coal both consist of carbon. Why is diamond a mineral whereas coal is not?

Lesson 3.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. All minerals
   a. form crystals.
   b. are inorganic.
   c. form naturally.
   d. all of the above
2. Minerals are divided into eight major groups based on their
   a. physical properties.
   b. chemical composition.
   c. crystalline structure.
   d. color and luster.
3. The basic building block of all silicate minerals is called a silica
   a. tetrahedron.
   b. pyramid.
   c. sphere.
   d. salt.
4. Which of the following minerals is a native element?
   a. gold
   b. fluorite
   c. magnetite
   d. muscovite
5. Which of the following minerals is an oxide?
   a. turquoise
   b. hematite
   c. azurite
   d. halite
6. The most common carbonate mineral is
   a. coal.
   b. silver.
   c. calcite.
   d. diamond.

7. Which statement about phosphate minerals is false?
    a. They are built of tetrahedra.
    b. There are very few of them.
    c. They contain phosphorus.
    d. Most of them are rare.

Lesson 3.2: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. minerals containing just one element

_____ 2. solid in which the atoms are arranged in a regular repeating pattern

_____ 3. way that light reflects off a mineral's surface

_____ 4. mineral's tendency to break along flat planes

_____ 5. color of a mineral's powder

_____ 6. minerals that form salts

_____ 7. largest mineral group

Terms

a. streak

b. silicates

c. crystal

d. halides

e. native elements

f. cleavage

g. luster

Lesson 3.2: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. A unique substance with a definite chemical composition that is made up of two or more elements is a chemical ___________.
2. How heavy a substance is relative to the same volume of water is its ___________.
3. ___________ is the pattern in which a mineral characteristically breaks.
4. Hardness and color are ___________ properties of minerals.
5. Feldspar and quartz belong to the ____________ group of minerals.
6. All minerals in the ___________ group have molecules that contain one carbon atom bonded to three oxygen atoms.

7. Oxides are minerals that contain one or two metal elements combined with __________.

Lesson 3.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify and describe two mineral groups. How do the two groups differ?

3.3 Mineral Identification

Lesson 3.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Minerals can be identified only by their chemical properties.

_____ 2. Every mineral has its own unique color.

_____ 3. All quartz is clear like glass.

_____ 4. The streak of a given mineral does not vary.

_____ 5. Some minerals do not have the property of streak.

_____ 6. Sparkly luster is a type of metallic luster.

_____ 7. The density of a mineral is calculated by multiplying its mass times its volume.

_____ 8. On the Mohs hardness scale, diamond has a value of 1.

_____ 9. A mineral breaks where its chemical bonds are weakest.

_____ 10. If a mineral smells like rotten eggs, it is the mineral calcite.

Lesson 3.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Color, Streak, and Luster

Diamonds are popular gemstones because of the way they reflect light. Their luster makes them appear very sparkly. Turquoise is prized for its color. It is a striking greenish blue. The color of minerals and how they reflect light are two physical properties that may help to identify minerals.

Although the color of a mineral is easy to observe, color alone is rarely very useful for identifying minerals. One reason is that different samples of the same mineral may vary in color. For example, different samples of quartz may be colorless (clear) or purple. Purple quartz contains tiny amounts of iron that give it its color. Many minerals are colored by chemical impurities in this way. Another reason that color alone may not be very useful is that different minerals may be the same color. For example, both gold and pyrite ("fool's gold") are yellowish gold in color, but the two are different minerals.

A more useful property for identifying many minerals is streak. Streak is the color of a mineral's powder. To check a mineral's streak, scrape a piece of the mineral across an unglazed porcelain plate. Streak is a more reliable property than color for mineral identification because a given mineral's streak does not vary. Even minerals that are the same color differ in the color of their streak. For example, gold has a golden yellow streak, whereas pyrite has a blackish streak. Streak cannot be used to identify all minerals because not all minerals leave a streak of powder when scraped across unglazed porcelain. Quartz is an example of a mineral that does not have streak.

Luster describes how light reflects off a mineral's surface. Mineralogists have special terms to describe luster. First, they divide all minerals into those with metallic luster and those with non-metallic luster. Minerals with metallic luster are opaque and shiny. Pyrite is an example. All other minerals have non-metallic luster. There are six different types of non-metallic luster, including adamantine luster, which appears sparkly. Diamond has adamantine luster. Other types of non-metallic luster are earthy luster, which appears dull and clay-like; pearly luster, which appears pearl-like; resinous luster, which appears resin-like, as in tree resin; silky luster, which appears soft looking with long fibers; and vitreous luster, which appears glassy.

Questions

1. Why is color alone rarely very useful for identifying minerals?
2. What is streak, and how can you check a mineral's streak? Why is streak more useful than color for identifying minerals?
3. What is luster? Outline how minerals are classified on the basis of luster.

Lesson 3.3: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Physical properties of minerals include
   a. chemical makeup.
   b. bonding.
   c. fracture.
   d. all of the above
2. Which of the following properties may vary for different samples of a given mineral?
   a. color
   b. luster
   c. streak
   d. hardness
3. Which mineral has a resinous luster?
   a. diamond
   b. quartz
   c. sulfur
   d. none of the above
4. Minerals with higher specific gravity have greater
   a. volume.
   b. fracture.
   c. density.
   d. mass.
5. No other mineral can scratch the mineral
   a. talc.
   b. quartz.
   c. diamond.
   d. corundum.

6. If a mineral has cleavage it breaks
    a. into pieces with jagged edges.
    b. along smooth curved surfaces.
    c. along smooth flat surfaces.
    d. into splinters like wood.
7. If a mineral bubbles when exposed to a weak acid, it has the property of
    a. radioactivity.
    b. magnetism.
    c. reactivity.
    d. acidity.

Lesson 3.3: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. sparkly non-metallic luster

_____ 2. softest mineral

_____ 3. amount of mass per unit volume

_____ 4. hardest mineral

_____ 5. glowing under ultraviolet light

_____ 6. break in a mineral that is not along a cleavage plane

_____ 7. glassy non-metallic luster

Terms

a. density

b. fluorescence

c. talc

d. fracture

e. vitreous

f. adamantine

g. diamond

Lesson 3.3: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The physical property that is usually least useful for mineral identification is __________.
2. Scientists who study minerals are known as __________.

3. You can see the __________ of a mineral by scraping the mineral across an unglazed porcelain plate.
4. Minerals that are opaque and shiny have a(n) __________ luster.
5. Earthy, pearly, and silky are types of __________ luster.
6. __________ is a measure of whether a mineral will scratch, or be scratched by, other minerals.
7. The __________ hardness scale is a reference for mineral hardness.

Lesson 3.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how the property of hardness can be used to help identify minerals. What role does the Mohs hardness scale play?

3.4 Mineral Formation

Lesson 3.4: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Magma cools more quickly than lava.

_____ 2. When melted rock cools quickly, large mineral crystals form.

_____ 3. Dissolved minerals are left behind when water evaporates.

_____ 4. Veins form when minerals are deposited in cracks in rocks by flowing water.

_____ 5. Halite easily precipitates out of water.

_____ 6. There are only three ways that minerals can form.

_____ 7. Minerals can form only from liquids.

_____ 8. Granite is a rock that forms when magma cools quickly.

Lesson 3.4: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Formation of Minerals from Solutions

Water on Earth, such as water in the oceans, contains dissolved chemical elements mixed into a solution. Various processes can cause these dissolved elements to combine and form solid minerals.

One way minerals can form from solutions is by evaporation. When water evaporates, elements dissolved in the water are left behind as mineral crystals. Another way minerals can form from solutions is by precipitation. Water can hold only a certain amount of dissolved elements. When this limit is exceeded, particles come together to form mineral solids, which sink to the bottom of the water. Both halite and calcite easily precipitate out of water in this way.

A third way minerals can form from solutions is by deposition in rock underground. Magma heats nearby underground water, and the hot water dissolves elements from rock. Then, as the water flows through open spaces in rock, it cools. The cool water cannot hold as many dissolved elements as the hot water, so it deposits some of the elements as mineral crystals. When minerals are deposited in cracks in rock, they form long, narrow deposits called veins. When minerals are deposited in open spaces in rock, they form large mineral crystals called geodes.

Questions

1. List three ways minerals can form from solutions.
2. Compare and contrast mineral formation by evaporation and precipitation.

3. Explain how minerals are deposited in underground rock. Why do some deposits form veins whereas others form geodes?

Lesson 3.4: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Minerals can form by
    a. oxidation.
    b. crystallization.
    c. deposition.
    d. all of the above
2. Mineral crystals do not grow very large when they form
    a. from lava.
    b. from magma.
    c. slowly.
    d. two of the above
3. Minerals in granite include
    a. quartz.
    b. geode.
    c. silicon.
    d. two of the above
4. Ocean water is a
    a. mixture.
    b. solution.
    c. mineral.
    d. two of the above
5. Assume that you dissolve some table salt in pure water and pour a small amount of the salt water onto a plate. If you let the water evaporate, what will be left on the plate?
    a. nothing
    b. halite
    c. calcite
    d. tufa
6. Heated underground water deposits minerals in rock when it
    a. cools.
    b. expands.
    c. evaporates.
    d. dries up.
7. Which statement about geodes is false?
    a. They form in cracks in rocks.
    b. They have large crystals.
    c. They are rocks that form underground.
    d. They are deposited by water.

Lesson 3.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. melted rock on Earth's surface

_____ 2. solid mixture of minerals

_____ 3. mineral deposit in a crack in rock

_____ 4. melted rock inside Earth

_____ 5. mineral deposit in an open space in rock

Terms

a. magma

b. lava

c. rock

d. vein

e. geode

Lesson 3.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The more quickly melted rock cools, the __________ the mineral crystals are.
2. Tufa towers in Mono Lake form by the process of __________.
3. Veins and geodes in rock form by the process of __________.
4. Granite forms underground so its mineral crystals are __________.
5. Minerals form when rocks become so hot that atoms or ions can move around and join into different ______-_____.

Lesson 3.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast the formation of minerals from magma and lava.

3.5 Mining and Mineral Use

Lesson 3.5: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. It costs less to obtain new minerals than to recycle used minerals.

_____ 2. There are only two ways to mine mineral ores.

_____ 3. Surface mining uses blasting to remove overlying rock.

_____ 4. Gold is the only mineral mined in California.

_____ 5. Mining can have harmful effects on the environment.

_____ 6. U.S. laws require the reclamation of land that has been mined.

_____ 7. All land ever mined in the U.S. has been reclaimed.

_____ 8. Sheetrock is made of the mineral gypsum.

_____ 9. The main ingredient of window glass is the mineral halite.

_____ 10. The metal copper is used for electric wires.

Lesson 3.5: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Finding and Mining Minerals

Geologic processes create and concentrate minerals that are valuable natural resources. Geologists study geological formations and then test the physical and chemical properties of soil and rocks to locate possible ore deposits. They also determine the size of the deposits and the concentration of mineral ores. These factors are important in deciding whether a mineral deposit is worth mining. A deposit will be mined only if it would be profitable to do so. A concentration of minerals is called an ore deposit only if it is profitable to mine.

Ore deposits that are close to the surface are mined by surface mining. In surface mining, any overlying rock is blasted away. The rock that contains the valuable minerals is placed in a truck and taken to a refinery. Specific methods of surface mining include open-pit mining, strip mining, mountain-top removal, and placer mining. In open-pit mining, minerals are extracted by digging a big hole in the ground. Strip mining is like open-pit mining except the material is removed in long strips. In mountain-top removal, a mountain top is completely removed to get to the level of the ore. Placer mining is the removal of ore that has been deposited in the gravel of a stream bed.

Ore deposits that are deep underground are mined by underground mining. Miners blast and tunnel into rock to gain access to the ore. The tunnels may be very deep under the ground. Underground mining is expensive and dangerous. Hazards in underground mines include toxic gases, lack of fresh air, total darkness, and the potential for accidents such as explosions and mine collapses.

Questions

1. What is an ore deposit? What factors determine whether a mineral deposit is profitable to mine?
2. Explain how ore deposits close to the surface are mined. Identify several specific methods.
3. Describe how ore deposits deep under the surface are mined. Why is this type of mining especially dangerous?

Lesson 3.5: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. Scientists who locate ore deposits are
   a. geologists.
   b. environmental scientists.
   c. soil scientists.
   d. paleontologists.
2. A mineral deposit will be mined only if it
   a. is profitable to mine.
   b. is located on the surface.
   c. contains many different minerals.
   d. is a renewable source of ores.
3. Methods of surface mining include
   a. dredging.
   b. mountain-top removal.
   c. strip mining.
   d. all of the above
4. Which statement about placer minerals is false?
   a. They are found in stream gravels.
   b. They end up in water because of weathering.
   c. They were responsible for the 1848 California gold rush.
   d. They are no longer being deposited in California.
5. Compared with surface mining, underground mining is
   a. less expensive.
   b. more dangerous.
   c. always a better way to extract ore.
   d. all of the above
6. Adding acid to rocks to remove ore is called
   a. flotation.
   b. leaching.
   c. smelting.
   d. crushing.
7. To extract metal from ore, the ore is
   a. mixed with water.

b. mixed with chemicals.
c. heated to a high temperature.
d. cooled to a sub-zero temperature.

Lesson 3.5: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. extracting minerals close to the surface by digging a large hole

_____ 2. restoring mined land to a natural state

_____ 3. concentration of minerals that is profitable enough to mine

_____ 4. extracting minerals from stream gravels

_____ 5. rock that contains minerals with useful elements

_____ 6. extracting minerals close to the surface by removing the surface in strips

_____ 7. mineral that is cut and polished for jewelry

Terms

a. gemstone

b. ore

c. ore deposit

d. placer mining

e. reclamation

f. strip mining

g. open-pit mining

Lesson 3.5: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The metal __________ is obtained from a mineral ore called bauxite.
2. Any method of extracting ores that are close to Earth's surface is called __________ mining.
3. After ores are mined, they are processed at a(n) __________.
4. Extracting ores that are deep under Earth's surface is called __________ mining.
5. The process of __________ heats ores to separate the minerals into layers.
6. The gemstone __________ is so hard that it is used to cut glass and metals.
7. The mineral __________ is mined for rock salt.

Lesson 3.5: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how mining can adversely affect the environment and how land that has been mined is reclaimed.

CHAPTER 4 HS Rocks Worksheets

Chapter Outline

4.1 Types of Rocks

Lesson 4.1: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Mineral grains in rocks are always visible to the unaided eye.

_____ 2. Each type of rock consists of a distinctive mineral or set of minerals.

_____ 3. Igneous rocks that cool slowly have smaller grains than those that cool quickly.

_____ 4. Sediments are never larger than grains of sand.

_____ 5. Some sedimentary rocks form from chemical precipitates.

_____ 6. Metamorphic rocks form only under Earth's surface.

_____ 7. Sandstone forms when quartzite is exposed to heat and pressure.

_____ 8. The concept of the rock cycle is attributed to geologist James Hutton.

_____ 9. The rock cycle always begins with igneous rock and ends with metamorphic rock.

_____ 10. Metamorphism can change the texture but not the mineral composition of rock.

Lesson 4.1: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

What Are Rocks?

Rocks are naturally formed, non-living Earth materials. Rocks are made of collections of mineral grains that are held together in a hard, solid mass. The mineral grains in rocks may be so tiny that you can see them only with a microscope, or they may be as big as your finger.

Rocks are identified primarily by the minerals they contain and by their texture. Each type of rock has distinctive minerals. A rock may be made of grains of all one mineral type. Much more commonly, a rock is made of a mixture of different minerals. Texture is a description of the size, shape, and arrangement of mineral grains. Two rocks may have the same chemical composition and contain mostly the same minerals, but they may have different textures. Their different textures indicate different histories. For example, a rock that formed from molten rock will have small grains and a fine texture if it cooled quickly on Earth's surface. A rock with the same composition that cooled slowly under Earth's surface will have larger grains and a coarser texture.

Questions

1. What are rocks, and what are they made of?
2. How are rocks identified?

3. Define rock texture. What determines the texture of rock? Give examples.

Lesson 4.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. All rocks
   a. are naturally forming.
   b. form beneath Earth's surface.
   c. consist of sediments.
   d. all of the above
2. Rocks are identified primarily by
   a. the minerals they contain.
   b. their texture.
   c. their color.
   d. two of the above
3. The classification of rocks into three major categories is based on
   a. how the rocks form.
   b. which chemicals the rocks contain.
   c. how old the rocks are.
   d. two of the above
4. Igneous rocks form by
   a. cementation.
   b. compaction.
   c. crystallization.
   d. precipitation.
5. Which of the following rocks is a sedimentary rock?
   a. diorite
   b. andesite
   c. quartzite
   d. sandstone
6. Processes that take place in the rock cycle include
   a. erosion.
   b. melting.
   c. tectonic burial.
   d. all of the above
7. Metamorphic rock can form from
   a. igneous rock.
   b. sedimentary rock.
   c. other metamorphic rock.
   d. all of the above

Lesson 4.1: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. broken piece of rock

_____ 2. exposed rock formation

_____ 3. solid material left behind when a liquid evaporates

_____ 4. rock that forms when molten rock solidifies

_____ 5. transport of sediments from one place to another

_____ 6. rock that forms from sediments

_____ 7. rock that forms when existing rock is changed by heat or pressure

Terms

a. erosion

b. igneous rock

c. metamorphic rock

d. sedimentary rock

e. outcrop

f. precipitate

g. sediment

Lesson 4.1: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. ___________ is a description of the size, shape, and arrangement of mineral grains in a rock.
2. The process in which mineral crystals form as molten rock cools is called ___________.
3. The process in which a rock changes due to heat or pressure inside Earth is ___________.
4. The continuous series of processes by which rocks change from one type to another is called the ___________.
5. ___________ is the deposition of transported sediments.
6. The wearing away of rocks at Earth's surface is known as ___________.
7. After molten rock flows onto Earth's surface, it is called ___________.

Lesson 4.1: Critical Writing

Name____________________ Class_______________ Date_________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast the three main categories of rocks.

4.2 Igneous Rocks

Lesson 4.2: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. About 70 different types of igneous rocks are known.

_____ 2. The most prevalent element in magma is oxygen.

_____ 3. Most rocks on Earth are igneous rocks.

_____ 4. Adding water to rock raises the rock's melting point.

_____ 5. All minerals melt at about the same temperature.

_____ 6. Minerals crystallize out of magma when it melts.

_____ 7. A pluton is an extrusive igneous rock that cooled on the crust.

_____ 8. Most igneous rocks lie below sedimentary rock or ocean water.

_____ 9. Pumice is an example of volcanic rock.

_____ 10. Obsidian is called natural glass.

Lesson 4.2: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Magma

The rock beneath Earth's surface is sometimes heated to high enough temperatures that it melts and forms magma. Different magmas have different compositions. They contain whatever elements were in the rock that melted. Magmas also contain gases. The main elements found in magma are the same as the elements that are found in crust. Oxygen and silicon are the most prevalent.

Whether a given rock melts and forms magma depends on several factors. Temperature is one factor. The temperature has to reach hundreds of degrees Celsius before any minerals melt. Minerals melt at different temperatures, so the mineral composition of rock is an important factor influencing whether it melts. Of common minerals, quartz melts at the lowest temperature (about 650 °C), whereas olivine melts at the highest temperature (about 1400 °C). Therefore, as the temperature of rock rises, the first mineral to melt is quartz (if present) and the last mineral to melt is olivine (if present). Partial melting occurs when the temperature rises high enough to melt only some of the minerals in rock. Temperature increases with depth below Earth's surface, so melting is more likely to occur at greater depths.

Pressure on rock also increases at greater depths. However, increased pressure raises the melting point of rock, so melting is less likely to occur at higher pressures. The addition of water to rock, on the other hand, lowers the melting point of rock, so melting is more likely to occur with added water.

Questions

1. How does magma form?
2. Describe the composition of magma.
3. Identify factors that influence the melting of rock. Explain the influence of each factor.

Lesson 4.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. All igneous rocks form when
   a. volcanoes erupt.
   b. minerals precipitate.
   c. molten rock hardens.
   d. lava crystallizes.
2. Which statement about magma is false?
   a. It contains gases.
   b. It is melted rock.
   c. It may form on Earth's surface.
   d. It consists of elements in Earth's crust.
3. Whether a given rock inside Earth melts depends on
   a. its temperature.
   b. the pressure exerted on it.
   c. its mineral composition.
   d. all of the above
4. Fractional crystallization is the
   a. breaking of crystals in magma.
   b. opposite of partial melting.
   c. formation of fractured rock.
   d. two of the above
5. Which of the following minerals forms crystals at the lowest temperature?
   a. quartz
   b. feldspar
   c. pyroxine
   d. olivine
6. Why does basalt have no visible crystals?
   a. It forms when lava cools quickly.
   b. It forms beneath the ocean floor.
   c. It consists of low-density minerals.
   d. It consists of ultramafic minerals.
7. Which class of igneous rock contains the mineral quartz?
   a. felsic
   b. intermediate
   c. mafic
   d. ultramafic

Lesson 4.2: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. most common intrusive igneous rock

_____ 2. any igneous rock that forms on Earth's surface

_____ 3. type of igneous rock that is light in color and low in density

_____ 4. igneous rock that cools so rapidly it lacks crystals

_____ 5. any igneous rock that forms beneath Earth's surface

_____ 6. type of igneous rock that is dark in color and high in density

_____ 7. most common extrusive igneous rock

Terms

a. intrusive rock

b. felsic rock

c. granite

d. mafic rock

e. extrusive rock

f. basalt

g. obsidian

Lesson 4.2: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. Bowen's reaction series shows the __________ at which minerals melt or crystallize.
2. __________ melting occurs when the temperature of rock is too low to melt all of the minerals.
3. The mineral that crystallizes at the highest temperature is __________.
4. Volcanic rock is another name for __________ igneous rock.
5. Igneous rock made only of the mineral olivine is classified as __________ in composition.
6. The stone in "stone-washed" is the igneous rock named __________.
7. Granite is an igneous rock with a(n) __________ composition.

Lesson 4.2: Critical Writing

Name____________________ Class_______________ Date_________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

California's Sierra Nevada Mountains consist mainly of granite. Based on what you know about granite, explain why the mountains could not have formed by volcanic activity. How did the mountains form?

4.3 Sedimentary Rocks

Lesson 4.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. The sediments in sedimentary rock may be precipitates.

_____ 2. Weathering breaks up or dissolves rock.

_____ 3. The more energy a stream has, the larger the sediments it can carry.

_____ 4. Sediments settle out of water in vertical layers.

_____ 5. Shale is a type of bioclastic sedimentary rock.

_____ 6. Sedimentary rocks are softer than igneous or metamorphic rocks.

_____ 7. Sedimentary rocks are too fragile to be used for construction.

_____ 8. Rock salt forms from a chemical precipitate.

_____ 9. Clastic rocks are sedimentary rocks that form only from sand-sized sediments.

_____ 10. Lithification is the second step of cementation.

Lesson 4.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Sedimentary Rock Formation

Accumulated sediments harden into sedimentary rock by lithification. Two important steps are needed for sediments to lithify: compaction and cementation.

1. Compaction occurs when sediments are squeezed together by the weight of all the sediments on top of them.
2. Cementation occurs when spaces between sediments fill in with mineral crystals. The minerals crystallize out of water that seeps through the sediments.

Sedimentary rocks can form from sediments with a wide range of sizes. The type of sedimentary rock that forms depends on the size of the sediments.

- If sediments are large and rounded, they form rock called conglomerate.
- If sediments are large and angular, they form rock called breccia.
- Smaller, sand-sized sediments form sandstone.
- Still smaller, silt-sized sediments form siltstone.
- The smallest, clay-sized sediments form shale.

When sediments settle out of calm water, they form horizontal layers. One layer is deposited first; then another layer is deposited on top of the first layer. More and more layers are deposited on the layers below them. Therefore, any layer of sedimentary rock is always younger than the layer below it, as long as the layers have not been disturbed.

Biochemical sedimentary rocks form at the bottom of an ocean or salt lake. Living creatures remove ions—such as calcium, magnesium, and potassium—from the salt water to make shells and other tissues. When the organisms die, they sink to the ocean floor. Their shells become biochemical sediments, which may then become compacted and cemented into sedimentary rocks.

Questions

1. What is lithification? What steps occur during lithification?
2. Relate sediment size to type of sedimentary rock.
3. Explain why any layer of sedimentary rock is younger than the layer below it, as long as the layers have not been disturbed.
4. What are biochemical sedimentary rocks? Where and how do they form?

Lesson 4.3: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Which statement about sandstone is false?
   a. It is very porous.
   b. It is chemical sedimentary rock.
   c. It forms from sand-sized sediments.
   d. It is easily penetrated by rainwater.
2. In which sequence do the processes of weathering, deposition, and erosion occur to provide the basis of sedimentary rock?
   a. weathering, erosion, deposition
   b. erosion, weathering, deposition
   c. deposition, erosion, weathering
   d. erosion, deposition, weathering
3. When flowing water slows down it
   a. drops sediments.
   b. has less energy.
   c. causes more erosion.
   d. two of the above
4. Each layer of sedimentary rock
   a. is older than the layer below it.
   b. is younger than the layer above it.
   c. was deposited after the layer below it.
   d. was deposited after the layer above it.
5. Biochemical sedimentary rock
   a. forms deep beneath Earth's surface.
   b. forms at the bottom of salt water.
   c. consists only of chemical precipitates.

   d. two of the above

6. Which of the following is a biochemical sedimentary rock?
   a. sandstone
   b. shale
   c. limestone
   d. siltstone
7. Uses of sedimentary rock include
   a. building stone structures.
   b. making concrete.
   c. making asphalt
   d. all of the above

Lesson 4.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. sedimentary rock that forms from chemical precipitates

_____ 2. process by which sediments harden into rock

_____ 3. sedimentary rock containing only inorganic sediments

_____ 4. breaking of rock into smaller pieces

_____ 5. crystallization that fills in the spaces between loose sediments

_____ 6. dissolving of minerals in rock

_____ 7. sedimentary rock containing organic sediments

Terms

a. physical weathering

b. clastic rock

c. chemical weathering

d. bioclastic rock

e. cementation

f. lithification

g. chemical rock

Lesson 4.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The White House in Washington, D.C., is made of the sedimentary rock __________.

2. The transport of sediments by water, wind, ice, or gravity is called __________.
3. The two steps of lithification are compaction and __________.
4. Sedimentary rock that consists of large angular sediments is named __________.
5. Sedimentary rock that forms from clay is called __________.
6. Sedimentary rock that consists of large rounded sediments is named __________.
7. The squeezing together of sediments by the weight of overlying sediments is called __________.

Lesson 4.3: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast the sedimentary rocks sandstone and limestone.

4.4 Metamorphic Rocks

Lesson 4.4: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. When rocks undergo metamorphism, they always change chemically.

_____ 2. Extreme pressure during metamorphism always causes rocks to develop layers.

_____ 3. Metamorphism can occur without extreme pressure being applied to rocks.

_____ 4. The metamorphism of shale can result in the metamorphic rock schist.

_____ 5. The metamorphic rock hornfels forms by regional metamorphism.

_____ 6. The parent rock of the metamorphic rock quartzite is limestone.

_____ 7. The metamorphic rock named schist may be used for landscaping.

_____ 8. Some toothpastes contain the metamorphic rock marble.

_____ 9. The metamorphic rock slate may be used as a building material.

_____ 10. The metamorphic rock quartzite is very soft and crumbly.

Lesson 4.4: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Metamorphism

Any type of rock—igneous, sedimentary, or metamorphic—can become a metamorphic rock. All that is needed is enough heat and/or pressure to alter the parent rock's physical or chemical makeup without melting the rock entirely. Rocks change during metamorphism because their minerals must be stable under the new temperature and pressure conditions. The need for stability may cause the structure of minerals to rearrange so new minerals form. Ions may move between minerals to create minerals with different chemical compositions.

Extreme pressure exerted from one direction only may cause foliation. During this process, layers form in rocks as they are squeezed by extreme pressure. Examples of foliated metamorphic rocks include slate and schist, both of which form from the sedimentary rock shale. Metamorphic rocks may also be non-foliated. Quartzite and marble are nonfoliated metamorphic rocks.

Questions

1. What causes rocks to undergo metamorphism?
2. Why do rocks change during metamorphism?
3. What is foliation? When does it occur?

Lesson 4.4: Multiple Choice

Name____________________ **Class**_______________ **Date**________

Circle the letter of the correct choice.

1. What happens during metamorphism?
    a. Rocks change physically or chemically.
    b. Rocks form from magma.
    c. Rocks melt completely.
    d. any of the above
2. Foliation normally occurs when
    a. rock temperature rises to the melting point.
    b. pressure is exerted in just one direction on rock.
    c. layers of rock are peeled away by extreme heat.
    d. layers in rock disappear due to extreme pressure.
3. Regional metamorphism may be caused by
    a. extreme pressure from overlying rock.
    b. burial of rock deep below Earth's surface.
    c. compression by geologic processes.
    d. all of the above
4. Contact metamorphism occurs
    a. over a wide area.
    b. because of extreme heat.
    c. when rock changes to magma.
    d. because of weathering and erosion.
5. All of the following are non-foliated metamorphic rocks except
    a. schist.
    b. marble.
    c. quartzite.
    d. metaconglomerate.
6. When shale undergoes metamorphism, it may change to
    a. phyllite.
    b. marble.
    c. quartzite.
    d. none of the above

Lesson 4.4: Matching

Name____________________ **Class**_______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. changes in enormous quantities of rock over a wide area

_____ 2. example of foliated metamorphic rock

_____ 3. formation of layers in rock due to pressure form one direction

_____ 4. example of non-foliated metamorphic rock

_____ 5. changes in rock due to heating by nearby magma

Terms

a. gneiss

b. foliation

c. hornfels

d. regional metamorphism

e. contact metamorphism

Lesson 4.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. __________ occurs when rock changes from one type to another due to extreme heat or pressure.
2. Slate forms when __________ undergoes metamorphism.
3. When sandstone undergoes metamorphism, it becomes __________.
4. Marble is a metamorphic rock that forms from __________.
5. Rocks change during metamorphism because the __________ must be stable under the higher temperature and pressure.
6. The rock from which a metamorphic rock forms is called the __________ rock.

Lesson 4.4: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast regional and contact metamorphism.

CHAPTER 5 HS Earth's Energy Worksheets

Chapter Outline

5.1 Energy Resources

Lesson 5.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. You need energy only when you move.

_____ 2. Energy can change from one form to another.

_____ 3. Energy can never be created or destroyed.

_____ 4. A ball rolling downhill has both potential and kinetic energy.

_____ 5. The heat released when a fuel burns is usually wasted energy.

_____ 6. Fossil fuels are nonrenewable energy resources because more fossil fuels can never be made.

_____ 7. The use of renewable energy resources has only pros and no cons.

_____ 8. Fossil fuels form from the decomposed remains of dead organisms.

_____ 9. The use of fossil fuels contributes to global warming.

_____ 10. Eventually, everyone will have to use renewable energy resources.

Lesson 5.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Types of Energy Resources

There are two basic types of energy resources. Like other natural resources, energy resources are either nonrenewable or renewable.

Nonrenewable resources are natural resources that either cannot be replaced at all or cannot be replaced as quickly as they are used. Fossil fuels—coal, oil, and natural gas—are the major nonrenewable energy resources used today. They form from the partially decomposed remains of once-living organisms. Fossil fuels take millions of years to form, far too long to be replaced as quickly as we use them. The use of fossil fuels also has adverse effects on the environment. When fossil fuels are burned, they release pollutants into the atmosphere that can harm human health and the health of ecosystems. The burning of fossil fuels also releases carbon dioxide and other greenhouse gases, which are causing global temperatures to rise.

Renewable resources are natural resources that either are virtually limitless or can be replaced as quickly as they are used. The sun will continue to provide us with solar energy for billions of years. Flowing water and wind will always be abundant. Sources of biomass energy, such as trees, can be replaced relatively quickly. Unlike the use of fossil fuels, the use of most renewable energy resources does not produce pollutants or carbon dioxide. However, some renewable energy resources can cause environmental problems. For example, damming streams to capture energy from flowing water can harm ecosystems. Some renewable energy resources are currently expensive to use. Some are needed for other uses in addition to energy. For example, trees are needed for lumber in addition to fuel.

Questions

1. Define nonrenewable and renewable resources.
2. Identify common nonrenewable energy resources. What problems are associated with their use?
3. What are some renewable energy resources? List at least one pro and one con of using renewable energy resources.

Lesson 5.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. When plants make "food" by photosynthesis, they change the energy in sunlight to
   a. heat energy.
   b. light energy.
   c. kinetic energy.
   d. chemical energy.
2. What happens every time energy changes form?
   a. New energy is created.
   b. Some energy is destroyed.
   c. The amount of energy stays the same.
   d. Most of the energy is given off as heat.
3. When you kick a soccer ball, you are changing
   a. kinetic energy to potential energy.
   b. kinetic energy to chemical energy.
   c. potential energy to chemical energy.
   d. chemical energy to kinetic energy.
4. All of the following are commonly used for fuel except
   a. food.
   b. water.
   c. sunlight.
   d. gasoline.
5. For fuel to be useful, energy must be released
   a. as heat or light.
   b. in a controlled way.
   c. continuously.
   d. over a long period of time.
6. Which of the following is a nonrenewable energy resource?
   a. geothermal
   b. anthracite
   c. sunlight
   d. biomass
7. Which of the following statements about renewable energy resources is true?

a. Using renewable energy resources never harms the environment.
b. There are endless supplies of all renewable energy resources.
c. All renewable energy resources are cheap to use.
d. none of the above

Lesson 5.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. energy stored in chemical bonds

_____ 2. any material that can release energy in a chemical change

_____ 3. energy that is stored

_____ 4. ability to do work or produce change

_____ 5. resource that is used more quickly than it can be replaced

_____ 6. energy of anything in motion

_____ 7. resource that is replaced as quickly as it is used

Terms

a. kinetic energy

b. nonrenewable resource

c. chemical energy

d. renewable resource

e. energy

f. fuel

g. potential energy

Lesson 5.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The law of __________ states that energy cannot be created or destroyed.
2. __________ energy has the potential to do work or be converted to other forms of energy.
3. Most of the energy released when fuel is burned is released as __________.
4. Coal, oil, and natural gas are called ___________ fuels.
5. The fuels in question 4 are all __________ energy resources.
6. Sunlight, flowing water, and wind are all __________ energy resources.
7. Your body breaks down food and stores the energy as __________ energy.

Lesson 5.1: Critical Writing

Name____________________ Class_______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate the concepts of energy, fuel, and heat.

5.2 Non-renewable Energy Resources

Lesson 5.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Fossil fuels form because of intense heat and pressure on organic remains.

_____ 2. Hydrocarbon compounds can be solids, liquids, or gases.

_____ 3. The main reason coal is burned today is to heat homes and other buildings.

_____ 4. About 90 percent of the energy used worldwide for transportation is provided by oil.

_____ 5. Natural gas forms at a lower temperature than crude oil.

_____ 6. Natural gas does not have to be processed before it can be used as a fuel.

_____ 7. Worldwide fossil fuel use has been declining for several decades.

_____ 8. At current rates of use, oil and natural gas will not run out for many centuries.

_____ 9. Wastes from nuclear power plants remain dangerous for thousands of years.

_____ 10. The U.S. no longer has any functioning nuclear power plants.

Lesson 5.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Oil

Oil, or petroleum, is a liquid fossil fuel. It is currently the single largest source of energy in the world. When oil first comes out of the ground, it is called crude oil. It is a thick, dark brown or black liquid. It forms from the remains of tiny organisms that live at the sea surface and then sink to the seafloor when they die, forming layers of deposits. As the layers pile up, heat and pressure increase. Over millions of years, the dead organisms turn into liquid oil.

Crude oil is a mixture of many different hydrocarbons. To separate the different hydrocarbons, crude oil must be broken down, or refined, in plants called refineries. Refining is possible because each hydrocarbon in crude oil boils at a different temperature. When the oil is boiled in a refinery, the different hydrocarbons boil off at different times and are collected separately. Most of the compounds that come out of the refining process are fuels, such as gasoline, diesel fuel, and jet fuel. Because these fuels are rich sources of energy and can be transported easily, they provide about 90 percent of the energy used for transportation around the world. The rest of the compounds from crude oil are used to make products such as waxes, plastics, and fertilizers.

The United States produces oil but only about one-quarter as much as the nation uses. The United States has only about 1.5% of the world's proven oil reserves, so most of the oil used by Americans must be imported from other nations. In the United States, the main oil-producing regions are the Gulf of Mexico, Texas, Alaska, and California.

Most offshore drilling occurs in the Gulf of Mexico. As in every type of mining, mining for oil has environmental consequences. Oil rigs are unsightly and spills are all too common. Oil spills can be disastrous to ecosystems.

Questions

1. How does crude oil form?
2. Explain why and how crude oil is refined.
3. Why are fuels from crude oil so widely used for transportation?
4. Besides fuels, what products can be made from crude oil?
5. Describe oil production in the United States.

Lesson 5.2: Multiple Choice

Name____________________ **Class**_______________ **Date**_________

Circle the letter of the correct choice.

1. How long does it take fossil fuels to form?
   a. about 500 thousand years
   b. up to 5 million years
   c. more than 100 million years
   d. none of the above
2. Which fossil fuels formed from dead sea organisms?
   a. coal and oil
   b. oil and natural gas
   c. coal and natural gas
   d. coal, oil, and natural gas
3. The fossil fuel that is likely to last the longest before running out is
   a. petroleum.
   b. natural gas.
   c. crude oil.
   d. coal.
4. Which form of coal has the fewest impurities?
   a. lignite
   b. anthracite
   c. bituminous
   d. subbituminous
5. The different types of hydrocarbons in crude oil can be separated by
   a. boiling.
   b. fracking.
   c. crushing.
   d. dissolving.
6. Which statement about oil and the U.S. is false?
   a. The U.S. has only about 1.5 % of the world's known oil reserves.
   b. The U.S. produces only about one-quarter as much oil as it uses.
   c. Most of the oil used in the U.S. is imported from other countries.
   d. Most of the oil produced by the U.S. is produced in the Northeast.

7. Problems associated with the use of nuclear power include
    a. production of hazardous wastes.
    b. dependence on a nonrenewable fuel.
    c. release of carbon dioxide into the air.
    d. two of the above

Lesson 5.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. form of petroleum when it first comes out of the ground

_____ 2. fossil fuel composed primarily of methane

_____ 3. type of compound made of carbon and hydrogen atoms

_____ 4. coal, oil, or natural gas

_____ 5. remains or traces of an organism that have turned to rock

_____ 6. single largest energy resource in the world today

_____ 7. fossil fuel that formed from the remains of ancient swamp plants

Terms

a. fossil fuel

b. petroleum

c. coal

d. crude oil

e. fossil

f. natural gas

g. hydrocarbon

Lesson 5.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Worldwide, more electricity is generated by burning ___________ than any other fuel.
2. Some compounds refined from __________ are used to make waxes, plastics, and fertilizers.
3. The fossil fuel that releases the least amount of pollutants when it burns is __________.
4. __________ is a method of drilling for natural gas that pumps fluids into underground rock.
5. The energy released when the nucleus of an atom splits is called __________ energy.
6. The element __________ is the fuel that is used in nuclear power plants.
7. __________ energy is a nonrenewable energy resource that does not pollute the air.

Lesson 5.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Weigh the pros and cons of using fossil fuels versus nuclear energy to produce electricity.

5.3 Renewable Energy Resources

Lesson 5.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Most renewable energy resources do not cause much pollution.

_____ 2. Solar energy has been used only in the past 100 years.

_____ 3. The International Space Station is powered by wind turbines.

_____ 4. Most of the streams in the U.S. that are suitable for hydroelectric power have not yet been dammed.

_____ 5. A dam floods land upstream and may kill or displace living things.

_____ 6. In many parts of the world, tide and wave power plants are very common.

_____ 7. Winds blow because of unequal heating of Earth's surface by the sun.

_____ 8. Wood and coal are both sources of biomass energy.

_____ 9. Solar panels take up a lot of space.

_____ 10. Dams can have adverse effects on downstream environments.

Lesson 5.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Solar Energy

The sun is Earth's main source of energy, making the development of solar power a natural choice for an alternative energy resource. The sun's energy comes from the fusion of atoms of the lightest element, hydrogen. The results of fusion are atoms of the second lightest element, helium, and tremendous amounts of energy. Some of the sun's energy travels to Earth, mostly as visible light. The light carries the energy through empty space from the sun to Earth as radiation.

Solar energy has been used for power on a small scale for hundreds of years, and plants have used it for photosynthesis for billions of year. Unlike energy from fossil fuels, which almost always come from a central power plant or refinery, solar power can be harnessed locally because sunlight is everywhere. For example, a set of solar panels on a home's rooftop can be used to heat water for a swimming pool or provide electricity to the house. Solar energy can also be used in devices such as calculators and outdoor lights.

The use of solar energy on a larger scale is just starting to be developed. Scientists and engineers have very active, ongoing research into new ways to harness energy from the sun more efficiently. In the United States, solar power is being developed in areas that receive a lot of sun, including southeastern California, Nevada, and Arizona. Solar power plants turn sunlight into electricity using a large group of mirrors to focus sunlight on one place, called a receiver. A liquid, such as oil or water, flows through the receiver and is heated to a high temperature by the focused sunlight. The heated liquid transfers its heat to a nearby object that has a lower temperature. This transfer occurs through a process called conduction. The energy conducted by the heated liquid is used to make electricity.

Solar energy has many advantages. It is extremely abundant and widespread, and it will never run out. But there are problems with the use of solar energy. For example, it is not available at night and not reliable in locations that are often cloudy. However, storage technology is being developed to overcome these problems. Other drawbacks include the expense of the technology needed to use solar energy and the relatively large amount of space required by solar panels.

Questions

1. Where does solar energy come from, and how does it reach Earth?
2. What are some ways that solar energy can be used?
3. How do solar power plants collect, focus, and transfer solar energy?
4. What are pros and cons of using solar energy?

Lesson 5.3: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. The sun gets its energy from
   a. radiation.
   b. conduction.
   c. nuclear fusion.
   d. geothermal power.
2. Which of the following is not a con of solar power?
   a. It contributes to global warming.
   b. It requires expensive technology.
   c. It is not available at night.
   d. It is not available when it is cloudy.
3. Potential sources of water power include
   a. runoff.
   b. waves.
   c. ponds.
   d. lakes.
4. Which of the following is a problem with using wind energy?
   a. Wind turbines are expensive.
   b. Wind turbines wear out quickly.
   c. Wind turbines cause air pollution.
   d. two of the above
5. Geothermal energy
   a. is found in only a few places on Earth.
   b. cannot be used to make electricity.
   c. needs to be processed before use.
   d. is clean and safe to use.

6. Compared with fossil fuels, biofuels
   a. burn less cleanly.
   b. create more pollution.
   c. release less carbon dioxide.
   d. two of the above
7. Possible sources of biomass include
   a. cow manure.
   b. food waste.
   c. algae.
   d. all of the above

Lesson 5.3: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. transfer of heat directly between objects in contact

_____ 2. organic material that is burned for energy or used to make fuel

_____ 3. reaction in which two hydrogen atoms combine to create a helium atom

_____ 4. transfer of energy through space

_____ 5. electricity made with energy from flowing water

_____ 6. energy from heat below Earth's surface

_____ 7. fuel made from crops such as corn

Terms

a. biofuel

b. hydroelectric power

c. conduction

d. nuclear fusion

e. radiation

f. biomass

g. geothermal

Lesson 5.3: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Energy sources that will not run out are __________ energy sources.
2. Earth's main source of energy is the __________.

3. Solar power plants use mirrors to focus sunlight on one place called the __________.
4. The form of renewable energy that is most widely used by people worldwide is __________ power.
5. Water held behind a dam has __________ energy.
6. A(n) __________ is a device that turns wind into electricity.
7. Ethanol is a(n) __________ that is added to gasoline to reduce fossil fuel use.

Lesson 5.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast moving air and flowing water as alternative energy resources.

CHAPTER 6 HS Plate Tectonics Worksheets

Chapter Outline

6.1 Inside Earth

Lesson 6.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Earth is divided by composition into three layers.

_____ 2. P-waves are the first seismic waves to reach a seismometer.

_____ 3. S-waves travel more slowly through liquids than solids.

_____ 4. The lithosphere is thinner than the crust.

_____ 5. The mantle is heated mainly by heat conducted from the core.

_____ 6. The outer core has a higher temperature than the inner core.

_____ 7. S-waves cannot travel through the outer core.

_____ 8. Radioactive elements break down in the inner core.

_____ 9. Ancient meteorites are thought to be similar to Earth's crust.

_____ 10. The core makes up about two-thirds of Earth by mass.

Lesson 6.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Exploring Earth's Interior with Seismic Waves

How do scientists know what is inside Earth? They don't have much direct evidence. Rocks yield some clues but mainly just about the upper crust. Only in rare instances does a mineral, such as diamond, come to the surface from the lower crust or mantle. Scientists know about Earth's interior mainly from indirect evidence such as seismic waves.

Seismic waves are caused by the energy from earthquakes traveling through the ground. Seismic waves travel outward in all directions from the point where the ground breaks in an earthquake. The waves are detected by seismometers around the world. Two types of seismic waves are most useful for learning about Earth's interior: P-waves and S-waves.

- P-waves (primary waves) are the fastest seismic waves, so they are always the first waves to arrive at seismometers. P-waves travel more slowly through liquids than solids.
- S-waves (secondary waves) are only about half as fast as P-waves, so they always arrive later at seismometers. S-waves cannot travel through liquids at all.

By tracking seismic waves with seismometers all over Earth, scientists have learned important information about the planet's interior. For example, P-waves slow down as they pass from the mantle to the outer core, so scientists know that the outer core is liquid whereas the mantle is solid. Another clue that the outer core is liquid is that S-waves stop at the mantle-core boundary.

Questions

1. How do scientists know about Earth's interior?
2. Compare and contrast P-waves and S-waves.
3. Explain how scientists were able to learn from seismic waves that the mantle is solid and the outer core is liquid.

Lesson 6.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Scientists know about Earth's interior by studying evidence from
   a. meteorites.
   b. seismic waves.
   c. Earth's magnetic field.
   d. all of the above
2. Which layer of Earth is the thinnest?
   a. crust
   b. mantle
   c. inner core
   d. outer core
3. The oceanic crust consists of rocks called
   a. basalt.
   b. granite.
   c. gabbro.
   d. two of the above
4. Relative to the oceanic crust, the continental crust
   a. is thinner.
   b. has greater denser.
   c. has less variety of rocks.
   d. rises higher on the mantle.
5. The lithosphere is
   a. soft.
   b. brittle.
   c. bendable.
   d. two of the above
6. Earth's mantle
   a. consists of liquid rock.
   b. is hotter than the crust.
   c. is made of granite.
   d. all of the above

7. Which statement about Earth's core is false?
   a. It is made of metal.
   b. It is Earth's hottest layer.
   c. It consists mostly of iron.
   d. It gets its heat from the sun.

Lesson 6.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. Earth's outermost layer

_____ 2. rock from space that has struck Earth

_____ 3. Earth's middle layer

_____ 4. rigid part of Earth that consists of the crust and upper mantle

_____ 5. how energy travels away from an earthquake

_____ 6. part of the upper mantle that can flow

_____ 7. Earth's innermost layer

Terms

a. crust

b. lithosphere

c. mantle

d. meteorite

e. asthenosphere

f. core

g. seismic wave

Lesson 6.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The part of Earth's crust that consists of mafic rock is __________ crust.
2. The part of Earth's crust that consists of felsic rock is __________ crust.
3. The layer of Earth that consists of ultramafic rock is the __________.
4. Heat is transferred throughout the mantle by the process of __________.
5. The densest layer of Earth is the __________.
6. Convection currents in Earth's __________ core give Earth a magnetic field.
7. The part of Earth's core that is solid is the __________ core.

Lesson 6.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate the lithosphere and asthenosphere to Earth's crust and mantle.

6.2 Continental Drift

Lesson 6.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Wegener thought that the continents were still drifting together to form the supercontinent Pangaea.

_____ 2. Wegener's hypothesis became widely accepted by other scientists only after he died.

_____ 3. Wegener offered a detailed explanation for continental drift.

_____ 4. The Rocky Mountains and mountains in eastern Greenland were once part of the same mountain range.

_____ 5. Evidence for continental drift from magnetic polarity was discovered in the 1950s.

_____ 6. Magnetite crystals in rocks always point to today's magnetic north pole.

_____ 7. The present continents look as though they fit together like puzzle pieces.

_____ 8. Evidence for ancient glaciers in currently tropical areas can be explained by continental drift.

_____ 9. Wegener's hypothesis explains how continents can plough through solid oceanic crust.

_____ 10. During the time of Pangaea, there were two magnetic north poles.

Lesson 6.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Evidence for Continental Drift: Magnetic Polarity

New evidence for magnetic drift was discovered in the 1950s from studies of Earth's magnetic history. Earth has a magnetic field like that of a bar magnet, with magnetic north and south poles. The magnetic poles are located near the geographic poles. In the 1950s, scientists studied the magnetic properties of rocks that formed at different times and in different places. They used magnetometers, which are devices that measure magnetic field direction and intensity. Why study rocks? Rocks containing the mineral magnetite have crystals that align with Earth's magnetic field. Magnetite crystals are like tiny magnets that point to the north magnetic pole as they crystallize from magma. Once the crystals form, their magnetic alignment, or polarity, is locked in place. Therefore, the alignment of crystals in rocks records the direction of Earth's magnetic field at the time the rocks formed. Scientists studying the magnetic polarity of rocks compared rocks that formed at different times and places. They made several important observations:

- Young rocks are aligned with Earth's current magnetic north pole regardless of the continent on which they formed.
- Old rocks of about the same age that formed on the same continent have the same magnetic field alignment, but it is different from Earth's current magnetic alignment.

- Old rocks of different ages, regardless of where they formed, are not aligned with each other or with Earth's current magnetic field.

How could these observations be explained? One possible explanation is that the locations of Earth's magnetic poles have changed their positions through time. However, to fit all the data, this explanation would require that Earth have had two magnetic north poles in the past. Another possible explanation—and one that is better supported by the data—is that the continents, and not the magnetic poles, have changed their positions through time. The magnetic polarity evidence supports the continental drift hypothesis. When the evidence was first discovered, it stimulated research to understand how continents can move over Earth's surface.

Questions

1. Describe Earth's magnetic field.
2. Why are rocks useful for studying Earth's magnetic history?
3. What observations did scientists make in the 1950s about the magnetic polarity of rocks?
4. How did the observations in question 3 support the continental drift hypothesis?

Lesson 6.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Evidence for continental drift includes
   a. identical rocks located on both sides of the Atlantic Ocean.
   b. similar mountain ranges found on both sides of North America.
   c. fossils of different organisms discovered on the same continent.
   d. ancient coal seams found in areas that are currently in the tropics.
2. Evidence of ancient glaciers supports Wegener's hypothesis because the evidence has been found on continents that are currently
   a. much colder than they used to be.
   b. located near the north pole.
   c. very close to the equator.
   d. covered by glaciers.
3. Earth is like a giant magnet with its north pole near the
   a. geographic north pole.
   b. center of Africa.
   c. Grand Canyon.
   d. equator.
4. Magnetite crystals always record the direction and strength of Earth's magnetic field at the
   a. present time.
   b. time of Pangaea.
   c. time Earth formed.
   d. time they crystallized.
5. When scientists first observed that differently aged rocks have different magnetic polarities, they proposed several possible explanations. Which of the following explanations did they propose?
   a. The continents remained fixed in place and the north magnetic pole moved.

   b. The north magnetic pole remained fixed in place and the continents moved.
   c. Both the continents and the north magnetic pole remained fixed in place.
   d. two of the above

6. Why did other scientists not accept Wegener's hypothesis at first?
   a. There were no geologists at that time.
   b. There was no evidence for the hypothesis.
   c. There was no known explanation for the hypothesis.
   d. two of the above
7. Which type of evidence convinced most scientists that the continents have drifted?
   a. magnetic polarity of ancient rocks containing magnetite.
   b. ancient maps showing the shape and location of Pangaea.
   c. current observations of the magnetic north pole wandering.
   d. coral reefs located in areas that are very warm today.

Lesson 6.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. mineral with crystals that are like tiny magnets

_____ 2. direction of a magnetic field

_____ 3. hypothesis that continents moved to their present positions over many millions of years

_____ 4. area over which a magnet exerts force

_____ 5. supercontinent that existed 250 million years ago

_____ 6. how Earth's north magnetic pole seems to have moved but actually has not

_____ 7. scientist who proposed that the continents have drifted

Terms

a. Pangaea

b. continental drift

c. magnetic polarity

d. Wegener

e. magnetic field

f. magnetite

g. apparent polar wander

Lesson 6.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. A device that can measure magnetic field intensity is called a(n) __________.
2. As magnetite crystals form from magma, they align with Earth's __________.
3. The continental drift hypothesis was first proposed in the early __________ century.
4. Earth's current magnetic north pole is located in northern __________.
5. Eastern South America and western __________ were once joined together as part of Pangaea.
6. Scientists explain apparent polar wander by assuming that the continents have __________.
7. Most other scientists initially __________ the hypothesis of continental drift.

Lesson 6.2: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify and explain evidence that Wegener collected to support the continental drift hypothesis.

6.3 Seafloor Spreading

Lesson 6.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Seafloor spreading explains Wegener's hypothesis.

_____ 2. An echo sounder with a single beam can create a 3-D map of the seafloor.

_____ 3. A mid-ocean ridge runs mainly in a north-south orientation through the Atlantic Ocean.

_____ 4. Abyssal plains are completely flat and lack any features.

_____ 5. Stripes of normal and reversed polarity form mirror images on either side of mid-ocean ridges.

_____ 6. Sedimentary rock on the seafloor is thickest at mid-ocean ridges.

_____ 7. Seafloor changes to continental crust at the edges of continents.

_____ 8. The seafloor-spreading hypothesis was proposed before World War II.

_____ 9. At a deep-sea trench, oceanic crust sinks into the mantle.

_____ 10. Seafloor spreading is caused by convection currents within the mantle.

Lesson 6.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Characteristics of the Seafloor

Although nobody really knows why, Earth's magnetic poles sometimes switch positions. The north magnetic pole becomes the south magnetic pole and vice-versa. This causes a reversal of Earth's polarity. When north and south magnetic poles are located where they are now, Earth's polarity is referred to as normal polarity. When the poles are in the opposite positions, Earth's polarity is referred to as reversed polarity.

During World War II, magnetometers were attached to battleships to help search for underwater submarines. The magnetometers discovered an astonishing feature: seafloor rocks show a pattern of normal and reversed magnetic polarity. Stripes of normal polarity and reversed polarity alternate across the ocean floor. The stripes form mirror images on either side of mid-ocean ridges. The stripes end abruptly at the edges of continents or at deep-sea trenches.

Other characteristics of the seafloor also change in a consistent way as distance from mid-ocean ridges increases. At the axis of a ridge, the rocks are youngest, thinnest, and hottest. They also have no sediments on top of them. With increasing distance from the axis of the ridge, the rocks become older, thicker, and cooler. They also have more sediments above them. Seafloor rocks are oldest near the edges of continents or deep-sea trenches. But even the oldest seafloor rocks are less than 180 million years old. This is much younger than the oldest rocks of continental crust. This means that seafloor is destroyed in a relatively short time after it is created.

Questions

1. Describe Earth's normal and reversed polarity.
2. How do reversals of Earth's polarity affect rocks on the seafloor?
3. What other characteristics of seafloor rocks change in a consistent way as distance from mid-ocean ridges increases?
4. Compare and contrast the ages of rocks in oceanic and continental crust.

Lesson 6.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Bathymetric maps show
   a. locations of ocean floor features.
   b. elevations of mid-ocean ridges.
   c. depths of deep-sea trenches.
   d. all of the above
2. Before scientists had data from echo sounders, they thought that the seafloor was
   a. broken up by trenches.
   b. covered with ridges.
   c. completely flat.
   d. steeply sloping.
3. The magnetic polarity of the seafloor
   a. is reversed at mid-ocean ridges.
   b. is the same everywhere.
   c. alternates in stripes.
   d. two of the above
4. Compared with seafloor rocks at the center of mid-ocean ridges, seafloor rocks sampled at a distance from mid-ocean ridges are
   a. older.
   b. hotter.
   c. thinner.
   d. all of the above
5. Continents drift because they are pushed by
   a. crashing ocean waves.
   b. spreading seafloors.
   c. erupting volcanoes.
   d. sinking seafloors.
6. Changes in magnetic polarity occur because the
   a. seafloor reverses its direction.
   b. magnetic poles switch positions.
   c. rocks on the seafloor form stripes.
   d. seafloor sinks into deep-ocean trenches.
7. The oldest seafloor is

a. more than 180 million years old.
b. older than the oldest continental crust.
c. found at the edges of continents.
d. two of the above

Lesson 6.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. situation in which Earth's north and south poles are aligned as they are now

_____ 2. long chain of mountains that runs through the middle of an ocean

_____ 3. mechanism by which continental drift occurs

_____ 4. deepest reach of the ocean floor typically found at the edge of a continent

_____ 5. device that uses sound waves to calculate the distance to the ocean floor

_____ 6. situation in which Earth's north and south poles are aligned opposite to their present alignment

_____ 7. flat area of the ocean floor

Terms

a. abyssal plain

b. reversed polarity

c. echo sounder

d. mid-ocean ridge

e. seafloor spreading

f. deep-sea trench

g. normal polarity

Lesson 6.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Oceanic crust forms when molten rock pours onto the surface at a(n) __________.
2. Seafloor is destroyed when it sinks below the crust at a(n) __________.
3. Distance to the ocean floor is calculated from the time it takes sound waves to travel there and back and the known __________ of sound waves in seawater.
4. After World War II, scientists pieced together ocean depths from many places to produce __________ maps of the seafloor.
5. Some deep-sea trenches are found far from continents near chains of active __________.
6. Newly formed rocks on the ocean floor at a mid-ocean ridge have __________ magnetic polarity.
7. Oceanic crust is constantly being pushed horizontally away from __________.

Lesson 6.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate the seafloor-spreading hypothesis to the continental drift hypothesis.

6.4 Theory of Plate Tectonics

Lesson 6.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Earthquake epicenters outline the edges of tectonic plates.

_____ 2. Convection cells in the mantle rise at deep-sea trenches.

_____ 3. Mid-ocean ridges occur at convergent plate boundaries.

_____ 4. Earthquakes occur only at transform plate boundaries.

_____ 5. Volcanoes are unlikely where two continental plates converge.

_____ 6. The Atlantic Ocean currently is shrinking because of plate tectonics.

_____ 7. Supercontinents form and break up in a cycle.

_____ 8. Hotspot volcanoes form in a line as crust moves over a mantle plume.

_____ 9. Hotspot magma rarely penetrates oceanic crust.

_____ 10. The Appalachian Mountains formed at a convergent plate boundary as Pangaea came together.

Lesson 6.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Earth's Tectonic Plates

The lithosphere is divided into a dozen major and several minor plates. The edges of the plates can be identified from the distribution of earthquake epicenters. That's because most earthquakes occur at plate boundaries. A single plate may consist only of oceanic lithosphere or only of continental lithosphere, but nearly all plates are made of a combination of both types of lithosphere.

Plates are constantly moving over Earth's surface. Movement of the plates is termed plate tectonics. Plates move at a rate of a few centimeters a year. The reason they move is seafloor spreading, which occurs because of convection currents in the mantle. Hot material rises at a mid-ocean ridge; gradually moves horizontally away from the axis of the ridge, dragging seafloor with it; and eventually sinks back deep into the mantle at deep-sea trenches.

Plate boundaries are the edges where two plates meet. Most geologic activities—including earthquakes, volcanoes, and mountain building—take place at plate boundaries. Because plates are always moving, they move relative to one another at plate boundaries. Plates can move relative to one another in three different ways:

- They can diverge, or move away from each other. This occurs at a divergent plate boundary.
- They can converge, or move toward each other. This occurs at a convergent plate boundary.

- They can transform, or slide past each other. This occurs at a transform plate boundary.

The type of plate boundary and the type of crust (oceanic or continental) found on each side of the boundary determine the type of geologic activity that will occur there.

Questions

1. Describe Earth's plates.
2. Explain what causes plates to move.
3. Define plate boundary, and identify types of plate boundaries.

Lesson 6.4: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Nearly all tectonic plates consist of
   a. only oceanic crust.
   b. only continental crust.
   c. both oceanic and continental crust.
   d. neither oceanic nor continental crust.
2. Each year, tectonic plates move a few
   a. millimeters.
   b. centimeters.
   c. kilometers.
   d. none of the above
3. Seafloor spreading occurs because of
   a. convection cells in the mantle.
   b. earthquakes in the oceanic crust.
   c. movement toward a ridge axis.
   d. subduction at a mid-ocean ridge.
4. Most geologic activity takes place
   a. within plates.
   b. at plate boundaries.
   c. where continents subduct.
   d. two of the above
5. Which feature could form at a divergent plate boundary?
   a. rift valley
   b. transform fault
   c. continental arc
   d. subduction zone
6. At a convergent plate boundary between oceanic and continental crust, the oceanic crust always plunges beneath the continental crust because oceanic crust is
   a. lighter.
   b. denser.
   c. colder.

   d. less viscous.

7. Some of the largest mountains in the world, including the Himalayas, occur where
   a. two oceanic plates diverge.
   b. two continental plates converge.
   c. an oceanic and a continental plate diverge.
   d. an oceanic and a continental plate converge.

Lesson 6.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. edge where two plates move toward each other

_____ 2. large body of intrusive igneous rock at the edge of a subducting plate

_____ 3. edge where two plates move away from each other

_____ 4. result of divergent plate boundaries that occur within a continent

_____ 5. point on the Earth's surface directly above the place where an earthquake occurs

_____ 6. line of coastal volcanic islands at the edge of a subducting plate

_____ 7. edge where two plates slip past each other

Terms

a. batholith

b. continental arc

c. continental rifting

d. epicenter

e. convergent plate boundary

f. transform plate boundary

g. divergent plate boundary

Lesson 6.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. A large chunk of lithosphere that can move over Earth's surface is called a(n) __________.
2. The edge where two tectonic plates meet is called a(n) __________.
3. __________ occurs when an oceanic plate plunges beneath a continental plate at a convergent plate boundary.
4. A region where the phenomenon described in question 3 occurs often is called a(n) __________.
5. The movement of plates over Earth's surface is called __________
6. A line of volcanoes that forms where two oceanic plates converge is called a(n) __________.

7. Geologic activity that takes place within a plate rather than at plate boundaries is known as __________-activity.

Lesson 6.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast geologic activity at a convergent plate boundary between oceanic and continental plates with that between two continental plates.

CHAPTER 7 HS Earthquakes Worksheets

Chapter Outline

7.1 Stress in Earth's Crust

Lesson 7.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. In geology, stress is the force per unit area that is placed on rock.

_____ 2. Tension is the major type of stress at transform plate boundaries.

_____ 3. Sedimentary rocks that do not have horizontal layers have been deformed.

_____ 4. In an anticline, the youngest rocks are at the center.

_____ 5. In a normal fault, the footwall drops down relative to the hanging wall.

_____ 6. A rock's response to stress depends only on the type of stress.

_____ 7. Basin-and-range landforms result from tension pulling crust apart.

_____ 8. Confining stress always causes folds or faults.

_____ 9. The oldest layers of sedimentary rock are on always the bottom unless rock layers have been disturbed.

_____ 10. Left-lateral and right-lateral faults are two types of dip-slip faults.

Lesson 7.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Stress and How It Changes Rock

Stress is force applied to an object. In geology, stress is the force per unit area that is applied to rock. A rock's response to stress depends on many factors. The factors include the type of rock, the surrounding temperature and pressure, the type of stress, and the length of time the rock is under stress. In response to stress, rocks may either deform (change shape) or fracture (break). If stress is removed from rocks that have deformed, they may or may not return to their original shape. If they do return to their original shape, the change in shape is called elastic deformation. If they do not return to their original shape, the change in shape is called plastic deformation.

Four types of stress that can act on rock are: confining stress, compression, tension, and shear.

- Confining stress is stress that is applied to a deeply buried rock by the weight of all the material above it. Because the rock cannot move, it cannot deform or fracture.
- Compression is stress that squeezes rocks together. It causes rocks to deform by folding or to fracture. Compression is the major type of stress at convergent plate boundaries.
- Tension is stress that pulls rocks apart. Rocks under tension lengthen or break apart. Tension is the major type of stress at divergent plate boundaries.

- Shear is stress that occurs when forces are parallel but applied in opposite directions. Shear stress is the major type of stress at transform plate boundaries.

Questions

1. How is stress defined in geology?
2. What factors determine a rock's response to stress?
3. Compare and contrast elastic and plastic deformation of rock.
4. Identify and describe the four types of stresses that can act on rock.

Lesson 7.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The most common stress on rocks at convergent plate boundaries is
   a. shear.
   b. tension.
   c. compression.
   d. confining stress.
2. A rock is more likely to fracture if
   a. it is located on the surface.
   b. it is deep within the crust.
   c. stress is applied gradually.
   d. two of the above
3. A simple bend in rock layers so they are no longer horizontal is called a
   a. compression.
   b. monocline.
   c. strain.
   d. fault.
4. In a syncline the
   a. youngest rocks are on the outside.
   b. folded rocks may form a dome.
   c. folded rocks may form a basin.
   d. two of the above
5. When rocks suddenly move along a fault, the energy released is a(n)
   a. deformation.
   b. earthquake.
   c. anticline.
   d. uplift.
6. Which of the following statements about dip-slip faults is false?
   a. The faults' dip is inclined relative to the horizontal.
   b. The faults may be normal faults or reverse faults.
   c. The faults occur because of shear stress.
   d. The faults may uplift mountain ranges.

7. A thrust fault
    a. is a type of reverse fault.
    b. has a nearly vertical dip.
    c. is a strike-slip fault.
    d. two of the above

Lesson 7.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. fracture in which there is no movement of rocks

_____ 2. break in rock

_____ 3. stress that pulls rocks apart

_____ 4. bend in rock due to compression

_____ 5. stress that squeezes rocks together

_____ 6. change in the shape of rock due to stress

_____ 7. fracture in which blocks of rock move

Terms

a. compression

b. tension

c. deformation

d. fracture

e. fold

f. fault

g. joint

Lesson 7.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Stress on a deeply buried rock that cannot deform is called __________ stress.
2. __________ deformation occurs when rock returns to its original shape after stress is removed.
3. __________ deformation occurs when rock does not return to its original shape after stress is removed.
4. A fold in rock that bends upward is called a(n) __________.
5. A fold in rock that bends downward is called a(n) __________.
6. The distance rocks move along a fault is known as the fault's __________.
7. The angle a fault makes with the horizontal surface of Earth is termed the fault's __________.

Lesson 7.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast the two major types of faults and the conditions under which they occur.

7.2 The Nature of Earthquakes

Lesson 7.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Each year, almost a million earthquakes are recorded by seismometers.

_____ 2. In about three-quarters of earthquakes, the focus is less than 5 kilometers below Earth's surface.

_____ 3. Earthquakes occur only at plate boundaries and never within plates.

_____ 4. Most earthquakes with a high magnitude have a shallow focus.

_____ 5. Divergent plate boundaries produce earthquakes all around the Pacific Ocean basin.

_____ 6. Earthquakes at mid-ocean ridges are typically small and shallow.

_____ 7. P-waves are seismic waves that can travel only through solids.

_____ 8. Seismic waves that cause a rolling motion of the ground are body waves.

_____ 9. The low point of a seismic wave is called a trough.

_____ 10. Surface waves travel outward in all directions from an earthquake's focus.

Lesson 7.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Seismic Waves

Energy is transmitted in waves. The energy from earthquakes is transmitted in waves called seismic waves. There are two basic types of seismic waves: body waves and surface waves.

Body waves are seismic waves that travel through the solid body of Earth. They originate at the focus of an earthquake and travel outward in all directions. Body waves include P-waves (primary waves) and S-waves (secondary waves). P-waves can travel through solids, liquids, and gases. They travel faster than any other type of seismic waves, so they are always the first waves to arrive at seismometers. P-waves move rocks forward and backward in the same direction that the waves are traveling. S-waves can travel only through solids. They travel more slowly than P-waves, so they reach seismometers after P-waves. S-waves move rocks up and down perpendicular to the direction that the waves are traveling.

Surface waves travel along the ground rather than through Earth. They travel outward from an earthquake's epicenter rather than its focus. They are the slowest of all seismic waves. Surface waves include Love waves and Rayleigh waves. Love waves cause the ground to move back and forth perpendicular to the direction that the waves are traveling. Rayleigh waves cause the ground to move in a circular motion. The combined ground movements of Love and Rayleigh waves give the surface of the ground a rolling motion. This motion causes most of the damage in an earthquake.

Questions

1. Distinguish between body waves and surface waves.
2. Describe the motions of rocks caused by P-waves and S-waves.
3. How do Love waves and Rayleigh waves move the ground?

Lesson 7.2: Multiple Choice

Name____________________ **Class**_______________ **Date**________

Circle the letter of the correct choice.

1. About 80 percent of all earthquake strike around the
   a. Indian Ocean.
   b. Pacific Ocean.
   c. Atlantic Ocean.
   d. Mediterranean Sea.
2. Most earthquakes that occur at transform plate boundaries are
   a. very weak earthquakes.
   b. shallow focus earthquakes.
   c. low magnitude earthquakes.
   d. two of the above
3. Earthquakes caused by subduction of oceanic lithosphere occur at
   a. convergent plate boundaries.
   b. divergent plate boundaries.
   c. transform plate boundaries.
   d. all of the above
4. Massive earthquakes are the hallmark of thrust faulting and folding where two
   a. continental plates converge.
   b. continental plates diverge.
   c. oceanic plates converge.
   d. oceanic plates diverge.
5. All waves, including seismic waves, have a high point called a(n)
   a. crest.
   b. peak.
   c. focus.
   d. epicenter.
6. Surface waves generated by an earthquake include
   a. P-waves.
   b. S-waves.
   c. Love waves.
   d. two of the above
7. The greatest danger posed by earthquakes in the ocean floor is
   a. Rayleigh waves.

b. body waves.
c. aftershocks.
d. tsunamis.

Lesson 7.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. type of seismic wave that can travel through solid Earth

_____ 2. point on Earth's surface directly about the focus of an earthquake

_____ 3. huge ocean wave generally caused by an earthquake beneath the seafloor

_____ 4. height of a wave from the centerline to a crest

_____ 5. place in the crust where rocks rupture, causing an earthquake

_____ 6. distance between corresponding points on two adjacent waves

_____ 7. type of seismic wave that travels most slowly

Terms

a. focus

b. amplitude

c. wavelength

d. body wave

e. epicenter

f. surface wave

g. tsunami

Lesson 7.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. A(n) __________ is ground movement caused by the sudden release of energy stored in rocks.
2. Almost 95 percent of all earthquakes occur along __________.
3. Earthquakes with a shallow focus are __________ damaging than earthquakes with a deeper focus.
4. P-waves and S-waves are the type of seismic waves known as __________ waves.
5. The most damaging seismic waves are the type known as __________ waves.
6. The theory that explains how earthquakes occur is the __________ theory.
7. The study of seismic waves is known as __________.

Lesson 7.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why many earthquakes occur around the Pacific Ocean basin.

7.3 Measuring and Predicting Earthquakes

Lesson 7.3: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. One way of determining the intensity of an earthquake is by the damage it causes.

_____ 2. The Richter magnitude scale is the earthquake intensity scale used by most scientists today.

_____ 3. The Mercalli intensity scale uses seismograph data to measure earthquake intensity.

_____ 4. The Richter magnitude and moment magnitude scales are logarithmic.

_____ 5. On average, one earthquake per year occurs with a Richter magnitude between 8.0 and 8.9.

_____ 6. Scientists are a long way from being able to predict earthquakes.

_____ 7. Small earthquakes, called foreshocks, always occur a few days before a major earthquake.

_____ 8. As stress builds up in rocks before an earthquake, the ground may start to tilt.

_____ 9. Seismographs record only the surface waves generated by an earthquake.

_____ 10. A seismometer must be very close to the epicenter of an earthquake to detect seismic waves.

Lesson 7.3: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Earthquake Prediction

Scientists are a long way from being able to predict earthquakes. A good prediction must be accurate in terms of where an earthquake will occur, when it will occur, and what magnitude it will be. This information is need to decide whether and when people should be evacuated from an area. An unnecessary evacuation due to an inaccurate prediction would be expensive. It also might cause people to disregard future evacuation orders.

Where an earthquake will occur is the easiest factor to predict. Scientists know that earthquakes take place at plate boundaries and tend to occur where they have occurred before. Earthquake-prone communities should always be prepared for an earthquake. For example, they can implement building codes to make structures earthquake safe.

When an earthquake will occur is much more difficult to predict. The stress on rocks along a fault builds up at a constant rate, so earthquakes should occur at regular intervals. However, this is not always the case. For example, near Parkfield, California, an earthquake of magnitude 6.0 or higher occurs about once every 22 years on average.

Based on the dates of previous earthquakes, seismologists predicted that the next earthquake would strike the area in 1993, but it didn't occur until 2004.

Sometimes certain signs precede large earthquakes. Small earthquakes called foreshocks may occur as stress builds up before a major earthquake. Rocks around a fault may dilate and develop fractures as stress builds up in them. Water levels in wells may fluctuate as water moves into or out of rock fractures. The ground may start to tilt with building stress. Although these changes often precede large earthquakes, they don't always occur. There have been many reports of animals behaving erratically before earthquakes. Whether animals can actually sense imminent earthquakes is not clear. It they can, scientists do not know what it is they are sensing.

Questions

1. If scientists could predict earthquakes, why would accurate predictions be important?
2. What is the easiest factor to predict about earthquakes? Why?
3. Identify signs that sometimes precede large earthquakes. Why are these signs not very useful for predicting earthquakes?

Lesson 7.3: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Seismograms contain information that can be used to determine how
   a. strong an earthquake was.
   b. long an earthquake lasted.
   c. far away an earthquake was.
   d. all of the above
2. A seismogram shows the arrival times of P-waves and S-waves from an earthquake. The greater the difference in arrival times is, the greater is the
   a. distance of the epicenter from the seismometer.
   b. magnitude of the earthquake.
   c. length of time the earthquake lasted.
   d. destruction caused by the earthquake.
3. If a seismometer records P-waves and surface waves but not S-waves, you can infer that the earthquake occurred
   a. on the other side of Earth.
   b. at more than one epicenter.
   c. very close to the seismograph.
   d. very far below Earth's surface.
4. The situation in question 3 occurs because S-waves cannot travel
   a. as far as P-waves.
   b. deep underground.
   c. as quickly as surface waves.
   d. through Earth's liquid outer core.
5. On the moment magnitude scale, the earthquake with the greatest intensity
   a. releases the most total energy.
   b. is felt by the largest number of people.

c. has a wave with the highest magnitude.
d. causes the greatest destruction to buildings.

6. How often do Richter magnitude 9 or higher earthquakes occur?

a. at least once a month
b. about five times a year
c. about once a year
d. several times a century

7. Which of the following earthquake features is easiest to predict?

a. when an earthquake will occur
b. where an earthquake will occur
c. how long an earthquake will last
d. what magnitude an earthquake will be

Lesson 7.3: Matching

Name____________________ Class_______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. scale of earthquake intensity based on what people feel and what damage is done

_____ 2. strength of an earthquake

_____ 3. device that records ground motions detected by a seismometer

_____ 4. scale of earthquake intensity based on the magnitude of the largest jolt of energy released by an earthquake

_____ 5. device that senses ground motions caused by seismic waves

_____ 6. scale of earthquake intensity based on the total energy released by an earthquake

_____ 7. record of the ground motions created by a seismograph

Terms

a. seismograph

b. earthquake intensity

c. Mercalli intensity scale

d. seismogram

e. Richter magnitude scale

f. moment magnitude scale

g. seismometer

Lesson 7.3: Fill in the Blank

Name____________________ Class_______________ Date________

Fill in the blank with the appropriate term.

1. Scientists currently favor the __________ scale for measuring earthquake intensity.
2. The __________ of an earthquake's largest seismic wave is used to determine the Richter magnitude of the earthquake.
3. The distance from the __________ of an earthquake to a seismometer can be calculated from the difference in arrival times of P- and S-waves.
4. The epicenter of an earthquake can be found based on the distance from the epicenter to __________ different seismometers.
5. On the Richter scale, the intensity of a magnitude 5 earthquake is __________ times greater than the intensity of a magnitude 3 earthquake.
6. An increase in two integers on the __________ scale equals a 900-fold increase in energy released by an earthquake.
7. The last seismic waves to arrive at a seismometer are __________ waves.

Lesson 7.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how to find the epicenter of an earthquake using data from different seismometers.

7.4 Staying Safe in Earthquakes

Lesson 7.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The ground shaking of earthquakes is almost never the direct cause of deaths.

_____ 2. Damage done by an earthquake depends only on the earthquake's intensity.

_____ 3. The key to earthquake-safe structures is flexibility.

_____ 4. Buildings in earthquake zones should be constructed on soft sediments.

_____ 5. Placing buildings on layers of steel and rubber helps absorb the shock of seismic waves.

_____ 6. The safest place in a building during an earthquake is under a sturdy table.

_____ 7. If you are in a car during an earthquake, you should flee from the car.

_____ 8. Immediately after an earthquake, you should make sure that the electricity and gas in your home are turned on.

_____ 9. Liquefaction of sediments occurs during earthquakes because of seismic waves.

_____ 10. It may be difficult to fight fires after an earthquake because of breaks in water mains.

Lesson 7.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Damage from Earthquakes

Earthquakes kill people and cause property damage. Collapsing structures are the major cause of destruction and death. The fires that follow most earthquakes also cause a lot of destruction and death. Several factors determine how destructive and deadly an earthquake is. One factor is earthquake intensity, but this factor may not be as important as you might think. A much more important factor is the quality of structures. Structures that are built to be earthquake proof are less likely to suffer damage and collapse than ordinary structures.

Other factors that influence how destructive and deadly an earthquake is include population density, whether the earthquake triggers a tsunami, and the type of ground upon which buildings are constructed. The following examples illustrate the influence of these factors.

- A magnitude 9.2 earthquake occurred near Anchorage, Alaska, in 1964. Despite the enormous intensity of the earthquake, it caused only 131 deaths. The main reason is that relatively few people lived in the hardest hit area.
- A magnitude 9.0 earthquake occurred in the Indian Ocean in 2004. About 230,000 people died in this earthquake. Most of them were killed by the huge tsunami that followed the earthquake.

- Soft sediments vibrate more during an earthquake than does solid bedrock, so structures built on sediments are more likely to be damaged and collapse. Sediments that are saturated with water also undergo liquefaction when the ground shakes, and they become like quicksand. Liquefied soil on a hillside may slide downhill in a landslide, burying homes and even entire village. Liquefied soil under buildings may cause them to collapse. For example, liquefied soil in the 1985 Mexico City earthquake caused a tremendous amount of damage to buildings and other structures.

Questions

1. What are the main causes of damage and death during earthquakes?
2. What factors influence how destructive and deadly an earthquake is?
3. Use examples to illustrate the factors you identified in your answer to question 2.

Lesson 7.4: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Causes of deaths during earthquakes include
   a. collapsing buildings.
   b. landslides.
   c. fires.
   d. all of the above
2. Which of the following materials is best for building in an earthquake zone?
   a. wood
   b. brick
   c. stone
   d. adobe
3. To help structures move with the ground without breaking during earthquakes, they can be built on
   a. rollers.
   b. layers of sediment.
   c. a deep bed of sand.
   d. two of the above
4. The number of deaths that occur in an earthquake is influenced by
   a. population density.
   b. type of ground.
   c. construction methods.
   d. all of the above
5. If you are in a structurally unsound building during an earthquake, you should
   a. go to the basement.
   b. move to the top floor.
   c. stand close to a window.
   d. leave as quickly as possible.
6. If you are outside during an earthquake, you should
   a. avoid open areas.

b. stay away from power lines.
c. take shelter under an overpass.
d. go inside the nearest building.

7. To make sure your home is safe during earthquakes, you should do all of the following except

a. bolt heavy furniture to walls.
b. attach brick chimneys to the roof.
c. check that gas lines are made of rigid material.
d. make sure heavy objects are not stored in high places.

Lesson 7.4: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. second most damaging type of natural disaster after a hurricane

_____ 2. small earthquake that follows a larger earthquake

_____ 3. process in which saturated sediments become like quicksand during an earthquake

_____ 4. number of people in a given area

_____ 5. event in which soil and rocks suddenly fall downhill

Terms

a. liquefaction

b. earthquake

c. population density

d. landslide

e. aftershock

Lesson 7.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The largest earthquake ever recorded occurred in the country of __________ in 1960.
2. Most of the fatalities following the 2004 Indian Ocean earthquake were caused by a(n) __________.
3. The least amount of earthquake damage is suffered by structures that are built on solid __________.
4. __________ start during earthquakes because the shaking ruptures gas and electric lines.
5. If you live in an earthquake-prone area, you should use __________ light bulbs to reduce the risk of fire.

Lesson 7.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain what people can do to protect themselves before, during, and after earthquakes.

CHAPTER 8 HS Volcanoes Worksheets

Chapter Outline

8.1 Where Volcanoes Are Located

Lesson 8.1: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. When magma flows onto Earth's surface, it always forms volcanic mountains.

_____ 2. Almost all volcanoes occur over hotspots within tectonic plates.

_____ 3. Volcanoes erupt at mid-ocean ridges.

_____ 4. Wherever mantle rock melts, volcanoes may result.

_____ 5. Any water on a subducting plate raises the melting point of mantle material.

_____ 6. The Cascade Mountains in Washington State occur along a transform plate boundary.

_____ 7. Volcanoes are likely along the San Andreas fault in California because it is a convergent plate boundary.

_____ 8. Volcanoes in an island arc are all about the same age.

_____ 9. The most geologically active region in the world is the Pacific Ring of Fire.

_____ 10. Volcanoes occur in the East African Rift Valley because the valley is over a hotspot.

Lesson 8.1: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Volcanic Hotspots

Most volcanoes are found at convergent or divergent plate boundaries, but there are some intraplate volcanoes. The Hawaiian Islands are examples. The islands are the exposed peaks of a great chain of volcanoes that lie in the middle of the Pacific plate. The youngest of the Hawaiian Islands sits directly above a column of hot rock called a mantle plume. As the plume rises through the mantle, pressure is released and mantle melts to create a hotspot. All of the Hawaiian Islands are hotspot volcanoes.

Earth is home to about 50 known hotspots. Most of them are in the oceans because magma can more easily penetrate oceanic than continental lithosphere. The hotspots that are known beneath continents are extremely large. For example, a huge hotspot is located beneath the Yellowstone volcano on the North American continent.

As a plate drifts over a mantle plume, a hotspot volcano slowly moves away from the hotspot. Then a new hotspot volcano forms. This keeps repeating as the plate continues to drift, forming a chain of hotspot volcanoes. The youngest volcano in the chain is always at the start of the chain, directly over the mantle plume. Each volcano after that is older than the one before it, with the oldest volcano at the opposite end of the chain.

Questions

1. What is a hotspot volcano? Give examples.
2. How does a hotspot volcano form?
3. How many hotspots are there, and where are they found?
4. Describe and explain the relative ages of volcanoes in a chain of hotspot volcanoes.

Lesson 8.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Mantle rocks may melt if
    a. its temperature rises.
    b. pressure on it decreases.
    c. water is added to it.
    d. any of the above
2. Volcanoes are common along
    a. convergent plate boundaries.
    b. divergent plat boundaries.
    c. transform plate boundaries.
    d. two of the above
3. About 75 percent of the world's volcanoes are found
    a. around the Atlantic Ocean basin.
    b. along the mid-Atlantic ridge.
    c. around the Pacific Ocean basin.
    d. throughout the American Northwest.
4. Melting occurs at divergent plate boundaries because hot mantle rock rises and this
    a. increases the temperature of the mantle.
    b. decreases the temperature of the mantle.
    c. allows runoff to seep into the mantle.
    d. releases pressure on the mantle.
5. Which of the following landforms result from volcanic activity?
    a. continental arcs
    b. hotspot islands
    c. island arcs
    d. all of the above
6. Volcanoes are common along oceanic trenches because this is where
    a. most hotspots are found.
    b. subduction occurs.
    c. new seafloor forms.
    d. none of the above
7. About how many known hotspots are there on Earth?
    a. 5
    b. 50
    c. 500
    d. 5000

Lesson 8.1: Matching

Name____________________ **Class**_______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. column of hot rock in the mantle

_____ 2. line of volcanic activity that surrounds the Pacific Ocean basin

_____ 3. crack in the ground at a divergent plate boundary where magma erupts

_____ 4. place above a mantle plume where melted rock can form a volcano

_____ 5. eruption of magma from the mantle onto the surface

_____ 6. example of islands that formed over a hotspot

_____ 7. example of islands that formed over a convergent plate boundary

Terms

a. volcano

b. fissure

c. mantle plume

d. hotspot

e. Ring of Fire

f. Aleutian Islands

g. Hawaiian Islands

Lesson 8.1: Fill in the Blank

Name____________________ **Class**_______________ **Date**________

Fill in the blank with the appropriate term.

1. The first step in the formation of a volcano is rock melting in the ___________.
2. Subduction of a plate into the mantle occurs at ___________ plate boundaries.
3. Subduction at the Middle American Trench creates volcanoes in ___________ America.
4. Icelandic volcanoes occur over a(n) ___________ along the mid-Atlantic ridge.
5. All intraplate volcanic activity occurs over ___________.
6. In a chain of hotspot volcanoes, the volcano that sits directly above the mantle plume is ___________.
7. Hotspots can penetrate oceanic lithosphere ___________ easily than continental lithosphere.

Lesson 8.1: Critical Writing

Name____________________ **Class**_______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Volcanoes erupt when mantle rock melts. Explain why this occurs at convergent and divergent plate boundaries.

8.2 Volcanic Eruptions

Lesson 8.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Mount St. Helens is a dormant volcano.

_____ 2. The 1980 Mount St. Helens eruption was an effusive eruption.

_____ 3. Each volcanic eruption is unique.

_____ 4. Mafic magma has higher viscosity than felsic magma.

_____ 5. An explosive eruption occurs because of built-up pressure in the magma chamber.

_____ 6. Mafic magma may cause a pyroclastic flow.

_____ 7. Volcanic gases can form poisonous clouds in the atmosphere.

_____ 8. In an effusive eruption, magma erupts through vents.

_____ 9. Eruptions of mafic magma are generally less deadly than eruptions of felsic magma.

_____ 10. Pillow lava forms when felsic magma cools very quickly under water.

Lesson 8.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Predicting Volcanic Eruptions

Volcanologists attempt to forecast volcanic eruptions, but this has proven to be nearly as difficult as predicting earthquakes. Many pieces of evidence can mean that a volcano is about to erupt, although the time and magnitude of the eruption are difficult to predict. Signs an eruption is likely may come from a history of previous volcanic activity, the occurrence of earthquakes, slope deformation, and gas emissions.

A volcano's history—how long since its last eruption and the time span between its previous eruptions—is a good first step in predicting eruptions. Currently erupting volcanoes (active volcanoes) and those that have erupted recently (dormant volcanoes) are heavily monitored because they may erupt again.

Moving magma shakes the ground, so the number and size of earthquakes may increase before an eruption. A volcano that is about to erupt may produce a sequence of earthquakes. Scientists use seismographs to record the length and strength of earthquakes to help them predict whether an eruption is imminent.

Magma and gas can push a volcano's slope upward, causing deformation in the ground. The changes may be subtle and only detectable by tiltmeters. These are instruments that measure the angle of a slope. In other cases, the changes may be very obvious. For example, Mount St. Helens grew a huge bulge on its north side before its 1980 eruption. Ground swelling may also cause rock falls and landslides.

Gases may escape from a volcano before magma reaches the surface. Scientists measure gas emissions in vents on or around volcanoes or from a distance using satellites. The gases measured may include sulfur dioxide, carbon dioxide, hydrochloric acid, and water vapor. The amounts of gases and their ratios are calculated to help predict eruptions.

Questions

1. Identify signs that a volcano may be likely to erupt.
2. Why do earthquakes often precede volcanic eruptions?
3. A volcano about to erupt may deform the ground. How can this be detected?
4. Why do scientists measure gases released on or around a volcano to help predict eruptions?

Lesson 8.2: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. The costliest and deadliest volcanic eruption in U.S. history was
   a. Mount Shasta.
   b. Mount Redoubt.
   c. Mount Mazama.
   d. Mount St. Helens.
2. The chemical composition of magma determines
   a. its eruption style.
   b. the type of volcanic cone it creates.
   c. the composition of rocks it forms.
   d. all of the above
3. Mafic magmas
   a. are low in silica.
   b. are light in color.
   c. contain minerals such as quartz.
   d. all of the above
4. Felsic magmas
   a. are not viscous.
   b. erupt effusively.
   c. do not flow easily.
   d. cool to form extrusive rocks.
5. A pyroclastic flow may
   a. knock down everything in its path.
   b. have a maximum temperature of 700 °C.
   c. travel at a speed of 1800 mph.
   d. consist of mafic magma.
6. Types of lava in explosive eruptions may include
   a. a’a.
   b. pāhoehoe.
   c. pillow lava.

   d. none of the above

7. Signs that a volcano may soon erupt include
   a. earthquakes.
   b. gas emissions.
   c. ground deformation.
   d. all of the above

Lesson 8.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. potentially devastating eruption of rock, lava, ash, and gas from a volcano

_____ 2. volcano that has not erupted recently and probably will not erupt again

_____ 3. resistance of a liquid to flow

_____ 4. hot ash, gas, and rock that race down a volcano's slopes during an explosive eruption

_____ 5. relatively gentle, non-explosive volcanic eruption

_____ 6. volcano that is not currently active but has erupted recently

_____ 7. volcano that is erupting or shows signs that it will erupt soon

Terms

a. active volcano

b. dormant volcano

c. extinct volcano

d. effusive eruption

e. explosive eruption

f. pyroclastic flow

g. viscosity

Lesson 8.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Smooth, ropy lava tubes that form from mafic magma are called __________.
2. A(n) __________ is a volcanic mudflow that occurs when a pyroclastic flow melts snow.
3. A region in the crust below a volcano where magma and gases collect is known as a(n) __________.
4. The material that erupts from a volcano in an explosive eruption is called __________.
5. __________ magmas contain dark-colored minerals such as olivine.
6. __________ magmas contain light-colored minerals such as quartz.

7. Scientists who study volcanoes are called __________.

Lesson 8.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate type of magma (mafic or felsic) to style of volcanic eruption (effusive or explosive). Explain the relationship.

8.3 Types of Volcanoes

Lesson 8.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. A volcano is a vent through which material escapes from a magma chamber.

_____ 2. Some volcanoes appear to be little more than cracks in the ground.

_____ 3. The shape of a volcano depends mainly on how much material erupts.

_____ 4. Composite volcanoes generally have effusive eruptions.

_____ 5. The layers of a shield volcano are usually very similar in composition.

_____ 6. A cinder cone is typically much larger than other types of volcanoes.

_____ 7. The idea of supervolcanoes dates back at least 1000 years.

_____ 8. Yellowstone sits atop a hotspot that has had three catastrophic eruptions.

_____ 9. Long Valley in California is the second largest supervolcano in North America.

_____ 10. Scientists have determined precisely when the next supervolcanic eruption will occur.

Lesson 8.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Composite and Shield Volcanoes

Composite volcanoes are created by felsic magma, which is viscous. The viscous lava cannot travel far down the sides of the volcano before it solidifies, forming the steeply sloping sides that are characteristic of composite volcanoes. Viscosity also causes some eruptions to explode as ash and small rocks. As a result, composite volcanoes consist of alternating layers of ash and lava that has solidified to form rock. The layers form the classic cone shape of composite volcanoes.

Shield volcanoes get their name from their shape. They are literally shaped like a shield. The sides of a shield volcano are not steep, but the volcano may cover a very large area. The lava that creates a shield volcano is mafic and not viscous, so it flows easily. The lava can flow over a wide area before it solidifies. This is what creates the broad shield shape. The low viscosity of the lava also means that shield volcano eruptions are effusive rather than explosive. As a result, the layers of shield volcanoes are usually very similar in composition.

Questions

1. Describe the shape of composite volcanoes. Why do composite volcanoes have this shape?
2. Describe the shape of shield volcanoes. Why do shield volcanoes have this shape?

3. Explain why composite volcanoes, but not shield volcanoes, consist of alternating layers of ash and rock.

Lesson 8.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Composite volcanoes have steep sides because the lava
   a. is not viscous.
   b. solidifies quickly.
   c. has a mafic composition.
   d. two of the above
2. You would expect to find alternating layers of rock and ash in a cross section of a(n)
   a. cinder cone.
   b. shield volcano.
   c. effusive volcano.
   d. composite volcano.
3. Shield volcanoes are common at
   a. convergent plate boundaries.
   b. divergent plate boundaries.
   c. intraplate hotspots.
   d. two of the above
4. The largest shield volcano on Earth is
   a. Mount St. Helens.
   b. Mount Fuji.
   c. Mauna Loa.
   d. Paricutín.
5. Cinder cone volcanoes
   a. are shaped like shield volcanoes.
   b. typically become supervolcanoes.
   c. grow slowly from many eruptions.
   d. are often found near larger volcanoes.
6. Supervolcanoes
   a. have frequent, explosive eruptions.
   b. are classified as cinder cone volcanoes.
   c. may have contributed to mass extinctions.
   d. include Mount Pinatubo in the Philippines.
7. To be classified as a supervolcano, the volume of material in an eruption must be more than
   a. 1000 km^3.
   b. 250 km^3.
   c. 120 km^3.
   d. 80 km^3.

Lesson 8.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. most common type of volcano

_____ 2. huge hole in a volcano into which the surface collapses

_____ 3. broad volcano with gently sloping sides

_____ 4. example of a composite volcano

_____ 5. most dangerous type of volcano

_____ 6. example of a supervolcano

_____ 7. large volcano with steeply sloping side

Terms

a. shield volcano

b. supervolcano

c. composite volcano

d. caldera

e. cinder cone

f. Mount St. Helens

g. Yellowstone

Lesson 8.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Composite volcanoes are made of __________ rock.
2. The type of eruptions that produce shield volcanoes are __________ eruptions.
3. __________ are small volcanoes composed of fragments of rocks such as pumice.
4. Low-viscosity magma produces __________ volcanoes.
5. High-viscosity magma produces __________ volcanoes.
6. Cinder cones usually have a(n) __________ at the summit.
7. Scientists think that a(n) __________ forms when a very large magma chamber erupts all at once.

Lesson 8.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain the possible causes and consequences of supervolcano eruptions.

8.4 Volcanic Landforms and Geothermal Activity

Lesson 8.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Hot springs are surface features associated with volcanic activity.

_____ 2. The more viscous lava is, the more quickly it flows over the surface.

_____ 3. A magma dome typically forms during an explosive volcanic eruption.

_____ 4. Lava plateaus consist of sheets of lava that solidified below the surface.

_____ 5. Lava creates new land as it flows into the ocean.

_____ 6. Geysers are found in many places on Earth's surface.

_____ 7. Underground water heated by magma may be hot enough to boil.

_____ 8. Extreme pressure causes a geyser to erupt onto the surface.

_____ 9. All geysers erupt as predictably as Old Faithful in Yellowstone National Park.

_____ 10. Flowing lava created the Hawaiian Islands.

Lesson 8.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Landforms from Lava

The most obvious landforms created by lava are volcanoes. These may be relatively small cinder cones or huge composite or shield volcano mountains. Sometimes lava erupts through a long crack, or fissure, instead through the vent of a volcano. The entire ocean floor is the result of fissure eruptions.

When lava is viscous, it flows slowly. Viscous lava typically causes explosive volcanic eruptions that form shield volcanoes. However, if there is not enough magma or enough pressure to cause an explosive eruption, the magma may form a lava dome instead. A lava dome is a large, rounded landform that forms when viscous lava cools and hardens before it can travel far from a vent. Lava domes often form in the middle of craters at the top of composite volcanoes. For example, there is a lava dome in the crater of Mount St. Helens.

When lava is not viscous, it flows quickly. It can flow over an extensive area before it cools and hardens. This type of lava flow may form a lava plateau. This is a wide, flat surface of igneous rock that forms when thin lava solidifies. The Columbia Plateau in the Pacific Northwest is a lava plateau. It covers more than 161,000 square kilometers (63,000 square miles) in Washington State, Oregon, and Idaho.

Lava may create new land by forming or expanding islands in the ocean. This occurs when lava solidifies on the coast or emerges from beneath the water. The Hawaiian Islands are formed from shield volcano eruptions and have grown over the last 5 million years.

Questions

1. List landforms created by lava.
2. How and why does a lava dome form?
3. What type of lava forms a lava plateau? Why?
4. Explain how the Hawaiian islands formed.

Lesson 8.4: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Surface features related to volcanic activity include
    a. geysers.
    b. lava domes.
    c. cinder cones.
    d. all of the above
2. A lava dome may form if lava is
    a. thin.
    b. mafic.
    c. viscous.
    d. under great pressure.
3. Where is a lava dome most likely to form?
    a. on the side of a shield volcano
    b. in the middle of a crater
    c. on the ocean floor
    d. on a lava plateau
4. A lava plateau
    a. forms from thin lava.
    b. consists of sedimentary rock.
    c. forms from the weathering of a volcanic mountain.
    d. results when hot lava cools beneath ocean water.
5. An example of a landform created from a magma intrusion is
    a. the Big Island of Hawaii.
    b. Shiprock in New Mexico.
    c. Mount St. Helens in Washington State.
    d. none of the above
6. Conditions necessary for a geyser to occur include
    a. water superheated by magma beneath Earth's surface.
    b. buildup of pressure on underground water.
    c. trapping of water in a narrow passageway underground.
    d. all of the above
7. About how many geysers are there worldwide?

a. 10
b. 100
c. 1000
d. 10,000

Lesson 8.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. large, flat surface of igneous rock that forms when lava flows over a wide area

_____ 2. location of rock formed solely by fissure eruptions

_____ 3. hot water that bubbles onto the surface

_____ 4. large, rounded landform created by lava

_____ 5. hot water that erupts onto the surface

Terms

a. lava dome

b. hot spring

c. lava plateau

d. geyser

e. seafloor

Lesson 8.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Volcanic landforms vary with the __________ of the magma that created them.
2. Viscous lava flows __________ slowly than non-viscous lava.
3. The Columbia Plateau in the Pacific Northwest is a(n) __________.
4. The Hawaiian Islands are formed from the eruptions of __________ volcanoes.
5. Water in a hot spring or geyser is heated by __________.
6. About half of all the geysers in the world are found in the __________.
7. The most obvious landforms created by lava are __________.

Lesson 8.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast hot springs and geysers. Why do you think there are fewer geysers than hot springs in the world?

Chapter 9 HS Weathering and Formation of Soil Worksheets

Chapter Outline

9.1 Weathering

Lesson 9.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Ice wedging is the transport of sediments by glaciers.

_____ 2. Agents of abrasion include wind and gravity.

_____ 3. Mechanical weathering increases the rate of chemical weathering.

_____ 4. Chemical weathering occurs because of chemical reactions.

_____ 5. Minerals that form deep under Earth's surface are unstable on the surface.

_____ 6. Clay is an example of a mineral that is unstable on Earth's surface.

_____ 7. Water can dissolve many minerals because water molecules are polar.

_____ 8. Acid rain accelerates the rate of chemical weathering.

_____ 9. Plants contribute to mechanical but not chemical weathering.

_____ 10. Cold, dry climates have the highest rates of weathering.

Lesson 9.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Chemical Weathering

Chemical weathering occurs when rocks undergo chemical reactions that change their mineral composition. Most minerals form under conditions of high pressure and temperature deep within the crust or even in the mantle. If the minerals reach Earth's surface where pressure and temperature are much lower, they become unstable. As a result, the minerals change chemically to other minerals, such as clay, that are more stable under conditions on the surface.

Water is the most important agent of chemical weathering. Water is a polar molecule, meaning that one side of the molecule is slightly positive and the other side is slightly negative. The positive side of each water molecule attracts negative ions and the negative side attracts positive ions. In this way, water molecules separate ions from their compounds and surround them. Water can completely dissolve some minerals, such as salt.

Two other important agents of chemical weathering are carbon dioxide and oxygen, both of which are gases in Earth's atmosphere.

- Carbon dioxide combines with water as raindrops fall through the atmosphere. This forms a weak acid, called carbonic acid, which can dissolve some types of rock.
- Oxygen is very reactive chemically. A common type of chemical reaction involving oxygen is oxidation. The

most familiar example of oxidation is the reaction of iron with oxygen to create iron oxide, or rust. Minerals rich in iron break down as the iron rusts. This is why some soils are red in color.

Questions

1. What is chemical weathering? Why does it occur?
2. How does water cause chemical weathering?
3. Explain the roles of carbon dioxide and oxygen in chemical weathering.

Lesson 9.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Weathering does not occur on the moon because the moon has no
    a. atmosphere.
    b. weather.
    c. gravity.
    d. two of the above
2. The general process that changes solid rock into sediments is called
    a. erosion.
    b. leaching.
    c. hydrolysis.
    d. weathering.
3. Mechanical weathering results in pieces of rock that are the same as the parent rock in
    a. mineral content.
    b. shape.
    c. size.
    d. two of the above
4. Abrasion may be caused by
    a. freezing and thawing.
    b. weak acids.
    c. oxidation.
    d. gravity.
5. Agents of mechanical weathering include
    a. burrowing animals.
    b. human beings.
    c. plants.
    d. all of the above
6. The rate of chemical weathering is higher when
    a. temperatures are lower.
    b. precipitation is higher.
    c. rocks are intrusive.
    d. all of the above
7. Which of the following can be an agent of both mechanical and chemical weathering?

a. carbon dioxide
b. oxygen
c. gravity
d. water

Lesson 9.1: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. chemical reaction in which a mineral is changed by reacting with water

_____ 2. major cause of mechanical weathering in climates with freeze-thaw cycles

_____ 3. process of removing dissolved minerals as they are carried to lower layers of soil

_____ 4. type of weathering in which rock breaks into smaller pieces

_____ 5. chemical reaction in which oxygen reacts with another element to create a metal oxide

_____ 6. form of mechanical weathering in which rocks scrape against each other

_____ 7. type of weathering that changes the mineral composition of rock

Terms

a. mechanical weathering

b. leaching

c. chemical weathering

d. ice wedging

e. oxidation

f. abrasion

g. hydrolysis

Lesson 9.1: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. Cobbles from a streambed are smooth and rounded because of the type of weathering called ___________.
2. The most important agent of chemical weathering is ___________.
3. Hydrolysis and leaching are more common in climates with high levels of ___________.
4. Carbon dioxide in the air combines with water in raindrops to form ___________.
5. Iron-rich minerals change to rust in the type of chemical reaction known as ___________.
6. Chemical weathering occurs ___________ quickly when temperatures are warmer.
7. The average temperature and precipitation in a region is its ___________.

Lesson 9.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify and explain two ways that ice causes mechanical weathering.

9.2 Soils

Lesson 9.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Peat is soil that is completely organic.

_____ 2. The same type of rock always produces the same type of soil.

_____ 3. Dry regions have thicker soils than wet regions.

_____ 4. Inorganic material is the source of nutrients in soil.

_____ 5. Fertile soils are rich in the element nitrogen.

_____ 6. Some soils develop as many as six distinct layers.

_____ 7. Soluble minerals and clays accumulate in subsoil.

_____ 8. Pedalfer soils are usually the least fertile.

_____ 9. Laterite soils are thick and rich in nutrients.

_____ 10. Soil is a renewable resource only if it is carefully managed.

Lesson 9.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Soil Horizons

Residual soil forms over many years as mechanical and chemical weathering slowly change solid rock into soil. Soil formation begins when bedrock cracks because of ice wedging or other processes of mechanical weathering. Water, oxygen, and carbon dioxide seep into the cracks and cause chemical weathering. Plants eventually start growing and cause biological weathering. As the weathered material collects, layers called soil horizons develop. The greatest degree of weathering is in the top layer, because this is where water and air first come into contact with rock. Each successive lower layer is less altered by weathering. Most soils have at least three distinct layers, called A, B, and C horizons. A cross-section of all the horizons is called a soil profile.

The A horizon is the top layer of soil. It is also called topsoil. This layer is usually darkest in color because it has the highest proportion of organic material. Topsoil is where most soil organisms live, including insects, worms, and other animals in addition to plants. Plant roots help to hold this layer of soil in place. Minerals in topsoil may dissolve in rainwater and soak into the next soil layer. Rainwater also transports tiny mineral particles such as clay deeper into the soil.

The B horizon is the next layer of soil. It is also called subsoil. This layer is lighter in color than topsoil because it contains less organic material. It is also where soluble minerals and clay particles from topsoil accumulate. Because of the presence of clay and other minerals, subsoil holds more water than topsoil does.

The C horizon is the lowest layer of soil. It consists of partially altered bedrock. There is some evidence of weathering in this layer, but pieces of the original rock are still visible and identifiable.

Questions

1. Describe how residual soil forms.
2. What is a soil profile?
3. Identify and distinguish among the three horizons found in most soils.

Lesson 9.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. In most soils, inorganic materials make up about
   a. 30 percent of soil.
   b. 50 percent of soil.
   c. 70 percent of soil.
   d. 90 percent of soil.
2. Factors that lead to greater soil formation include
   a. lower precipitation.
   b. higher temperature.
   c. slower plant growth.
   d. all of the above
3. Humus in soil
   a. binds together mineral grains.
   b. increases the soil's fertility.
   c. helps the soil hold water.
   d. all of the above
4. The soil layer with the greatest degree of weathering is called the
   a. A horizon.
   b. B horizon.
   c. C horizon.
   d. D horizon.
5. Relative to other soil layers, topsoil has the
   a. highest percentage of organic material.
   b. least amount of biological activity.
   c. lightest color.
   d. two of the above
6. Which soil type is most permeable?
   a. silt
   b. clay
   c. sand
   d. loam

7. Under the best soil-forming conditions, soil forms at a rate of about
    a. 10 cm/year.
    b. 1 cm/year.
    c. 10 mm/year.
    d. 1 mm/year.

Lesson 9.2: Matching

Name____________________ Class_______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. subsoil layer of a soil profile

_____ 2. type of soil that contains a mixture of mineral grain sizes

_____ 3. type of soil that forms in grasslands

_____ 4. component of soil that consists of decayed organic remains

_____ 5. type of soil that forms in tropical rainforests

_____ 6. type of soil that forms in deciduous forests

_____ 7. topsoil layer of a soil profile

Terms

a. humus

b. loam

c. pedalfer

d. A horizon

e. pedocal

f. laterite

g. B horizon

Lesson 9.2: Fill in the Blank

Name____________________ Class_______________ Date________

Fill in the blank with the appropriate term.

1. The major factor that determines the type of soil in an area is ___________.
2. Soils that form in the same place where they are found are called ___________ soils.
3. Soils that formed somewhere else and were moved by erosion are called ___________ soils.
4. Soils that are ___________ allow water to flow easily through them.
5. A cross-section of soil showing its different layers is called a soil ___________.
6. The layer of soil consisting only of partially altered bedrock is the ___________.
7. Soil called pedalfer gets its name from the iron and ___________ it contains.

Lesson 9.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast pedalfer and pedocal soils, and explain any differences.

CHAPTER 10 HS Erosion and Deposition Worksheets

Chapter Outline

10.1 Water Erosion and Deposition

Lesson 10.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Streams play a vital role in the water cycle.

_____ 2. The dissolved load of a stream is composed of tiny sediments.

_____ 3. The size of particles that a stream can carry depends on its velocity.

_____ 4. Down cutting into the streambed is done mainly by a stream's suspended load.

_____ 5. The highest elevation of a stream is at its headwaters.

_____ 6. Floodplains have nutrient-rich soils.

_____ 7. A decrease in gradient causes a stream to erode more sediment.

_____ 8. Alluvial fans generally form in arid regions.

_____ 9. Carbonic acid in groundwater comes from dissolved rocks.

_____ 10. Base level is the elevation where a stream enters a body of standing water.

Lesson 10.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Groundwater Erosion and Deposition

Rainwater absorbs carbon dioxide from the atmosphere as it falls through the air. The carbon dioxide combines with water to form carbonic acid. The slightly acidic water sinks into the ground and moves through spaces in soil called pores. The acidic water also travels downward through cracks in rock. Water that flows under the ground through soil or rock is called groundwater. Groundwater is a strong erosional force.

Working slowly over many years, groundwater moving through cracks in rocks dissolves and carries away rock minerals. This enlarges the cracks little by little. Eventually a cave may form. Dissolved minerals in groundwater may also be deposited in a cave, creating formations called stalactites and stalagmites. They form when calcium carbonate dissolved in groundwater comes out of solution. Stalactites form as water drips from the ceiling of a cave, creating icicle-like formations. Stalagmites form as water drips onto the floor of a cave, creating formations like upside-down icicles that grow from the floor of the cave upward. If a stalactite and stalagmite join together, they form a column. Sometimes the roof of a cave collapses. This forms a hole on the surface called a sinkhole. A sinkhole may be large enough to swallow a home or even several homes.

Questions

1. What is groundwater? Why is groundwater a strong erosional force?

2. Explain how groundwater erodes a cave.
3. Describe features created by groundwater deposition.
4. How does a sinkhole form?

Lesson 10.1: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. Sediments carried as solids in the water of a stream make up its
   a. suspended load.
   b. dissolved load.
   c. transported load.
   d. bed load.
2. A stream that can carry larger sediments has a
   a. greater competence.
   b. gentler gradient.
   c. slower velocity.
   d. two of the above
3. The suspended load of a stream is most likely to include
   a. clay.
   b. gravel.
   c. pebbles.
   d. dissolved ions.
4. A stream on a steep slope mainly erodes its
   a. bed.
   b. delta.
   c. banks.
   d. levees.
5. Flowing water does the work of
   a. erosion.
   b. deposition.
   c. weathering.
   d. all of the above
6. A meander slowly migrates when
   a. sediments are deposited on the inside of the curve.
   b. sediments are eroded on the outside of the curve.
   c. sediments are deposited on the outside of the curve.
   d. two of the above
7. The carbonic acid in groundwater is especially good at dissolving the rock
   a. limestone.
   b. sandstone.
   c. granite.
   d. basalt.

Lesson 10.1: Matching

Name____________________ Class_______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. deposit of calcium carbonate on the floor of a cave

_____ 2. deposit by a stream where it enters a body of still water

_____ 3. curve in a stream channel caused by erosion and deposition along the banks

_____ 4. deposit by a stream when it goes from a steep slope to a flat valley

_____ 5. deposit of calcium carbonate on the ceiling of a cave

_____ 6. intermittent movement of bed load

_____ 7. ability of a stream to carry particles of sediment

Terms

a. meander

b. stalactite

c. saltation

d. competence

e. alluvial fan

f. delta

g. stalagmite

Lesson 10.1: Fill in the Blank

Name____________________ Class_______________ Date________

Fill in the blank with the appropriate term.

1. Any body of running water is called a(n) ___________.
2. Water that travels through the soil and rocks underground is known as ___________.
3. The area a stream covers when it overflows its banks is its ___________.
4. When a stream floods, it may deposit ridges called ___________ at the edges of its channel.
5. A(n) ___________ is an underground cavern eroded by groundwater.
6. If a stalactite and a stalagmite join together, they form a(n) ___________.
7. If the roof of a cave collapses, it forms a(n) ___________.

Lesson 10.1: Critical Writing

Name____________________ Class_______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how a typical stream's work changes as it flows from its headwaters to its base level.

10.2 Wave Erosion and Deposition

Lesson 10.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Ocean waves form from wind blowing over the water.

_____ 2. The energy of waves is likely to be dispersed in a bay.

_____ 3. Further erosion may create a wave-cut cliff from a wave-cut platform.

_____ 4. All the sediment carried by waves comes from rivers that enter the ocean.

_____ 5. Waves continually move sand along the shore.

_____ 6. Sandbars are artificial barriers built to protect beaches from wave erosion.

_____ 7. Most barrier islands are just a few kilometers wide.

_____ 8. Dunes are natural features that protect inland areas from wave erosion.

_____ 9. Sand is trapped on the up-current side of a groin.

_____ 10. Sediments in waves erode cliffs by abrasion.

Lesson 10.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Wave Deposition

Rivers carry sediments from the land to the sea. When a river flows into the ocean, the sudden loss of velocity typically results in the formation of a delta. However, if wave action is high, a delta will not form. Instead, waves will spread the sediments along the coastline and create a beach. Waves also erode sediments from cliffs and shorelines and transport them onto beaches. Beaches are most likely to form in quiet areas along a shoreline. For example, a beach may form where water comes ashore in a protected bay. Waves continually move sand on beaches down the shoreline. Waves also move sand back and forth from beaches on shore to bars of sand offshore as the seasons change. In the summer, waves have lower energy, so they deposit sand on beaches. In the winter, waves have higher energy, so they carry the sand back offshore to sandbars.

Besides beaches, several other features may be formed by wave-deposited sand. Barrier islands are islands of sand that are deposited by waves parallel to shore. They are usually just a few kilometers wide but tens of kilometers long. They tend to form along shores that are flat or gently sloping. In their natural state, barrier islands are the first defense against powerful wave erosion during hurricanes and other storms. They bear the brunt of the wave energy and help to protect shorelines from serious wave erosion. However, when barrier islands are built up with homes and other structures, they offer less protection to the shore, and the structures built on them may suffer serious wave damage.

Two other features deposited by waves are spits and tombolos. A spit is a sand deposit that is connected to land and extends out into the water. If a spit develops a curved, hook-like end, it is called a tombolo.

Questions

1. Where and when are waves most likely to deposit sand and form beaches?
2. Explain how barrier islands form and how they protect shorelines from wave erosion.
3. Describe spits and tombolos.

Lesson 10.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Factors that influence the size of ocean waves include how
   a. strong the wind blows.
   b. long the wind blows.
   c. far the wind blows.
   d. all of the above
2. Features that result directly from wave erosion include
   a. cliffs.
   b. breakwaters.
   c. spits.
   d. beaches.
3. Features that result from wave deposition include
   a. groins.
   b. barrier islands.
   c. sea walls.
   d. sea stacks.
4. Wave refraction may
   a. concentrate wave energy.
   b. destroy wave energy.
   c. create wave energy.
   d. all of the above
5. Which choice shows the correct sequence of features formed by continued wave erosion?
   a. wave-cut cliff, sea arch, sea stacks
   b. sea arch, wave-cut cliff, sea stacks
   c. sea stacks, wave-cut cliff, sea arch
   d. sea arch, sea stacks, wave-cut cliff
6. In addition to sand, sediments found on beaches may include
   a. mineral grains.
   b. rock fragments.
   c. pieces of shell.
   d. all of the above
7. Artificial structures that are built to protect shorelines from wave erosion include

a. barrier islands.
b. tombolos.
c. groins.
d. all of the above

Lesson 10.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. sand deposited by waves in a quiet area along a shoreline

_____ 2. long, narrow feature of sand deposited by waves parallel to a shoreline

_____ 3. natural feature that forms when waves erode a cliff from two sides

_____ 4. artificial structure built perpendicular to the shoreline to keep sand on a beach

_____ 5. natural feature that forms when waves erode the top of a sea arch

_____ 6. energy traveling through ocean water

_____ 7. artificial barrier island built to protect the shore from incoming waves

Terms

a. sea arch

b. sea stack

c. beach

d. barrier island

e. breakwater

f. ocean wave

g. groin

Lesson 10.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The "bending" of a wave when it strikes the shore at an angle is called __________.
2. A spit that develops a hook-like shape forms a feature called a(n) __________.
3. A(n) __________ is an onshore structure built parallel to the shoreline to protect it from wave erosion.
4. A level area formed by waves that undercut a wave-cut cliff is called a(n) __________.
5. With continued wave erosion, a sea arch may form two __________.
6. If wave action is high, waves may prevent the formation of a(n) __________ where a river enters the ocean.
7. During the __________, waves have less energy and tend to deposit sand on beaches.

Lesson 10.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify two artificial structures that are built to protect shorelines from wave erosion. Explain how the structures do their job.

10.3 Wind Erosion and Deposition

Lesson 10.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Wind is a more important erosional force in humid regions.

_____ 2. Particles transported by saltation may stay in the air for days.

_____ 3. The wind usually transports sand-sized particles by creep.

_____ 4. Desert pavement is a surface covered by sand.

_____ 5. Desert pavement forms as a result of deflation.

_____ 6. Desert varnish forms because of wind-blown clay.

_____ 7. Beach dune sand is usually made of a variety of minerals.

_____ 8. Desert dune sand is usually composed only of quartz.

_____ 9. Dune sand particles are rounded because rounded grains roll more easily than angular grains.

_____ 10. Wind drops the sediments it is transporting when it slows down.

Lesson 10.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Sand Dunes

Deserts and seashores often have sand dunes. Sand dunes are small hills of sand deposited layer upon layer by the wind. For sand dunes to form there must be an abundant supply of sand and steady winds. A dune forms when a strong wind slows down—often when it blows over some type of obstacle, such as a rock or clump of grass—and drops its sand. As the wind moves up and over the obstacle, it increases in speed. It carries the sand grains up the upwind side of the dune by saltation. As the wind passes over the crest of the dune, its speed decreases. Sand cascades down the other side, forming the slip face of the dune. Sand dunes slope gently on the upwind side and steeply on the downwind slip face side. The slip face is steep because dry sand can form a relatively steep angle without falling downslope.

Sand in beach dunes may vary in composition depending on their location. Beach dune sand is usually composed of quartz because in humid areas other minerals weather into clays. In the tropics, they may be composed of calcium carbonate. Sand in desert dunes may be composed of a variety of minerals. There is little weathering in deserts, so less stable minerals are left behind. Although sand dunes may differ in the composition of their sand, the sand particles themselves are similar and usually very uniform in size and shape. The particles are sand-sized, because larger particles are generally too heavy for the wind to transport easily. The particles are rounded because rounded grains roll more easily than angular grains.

The type of sand dune that forms depends on the amount of sand available, the strength and direction of winds, and the type of ground over which the sand is moving. For example, crescent-shaped dunes form where a large amount of sand is available, winds blow consistently in one direction, and the ground is hard. Linear dunes form long straight lines parallel to the wind direction. They form in areas with less sand where winds come together from different directions.

Questions

1. What are sand dunes?
2. Explain how a sand dune forms.
3. Describe similarities and differences among the sands of different dunes.
4. Identify factors that affect the type of sand dune that forms. Give examples.

Lesson 10.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The ability of wind to erode sediments depends on
    a. sediment size.
    b. wind strength.
    c. degree of aridity.
    d. all of the above
2. Wind transports particles of silt and clay
    a. by creep.
    b. as bed load.
    c. by saltation.
    d. over great distances.
3. What is needed for a sand dune to form?
    a. bare ground
    b. plenty of sand
    c. winds that never change direction
    d. all of the above
4. Loess deposits form downwind of
    a. glacial deposits.
    b. deserts.
    c. forests.
    d. two of the above
5. Loess deposits
    a. have gently sloping sides.
    b. make very fertile soils.
    c. form in vertical layers.
    d. are mined for mineral ores.
6. The bed load of wind typically includes particles the size of
    a. clay.
    b. silt.

c. sand.
d. two of the above.

7. Sand dunes form cross beds when the
   a. wind often changes direction.
   b. slip face collapses.
   c. particles vary in size.
   d. obstacles keep moving.

Lesson 10.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. stone that has been polished due to abrasion by wind-blown sand

_____ 2. surface covered by gravel-sized particles that are not easily eroded by wind

_____ 3. steep side of a sand dune

_____ 4. lowering of the ground surface due to wind erosion of sediments

_____ 5. small hill in a desert or on a beach formed by wind deposition of sand

_____ 6. layers of very fine particles that have been deposited by the wind

_____ 7. dark-colored coating that forms on exposed rocks in desert areas

Terms

a. deflation

b. desert pavement

c. desert varnish

d. loess

e. sand dune

f. slip face

g. ventifact

Lesson 10.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The way the wind transports silt-sized particles is called __________.
2. Particles moved by wind cause erosion through the process of __________.
3. Wind carries sand grains up a sand dune by __________.
4. The __________ load carried by the wind includes particles of clay.
5. __________ sands are usually rounded and very uniform in size and shape.

6. Mud on the ocean floor comes from silt and clay carried from the land by __________.
7. __________ deposits consist of layer upon layer of wind-deposited clay and silt.

Lesson 10.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate sediment size to the way sediments are transported by wind.

10.4 Glacial Erosion and Deposition

Lesson 10.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Glaciers currently cover about 30 percent of Earth's total surface.

_____ 2. Glaciers cause erosion by abrasion and plucking.

_____ 3. A varve is a high-altitude lake that forms in a cirque.

_____ 4. Glaciers can carry sediments only if they are pebble-sized or smaller.

_____ 5. Lateral moraines form from material plucked up by a glacier.

_____ 6. A glacier advances when less ice melts than accumulates during a year.

_____ 7. Alpine glaciers flow outward in all directions from the greatest accumulation of snow and ice.

_____ 8. Continental glaciers erode features such as tarns and arêtes.

_____ 9. Glaciers may carry sediments for many years.

_____ 10. A broad area of stratified drift from meltwater is called an outwash plain.

Lesson 10.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Depositional Features of Glaciers

Glaciers can carry rock particles of any size, from giant boulders to silt. The sediments can be carried for many kilometers over long durations of time. Melting glaciers deposit the sediments they are carrying in a jumble of particle sizes. The unsorted deposits are called glacial till. Many deposits of glacial till have a linear shape. Linear deposits are called moraines. Geologists study moraines to figure out how far glaciers advanced and how long it took them to recede. Moraines are named for their location relative to the glacier.

- Lateral moraines form at the edges of an alpine glacier from material that drops onto the glacier from erosion of the valley walls.
- A medial moraine forms where the lateral moraines of two tributary glaciers join together in the middle of a larger glacier.
- Ground moraines form from sediment underneath a glacier that is deposited as the glacier melts. Deposits of ground moraine may improve soil fertility.
- Terminal moraine forms in a long ridge at the farthest point a glacier reaches.
- End (recessional) moraines form wherever a glacier stops long enough as it recedes to deposit a ridge of sediment.

After glaciers dump unsorted sediments, glacial meltwater can pick up, transport, and re-deposit the sediments. As meltwater moves through unsorted glacial till, it leaves behind the larger particles and takes away the smaller particles, especially silt and sand. The meltwater flowing beneath a glacier may deposit some of the sediments it is carrying in a winding ridge called an esker. As the sediments settle out of meltwater, the larger particles settle first, followed by layers of increasingly smaller sediments. These stratified layers are called stratified drift. A broad area of stratified drift from meltwater at the end of a receding glacier is called an outwash plain.

Questions

1. What is glacial till? What is a moraine?
2. Identify five types of glacial moraines.
3. Explain why sediments deposited by glacial ice are unsorted whereas sediments deposited by glacial meltwater are sorted.
4. Identify two depositional features of glacial meltwater.

Lesson 10.4: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. A bowl-shaped depression carved into the side of a mountain by a glacier is called a(n)
   a. arête.
   b. cirque.
   c. tarn.
   d. horn.
2. Any linear rock deposit dropped by a melting glacier is known as a(n)
   a. till.
   b. erratic.
   c. striation.
   d. moraine.
3. Unsorted glacial till may be sorted into differently sized particles by
   a. tributary glaciers.
   b. meltwater.
   c. plucking.
   d. gravity.
4. Ground moraine is sediment from the
   a. bottom of a glacier.
   b. sides of two tributary glaciers.
   c. terminal end of a glacier.
   d. top of a valley glacier.
5. Scientists can determine the direction a glacier moved by examining
   a. striations.
   b. drumlins.
   c. stratified drifts.
   d. two of the above
6. When a block of ice in glacial till melts, it may form a(n)

a. outwash plain.
b. kettle lake.
c. waterfall.
d. varve.

7. Features formed by glacial deposition include

a. glacial striations.
b. hanging valleys.
c. glacial erratics.
d. two of the above

Lesson 10.4: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. jumble of unsorted rock deposited by a melting glacier

_____ 2. ridge deposited by a glacier where it paused while receding

_____ 3. ridge deposited by a glacier at the farthest point it reached

_____ 4. long, deep groove scratched in bedrock by glacial sediment

_____ 5. linear deposit of till at the edge of an alpine glacier

_____ 6. process of glacial erosion in which rock is picked up and carried away by a glacier

_____ 7. large rock deposited by a glacier that is different from surrounding bedrock

Terms

a. glacial striation

b. plucking

c. glacial erratic

d. glacial till

e. lateral moraine

f. terminal moraine

g. end moraine

Lesson 10.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. A large ice sheet that covers relatively flat ground is called a(n) __________ glacier.
2. A glacier that flows downhill through mountains is called a(n) __________ glacier.
3. A(n) __________ valley forms where an alpine glacier cuts off a tributary glacier and creates a cliff.

4. A peak called a(n) __________ forms when several glaciers flow in different directions from a mountaintop.
5. An alpine glacier erodes its valley into a __________ shape.
6. A winding ridge of sand deposited under a glacier by a stream of meltwater is a(n) __________.
7. A hill of sediments that points in the direction a glacier moved is a(n) __________.

Lesson 10.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast alpine and continental glaciers.

10.5 Erosion and Deposition by Gravity

Lesson 10.5: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Gravity always moves material from a higher to a lower elevation.

_____ 2. A landslide can move as quickly as 500 kilometers per hour.

_____ 3. The California coastline is prone to landslides.

_____ 4. Vegetation helps to prevent soil from sliding downhill.

_____ 5. Creep occurs only when a slope is undercut.

_____ 6. Slump occurs so slowly that you cannot actually watch it happening.

_____ 7. A volcanic eruption might shake the ground and trigger a landslide.

_____ 8. Landslides cause about a million dollars of damage in the U.S. each year.

_____ 9. Installing good drainage on hillsides may help prevent landslides.

_____ 10. Landslides are most likely to happen where they have occurred before.

Lesson 10.5: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Types of Rapid Mass Movements

Mass movement is any movement of Earth materials by the force of gravity. Several types of mass movement occur suddenly and rapidly. They include landslides, avalanches, mudflows, and lahars.

Landslides and avalanches are the most dramatic, sudden, and dangerous types of mass movement. Landslides are sudden falls of rock, whereas avalanches are sudden falls of snow. When large amounts of rock suddenly break loose from a cliff or mountainside, they move quickly and with tremendous force. Landslides are exceptionally destructive. Homes may be destroyed as hillsides collapse. A landslide may bury entire villages. A landslide that dams a stream may create a lake. A landslide that flows into a lake or bay may trigger a tsunami. Landslides often occur on steep slopes in dry or semi-arid climates, especially following a heavy rain. The California coastline has steep cliffs and years of drought punctuated by seasons of abundant rainfall, so it is prone to landslides.

On hillsides with soils rich in clay, a period of heavy rain that thoroughly saturates the soil may create a mudflow. This is especially likely if there is not much vegetation to hold the wet soil in place. Mudflows follow river channels, and they may wash out any bridges, trees, and homes that are along their path. A lahar is a mudflow that flows down the side of a composite volcano. Ash from an eruption mixes with snow and ice. The snow and ice melt and contribute to the formation of hot, fast-moving mud.

Questions

1. Define mass movement, and list four types of rapid mass movement.
2. Describe landslides and their possible effects.
3. What conditions promote mudflows? What are possible consequences of mudflows?
4. What are lahars, and when do they occur?

Lesson 10.5: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Types of mass movement that involve snow include
   a. slump.
   b. lahar.
   c. avalanches.
   d. two of the above
2. Types of mass movement that involve mud include
   a. landslides.
   b. creep.
   c. lahar.
   d. two of the above
3. Sudden mass movements include all of the following except
   a. landslides.
   b. avalanches.
   c. mudflows.
   d. creep.
4. Factors that make landslides more likely include
   a. dry climate.
   b. steep slope.
   c. recent heavy rain.
   d. all of the above
5. Mudflows follow
   a. mountain ridges.
   b. river channels.
   c. talus slopes.
   d. none of the above
6. Evidence of creep includes
   a. tilted electric poles.
   b. trees with curved trunks.
   c. crescent-shape scars on hills.
   d. two of the above

Lesson 10.5: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. deposit of rocks that fall and slowly accumulate at the base of a cliff

_____ 2. movement of a large block of rock as a single unit down a slope

_____ 3. sudden fall of rocks down a slope

_____ 4. extremely gradual movement of soil down a slope

_____ 5. mudflow of volcanic ash and melted snow down the side of a volcano

_____ 6. sudden fall of snow down a slope

_____ 7. sudden slipping of mud down a slope

Terms

a. creep

b. landslide

c. talus slope

d. slump

e. mudflow

f. avalanche

g. lahar

Lesson 10.5: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Any transport of Earth materials by gravity is called __________.
2. If a landslide dams a stream, it may form a(n) __________.
3. If a landslide flows into a lake or bay, it may trigger a(n) __________.
4. Seismic waves from a(n) __________ may trigger landslides.
5. A crescent-shaped scar on the side of a hill is left behind when __________ occurs.
6. Mudflows are more likely when saturated soils contain a lot of __________.

Lesson 10.5: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify factors that increase the chances of mass movement. Explain why each factor increases the risk.

CHAPTER 11 HS Evidence About Earth's Past Worksheets

Chapter Outline

11.1 Fossils

Lesson 11.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. People have been discovering fossils for thousands of years.

_____ 2. In ancient times, fossils inspired legends of mythical creatures.

_____ 3. Fossilization is a fairly common occurrence.

_____ 4. There is virtually no fossil record of organisms that lacked hard parts such as bones or shells.

_____ 5. A dead organism is less likely to become a fossil if it is buried by sediments.

_____ 6. Because of difficulties of preservation, only a few thousand fossils have ever been discovered.

_____ 7. The least common type of fossilization is the preservation of soft tissues.

_____ 8. Some insects have been perfectly preserved in amber.

_____ 9. Fossils of marine organisms found on land show that the land was once covered by a sea.

_____ 10. Rocks containing the same index fossils are about the same age.

Lesson 11.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

How Fossils Form

A fossil is any preserved remains or traces of once-living organisms. Fossils include body fossils, which are fossilized remains of body parts, and trace fossils, which include burrows, tracks, feces, or other traces left by an organism. Collections of fossils that are found together are known as fossil assemblages.

The process of a once-living organism or its traces becoming a fossil is called fossilization. It most often occurs when the remains or traces are buried by sediments and then gradually change to rock. Fossilization is very rare. Only a tiny percentage of the organisms that have ever lived have become fossils. Usually, it is only the hard parts of organisms that are fossilized. The fossil record consists almost entirely of the shells, bones, or other hard parts of animals. Mammal teeth are much more resistant than bones, so a large portion of the mammal fossil record consists of teeth. The shells of marine organisms are also common. Organisms that lack hard parts, from bacteria to jellyfish, rarely become fossils.

Quick burial is almost always necessary for an organism to be fossilized because most decay and fragmentation occur when remains are exposed at the surface. Marine animals that die near a river delta may be buried rapidly by river sediments. A storm at sea may shift sediment on the ocean floor, covering a body and helping to preserve its skeletal remains. In general, quick burial is rare on land, so fossils of land organisms are less common than fossils of marine organisms. However, land organisms are sometimes buried by mudslides, volcanic ash, or sand in a sandstorm. They may also be buried by mud in lakes, swamps, or bogs. Rarely, they may be buried by tar in tar pits or the ice of glaciers.

Questions

1. What is a fossil? Distinguish between body fossils and trace fossils.
2. Why is fossilization rare?
3. What factors make fossilization more likely?

Lesson 11.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. "Dragon bones" found in China 2000 years ago were probably
   a. unusually shaped rocks.
   b. dinosaur fossils.
   c. bones of lizards.
   d. pillow lava.
2. Coprolites are
   a. fossilized feces.
   b. extinct sea organisms.
   c. minerals found in replacement fossils.
   d. any fossilized traces of once-living organisms.
3. Which statement about fossils is false?
   a. Only a tiny percentage of organisms becomes fossils.
   b. Soft-bodied organisms are the least likely to become fossils.
   c. Quick burial is almost always essential for remains to become fossils.
   d. Land organisms are more likely to become fossils than marine organisms.
4. Complete preservation is possible if an organism is buried in
   a. tar.
   b. mud.
   c. tree sap.
   d. any of the above
5. Petrified wood forms because of
   a. compression.
   b. replacement.
   c. permineralization.
   d. none of the above
6. Compression is most common for fossils of
   a. leaves.
   b. teeth.
   c. bones.
   d. shells.
7. Fossils can provide clues about

a. past climates.
b. plate tectonics.
c. extinct species.
d. all of the above

Lesson 11.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. most common method of fossilization

_____ 2. space in rock left behind when an organism or part of an organism decays

_____ 3. hardened ancient tree sap

_____ 4. any preserved remains or traces of an ancient organism

_____ 5. type of fossil that forms when a mold fills in with sediments

_____ 6. common, widespread fossil that can be used to identify the ages of rocks

_____ 7. any process by which fossils form

Terms

a. permineralization

b. cast

c. fossilization

d. mold

e. amber

f. fossil

g. index fossil

Lesson 11.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The preserved remains of an organism's body parts is called a(n) __________ fossil.
2. A preserved burrow, track, or other evidence of an organism's life is called a(n) __________ fossil.
3. __________ is the process in which water deposits minerals within the remains of a buried organism.
4. A(n) __________ of organic remains forms when the remains are compressed by high pressure.
5. The best form of evidence about the history of life on Earth is __________.
6. Organisms that make good index fossils are widespread and existed for a(n) __________ period of time.
7. For a fossil that forms by __________, the original bone or shell dissolves and is replaced by different minerals.

Lesson 11.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast two different methods of fossilization.

11.2 Relative Ages of Rocks

Lesson 11.2: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Natural laws never change.

_____ 2. Steno correctly explained how marine fossils could end up on mountains far from an ocean

_____ 3. Fossils in a rock layer represent the organisms that lived when the rock was formed.

_____ 4. The oldest rock layers in the Grand Canyon are at the top.

_____ 5. A fault is always older than the rock layers it cuts through.

_____ 6. Nicholas Steno was the first scientist to question the Biblical age of Earth.

_____ 7. William Smith is often called the father of modern geology.

_____ 8. Rocks in different places that have the same index fossils are about the same age.

_____ 9. Microfossils are useful index fossils because they are so widespread.

_____ 10. The oldest ages are at the top of the geologic time scale.

Lesson 11.2: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Matching Up Rock Layers

When rock layers are located in different places, laws such as superposition and cross-cutting cannot be used to match rocks that are the same age. Matching these rocks requires other evidence.

Sometimes distinctive rock formations may be recognizable in different locations. If so, rocks in the different locations are assumed to have formed under the same conditions at the same time. For example, the famous White Cliffs of Dover in southwest England consist of a soft rock called chalk. The rock formed from organisms that settled to the bottom of an ancient sea. Similar white chalk cliffs are also found in Denmark and Germany. They formed at the same time as the cliffs in Dover.

Index fossils can often to be used to match rocks in different places. Rocks with the same index fossil(s) must be about the same age. To be useful as an index fossil, a fossil must represent an organism that was widespread but existed for only a short period of time. The well-known trilobite is often used as an index fossil.

Key beds can be used like index fossils to match rock layers in different locations. A key bed is a distinctive layer of rock that is found in many areas of the world or even worldwide. A famous key bed is a thin clay layer that formed all over the world at the boundary between the Cretaceous Period and the Tertiary Period. This is when the dinosaurs and many other organisms went extinct. The clay layer contains a high concentration of iridium, an element that is rare on Earth but common in asteroids. The iridium makes this key bed easy to identify wherever it is found on the planet. Many scientists think that a huge asteroid struck Earth late in the Cretaceous Period, blanketing the planet with iridium-rich dust. The dust may have been a major reason for the mass extinction because it would have blocked sunlight from reaching Earth. When the dust settled, it formed a thin layer of iridium-rich sedimentary rock.

Questions

1. Explain how distinctive rock formations can be used to match rocks in different places.
2. Why are index fossils useful for finding rock layers that are the same age? What makes a good index fossil?
3. What is a key bed? Describe the famous key bed that formed at the boundary between the Cretaceous and Tertiary Periods.

Lesson 11.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Steno's laws include the law of
   a. lateral continuity.
   b. faunal succession.
   c. cross-cutting relationships.
   d. all of the above
2. The Colorado River must be younger than all of the rock layers through which it has eroded, according to the principle of
   a. cross-cutting relationships.
   b. uniformitarianism.
   c. superposition.
   d. relative age.
3. If you know the relative ages of two rocks, you know
   a. how old the rocks are in years.
   b. which rock formed earlier.
   c. which rock is younger.
   d. two of the above
4. In the 1600s, most Europeans believed that Earth was about
   a. 6 billion years old.
   b. 6 million years old.
   c. 6 thousand years old.
   d. 6 hundred years old.
5. Eroded gaps in rock sequences are known as
   a. key beds.
   b. erosion zones.
   c. unconformities.
   d. lateral continuities.
6. The longest subdivisions of the geologic time scale are
   a. eras.

b. eons.
c. epochs.
d. periods.

7. The current epoch of the geologic time scale is the

a. Cenozoic.
b. Quaternary.
c. Holocene.
d. Pleistocene.

Lesson 11.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. law that younger layers of sedimentary rock are deposited on top of older layers

_____ 2. principle that rock cutting across horizontal layers must be younger than all the layers

_____ 3. scientist who developed the law of superposition

_____ 4. scientist who developed the principle of cross-cutting relationships

_____ 5. principle describing how changes in fossils represent changes in species through time

_____ 6. scientist who developed the principle of faunal succession

_____ 7. law that sediments are always deposited in flat, horizontal layers

Terms

a. original horizontality

b. William Smith

c. superposition

d. James Hutton

e. cross-cutting relationships

f. faunal succession

g. Nicholas Steno

Lesson 11.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. According to the law of __________, sediments are deposited in continuous sheets that span the body of water where they are deposited.
2. The __________ age of a rock is its age in comparison with the ages of other rocks.
3. The idea that the same geologic processes occurring today also occurred in the past is called __________.

4. The scientist who introduced the idea stated in question 3 was __________.
5. Fossils of microscopic organisms are called __________.
6. A(n) __________ is a rock layer that is defined by a single index fossil or fossil assemblage.
7. A distinctive layer of rock that can be recognized across a large area is called a(n) __________.

Lesson 11.2: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

"The present is the key to the past" applies to the work of James Hutton. Explain how.

11.3 Absolute Ages of Rocks

Lesson 11.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Radioactivity was discovered in the late 1800s.

_____ 2. Each ring inside a tree trunk represents one decade of growth.

_____ 3. During beta decay, a radioactive isotope emits two protons and two neutrons.

_____ 4. Carbon-14 breaks down in the process of beta decay.

_____ 5. All radioactive isotopes decay at the same rate.

_____ 6. Potassium-argon dating has been used to date human fossils.

_____ 7. The earliest geologic time scale included dates for each of the major subdivisions of time.

_____ 8. Ice cores can reveal how concentrations of atmospheric gases changed over time.

_____ 9. As time passes, the number of parent isotopes in a radioactive material increases.

_____ 10. A radioactive isotope with a short half-life cannot be used to date very old rocks.

Lesson 11.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Radiometric Dating

Radiometric dating is the process of using concentrations of radioactive isotopes and their daughter products to estimate the ages of materials. It is a very useful tool for dating fossils and rocks. Different isotopes are used to date materials of different ages because different isotopes have different rates of decay. Using more than one isotope also helps scientists check the accuracy of the ages they calculate.

Radiocarbon dating is used to find the age of once-living materials between 100 and 50,000 years old. This range is especially useful for determining the absolute ages of recent human fossils and living sites. Carbon-14 is the only radioactive isotope of carbon, and it has a half-life of 5,730 years. A tiny and constant percentage of carbon in the atmosphere is carbon-14. Plants take in carbon dioxide containing carbon-14—along with nonradioactive isotopes of carbon—during photosynthesis. Animals consume this carbon when they eat plants or other animals that have eaten plants. The carbon-14 in organisms constantly decays, but it is continuously replaced as long as an organism is alive. After an organism dies, the carbon-14 it contains continues to decay, but no new carbon-14 is taken in to replace it. Therefore, the carbon-14 content of the remains constantly declines. The remaining carbon-14 in organic materials can be measured and used to estimate the amount of time that has passed since the organism died.

Different radioactive isotopes are more useful for estimating the ages of older materials. For example, potassium-

40 decays to argon-40 with a half-life of 1.26 billion years. Potassium-argon dating can be used to date materials between 100,000 and over a billion years old. Two uranium isotopes are also used for radiometric dating. Uranium-238 decays to lead-206 with a half-life of 4.47 billion years. Uranium-235 decays to form lead-207 with a half-life of 704 million years. Uranium-lead dating can be used to date materials between 1 million and 4.6 billion years old.

Questions

1. What is radiometric dating? Why are different isotopes used to date materials of different ages?
2. Explain how carbon-14 enters living things and how the carbon-14 content of organisms changes after they die. Why is radiocarbon dating useful only for relatively young specimens?
3. Identify other radioisotopes that are used for radiometric dating and the ages of the materials they can date.

Lesson 11.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Information on past climates can be obtained from
   a. tree rings.
   b. ice cores.
   c. varves.
   d. all of the above
2. If you start with a given amount of a radioactive isotope, what proportion of the original amount will remain after three half-lives?
   a. [U+215B]
   b. $\frac{1}{4}$
   c. [U+2153]
   d. $\frac{1}{2}$
3. Carbon-14 releases a beta particle when it decays to
   a. carbon-13.
   b. carbon-12.
   c. nitrogen-13.
   d. nitrogen-14.
4. Alpha decay of a parent isotope results in the formation of a(n)
   a. daughter isotope.
   b. large amount of energy.
   c. alpha particle.
   d. all of the above
5. Which of the following radioactive isotopes has the longest half-life?
   a. carbon-14
   b. potassium-40
   c. uranium-238
   d. uranium-235
6. Drawbacks of radiometric dating include which of the following?
   a. It is not very useful for aging sedimentary rocks.
   b. It cannot be used to estimate the ages of organic materials.

c. It cannot be used to age rocks that are more than 1 billion years old.
d. all of the above

7. Earth's age is now generally considered to be about
    a. 4.6 million years.
    b. 100 million years.
    c. 2.6 billion years.
    d. 4.6 billion years.

Lesson 11.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. rate of decay of a radioactive isotope

_____ 2. using concentrations of radioactive isotopes to estimate the age of a material

_____ 3. two protons and two neutrons

_____ 4. layered sediment at the bottom of a lake near a glacier

_____ 5. form of an atom that is unstable and spontaneously gains or loses particles

_____ 6. isotope formed during radioactive decay

_____ 7. tendency of certain atoms to decay into other atoms and emit energy

Terms

a. alpha particle

b. daughter product

c. radiometric dating

d. radioactivity

e. radioactive isotope

f. half-life

g. varve

Lesson 11.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The age of a rock or fossil in years is its __________ age.
2. A method of dating old wood based on tree growth is called ____________ dating.
3. The time it takes for half of a given amount of radioactive isotope to decay is its __________.
4. Scientists drill into ice sheets to obtain cross-sections of ice called __________.
5. __________ of elements inside Earth's interior provides a steady source of heat.

6. The type of radiometric dating called __________ dating is used to date organic materials from 100 to 50,000 years old.
7. Of the three isotopes of carbon, only the isotope named __________ is radioactive.

Lesson 11.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

How did the discovery of radioactivity contribute to our knowledge of Earth's history?

CHAPTER 12 HS Earth's History Worksheets

Chapter Outline

12.1 Early Earth

Lesson 12.1: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Earth formed about a billion years later than the sun.

_____ 2. The oldest materials found on Earth are zircon crystals.

_____ 3. Asteroid impacts helped to cool down early Earth.

_____ 4. All of Earth's first crust was recycled into the mantle by convection.

_____ 5. Earth has a slower spin than it should have for a planet of its size and distance from the sun.

_____ 6. The moon formed from molten materials.

_____ 7. The "Genesis Rock" is a chunk of Earth's original crust.

_____ 8. Earth formed oceans before it formed an atmosphere.

_____ 9. Earth has more volcanic activity now than at any time in the past.

_____ 10. Most of the oxygen in Earth's atmosphere was produced by plants.

Lesson 12.1: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

How the Moon Formed

One of the most unique features of planet Earth is its large moon. Unlike the only other inner planet moons—the moons of Mars—Earth's moon is not a captured asteroid. Understanding the moon's origin reveals a great deal about Earth's early history. To determine how the moon formed, scientists considered several lines of evidence:

- The moon is large. It is not much smaller than the smallest planet, Mercury.
- Earth and the moon are very similar in composition.
- The moon's surface is 4.5 billion years old, about the same age as the rest of the solar system.
- For a body of its size and distance from the sun, the moon has very little core, whereas Earth has a fairly large core.
- The oxygen isotope ratios of Earth and the moon indicate that they originated in the same part of the solar system.
- Earth has a faster spin than it should have for a planet of its size and distance from the sun.

Astronomers have carried out computer simulations that are consistent with these facts. From their analyses, they have detailed a "birth" story of the moon. According to the story, a little more than 4.5 billion years ago, Earth was struck by a Mars-sized asteroid. The tremendous energy from the impact melted both Earth and the asteroid, and their molten materials mixed together. The dense metals remained on Earth but some of the molten materials were flung into orbit around Earth. These materials eventually accreted into a single body, the moon. Both planetary bodies were molten, so materials on both of them could differentiate into core, mantle, and crust. Earth's fast spin is due to energy imparted to it by the asteroid impact.

Questions

1. What evidence did scientists consider when they tried to determine how the moon formed?
2. Summarize the "birth" story of the moon.
3. Why does Earth have such a fast spin?

Lesson 12.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Information scientists used to learn about early Earth came from
   a. zircon crystals.
   b. meteorites.
   c. lunar rocks.
   d. all of the above
2. Why was early Earth extremely hot?
   a. Gravity put its interior under great pressure.
   b. It was closer to the sun than it is now.
   c. Its surface was covered with hot water.
   d. all of the above
3. Earth's earliest crust formed by the process of
   a. outgassing.
   b. convection.
   c. differentiation.
   d. radioactive decay.
4. Which statement about Earth's moon is false?
   a. It formed by accretion.
   b. It is a captured asteroid.
   c. It is similar in composition to Earth.
   d. It is almost as old as Earth.
5. Earth's first atmosphere consisted of
   a. hydrogen and helium.
   b. water vapor and methane.
   c. carbon dioxide and oxygen.
   d. all of the above
6. Which of the following do scientists think formed first?
   a. Earth's moon
   b. Earth's oceans
   c. Earth's atmosphere

d. Earth's earliest organisms

7. Reasons oxygen is essential for most life on Earth include that it is needed for
   a. breathing.
   b. the ozone layer.
   c. the water cycle.
   d. two of the above

Lesson 12.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. cloud of gas and dust from which the solar system formed

_____ 2. separation of Earth into layers based on density

_____ 3. organism adapted to an extreme environment

_____ 4. coming together of smaller particles to form a larger body such as a planet

_____ 5. scientist who finds and studies fossils to learn about the history of life

_____ 6. gas that blocks ultraviolet radiation from the sun

_____ 7. release of gases from Earth's interior by volcanic eruptions

Terms

a. accretion

b. paleontologist

c. solar nebula

d. ozone

e. extremophile

f. differentiation

g. outgassing

Lesson 12.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Earth formed when __________ caused small pieces of rock and metal to smash together and create the planet.
2. During differentiation, early Earth's densest materials moved to the planet's __________.
3. Scientists think that the moon formed from Earth when the planet was struck by a very large __________.
4. Earth's second atmosphere came from volcanic activity and impacts by __________.
5. Before there were plants on Earth, the planet's atmosphere contained very little __________.
6. Earth could not have oceans until the planet became __________ enough for water to condense.

7. Scientists think that Earth formed nearly __________ years ago.

Lesson 12.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain the origins of Earth's atmosphere and oceans.

12.2 The Precambrian

Lesson 12.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The Precambrian Era ended about 2.5 billion years ago.

_____ 2. Earth's first crust was made of felsic rock.

_____ 3. Early in the Precambrian, Earth was cooler than it is today.

_____ 4. About a billion years ago, North America was part of the continent of Laurentia.

_____ 5. Scientists think it is likely that life evolved more than once on Earth.

_____ 6. One way that scientists learn about early life is by studying extremophiles.

_____ 7. Proteins are the least abundant class of organic molecules.

_____ 8. RNA can encode genetic instructions and also build proteins.

_____ 9. Cells evolved when organic molecules developed a nucleus.

_____ 10. The earliest cells were probably prokaryotes similar to E. coli.

Lesson 12.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Photosynthesis and Earth's Changing Atmosphere

Without photosynthesis, the earliest cells most likely absorbed nutrients that floated in the organic soup that surrounded them. After hundreds of millions of years, these nutrients would have become less abundant. Sometime around 3 billion years ago, photosynthesis began. Photosynthesis allowed organisms to use sunlight and inorganic molecules to create chemical energy that they could use for food. They no longer needed to rely on nutrients floating in their environment. Photosynthesizing organisms could also become food for other organisms.

A byproduct of photosynthesis is the production of oxygen. After photosynthesis evolved, oxygen was soon present in the atmosphere in far greater concentrations than ever before. The addition of oxygen from photosynthesis created Earth's third atmosphere. This event is sometimes called the oxygen catastrophe because so many organisms died out. For organisms adapted to an oxygen-free environment, oxygen was toxic. The event is also called the great oxygenation event because it was a great opportunity for other organisms. The few organisms that survived developed a vital use for oxygen, cellular respiration. This is the process by which cells use oxygen to obtain energy from organic molecules. These organisms were able to flourish in the new atmosphere.

The addition of oxygen to the atmosphere was important to living things for another reason as well. With oxygen in the atmosphere, the ozone layer could develop. The ozone layer protected Earth's surface from harmful ultraviolet light radiating from the sun. This allowed more complex life forms to evolve.

Questions

1. What is photosynthesis? When did it evolve? How did organisms obtain nutrients before photosynthesis evolved?
2. How did photosynthesis change Earth's atmosphere?
3. Why was the addition of oxygen to the atmosphere both a catastrophe and a great opportunity for life on Earth?

Lesson 12.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. To be considered alive, a molecule must
    a. be organic.
    b. have metabolism.
    c. be able to reproduce.
    d. all of the above
2. Miller and Urey's experiment showed that
    a. organic molecules could form under conditions on early Earth.
    b. amino acids arrived on Earth from meteorites.
    c. proteins originated at hydrothermal vents.
    d. DNA has a double helix structure.
3. An organism that consists of a cell without a nucleus is a(n)
    a. prokaryote.
    b. nucleic acid.
    c. eukaryote.
    d. stromatolite.
4. Photosynthesis evolved about
    a. 5 billion years ago.
    b. 3 billion years ago.
    c. 5 million years ago.
    d. 3 million years ago.
5. The earliest photosynthesizers were probably most like today's
    a. plants.
    b. grasses.
    c. algae.
    d. ferns.
6. Organelles in eukaryotic cells probably evolved from
    a. smaller prokaryotic cells.
    b. other eukaryotic cells.
    c. proteins.
    d. RNA.
7. Organisms that adapted to the oxygen in Earth's third atmosphere used oxygen for

a. photosynthesis.
b. cellular respiration.
c. reproduction.
d. replication.

Lesson 12.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. ancient core of a continent

_____ 2. supercontinent that existed about 1.1 billion years ago

_____ 3. part of Rodinia

_____ 4. place where a craton crops out at the surface

_____ 5. type of rock found in oceanic trenches

_____ 6. craton with a covering of younger rocks

_____ 7. type of rock that makes up continents

Terms

a. platform

b. Laurentia

c. craton

d. Rodinia

e. shield

f. felsic

g. greenstone

Lesson 12.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The __________ Era began when Earth formed.
2. Earth's early tectonic plates were __________ in size than modern plates.
3. __________ is the hypothesis that Earth was covered with ice at the end of the Precambrian.
4. About 2.5 billion years ago, small continents called __________ collided to create supercontinents.
5. Molecules that make up proteins are __________ acids.
6. Molecules that store and pass on genetic information are __________ acids.
7. The idea that RNA was the earliest organic molecule to evolve is the __________ hypothesis.

Lesson 12.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain they hypothesis that eukaryotes evolved from prokaryotes.

12.3 Phanerozoic Earth History

Lesson 12.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The Paleozoic Era began about 60 million years ago.

_____ 2. The Paleozoic began and ended with a supercontinent.

_____ 3. Six complete cycles of marine transgressions and regressions occurred during the Paleozoic.

_____ 4. Scientists think that the Appalachian Mountains were once higher than the Himalayas are now.

_____ 5. Pangaea existed about 2.5 million years ago.

_____ 6. In the past, heat built up beneath supercontinents.

_____ 7. The Atlantic Ocean basin is currently growing smaller.

_____ 8. The Sierra Nevada Mountains in California are uplifted igneous intrusions.

_____ 9. The Cenozoic Era began about 65.5 million years ago.

_____ 10. The paleogeography of the Cenozoic was very much like it is today.

Lesson 12.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Mesozoic Era

The Mesozoic Era began about 240 million years ago and ended about 66 million years ago. The era is best known as the age of the dinosaurs. It was an active geological era as well.

At the beginning of the Mesozoic, there was one continent, Pangaea, and one ocean, Panthalassa. By about 180 million years ago, Pangaea began to break apart. At the same time, the Panthalassa Ocean began to separate into the individual but interconnected oceans that we see on Earth today. Why would a supercontinent break up after being together for tens of millions of years? A supercontinent is like a giant insulating blanket that does not allow mantle heat to escape very effectively. As heat builds up beneath a supercontinent, continental rifting begins. Basaltic lavas fill in the rifts and eventually lead to seafloor spreading and the formation of new ocean basins. The Atlantic Ocean basin formed as Pangaea split apart and seafloor spreading pushed Africa and South America apart.

As the continents making up Pangaea moved apart, there was an intense period of plate tectonic activity. Seafloor spreading was so vigorous that the mid-ocean ridge buoyed upward and displaced so much water that there was a marine transgression. Much of the North American continent was covered with water. Later in the Mesozoic, those seas regressed and then transgressed again. The moving continents also collided with island arcs and microcontinents so that mountain ranges accreted onto the continents' edges. For example, the subduction of the oceanic Farallon plate beneath western North America during the late Jurassic and early Cretaceous produced igneous intrusions and other structures. The intrusions have since been uplifted to form the Sierra Nevada Mountains.

Questions

1. Describe Earth's continents and oceans at the beginning of the Mesozoic Era.
2. Why do supercontinents break up?
3. What caused the Atlantic Ocean basin to form? Why is it still growing larger?
4. Why was much of North America under water as Pangaea broke apart early in the Mesozoic?
5. Describe how California's Sierra Nevada Mountains formed in the Mesozoic.

Lesson 12.3: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. The longest era of the Phanerozoic is the
   a. Cenozoic.
   b. Mesozoic.
   c. Paleozoic.
   d. Precambrian.
2. Geologists know about marine transgressions and regressions from
   a. sedimentary rock.
   b. glacial advances.
   c. continental collisions.
   d. all of the above
3. Orogeny occurs
   a. over many millions of years.
   b. when continents smash into microcontinents.
   c. as continents collide with island arcs.
   d. all of the above
4. When Laurentia and Gondwana collided, the collision created the
   a. Appalachian Mountains.
   b. Alps Mountains.
   c. Himalaya Mountains.
   d. Rocky Mountains.
5. During the Mesozoic, the climate was predominantly
   a. tropical.
   b. polar.
   c. temperate.
   d. subpolar.
6. What occurs as a supercontinent begins to break up?
   a. seafloor spreading
   b. continental rifting
   c. formation of new ocean basin
   d. all of the above

7. Toward the end of the Mesozoic Era
    a. much of North America was covered with water.
    b. glaciers advanced as far south as Chicago.
    c. a marine transgression occurred.
    d. two of the above

Lesson 12.3: Matching

Name____________________ **Class**_______________ **Date**_________

Match each definition with the correct term.

Definitions

_____ 1. characteristic sedimentary rock layers from marine transgressions and regressions

_____ 2. retreating of sea level from land

_____ 3. mountain-building event

_____ 4. rising of sea level over the land

_____ 5. most recent supercontinent

_____ 6. oldest era of the Phanerozoic Eon

_____ 7. age of dinosaurs

Terms

a. Paleozoic

b. facies

c. marine transgression

d. orogeny

e. marine regression

f. Mesozoic

g. Pangaea

Lesson 12.3: Fill in the Blank

Name____________________ **Class**_______________ **Date**_________

Fill in the blank with the appropriate term.

1. The eon in which we currently live is the ___________ Eon.
2. Scientists think that Paleozoic marine transgressions and regressions occurred because of changes in the size of ___________.
3. During the time of Pangaea, most of Earth's water formed a huge ocean called the ___________ Ocean.
4. The most recent era of the Phanerozoic Eon is the ___________ Era.
5. Ice ages occurred during the ___________ Epoch of the Cenozoic Era.
6. During the Paleozoic, the southern continents merged to form ___________.
7. When Laurentia and Gondwana collided, they created the supercontinent ___________.

Lesson 12.3: Critical Writing

Name____________________ Class_______________ Date_________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain factors that may have led to the Pleistocene ages.

12.4 History of Earth's Complex Life Forms

Lesson 12.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The main mechanism for biological evolution is natural selection.

_____ 2. The first multicellular organisms evolved during the Paleozoic Era.

_____ 3. The Phanerozoic Eon extends from about 540 million years ago to the present.

_____ 4. The first humans appeared during the Mesozoic Era.

_____ 5. Plants colonized the land before animals did.

_____ 6. Mass extinctions are generally preceded by adaptive radiations.

_____ 7. The Cambrian Period had a tremendous diversification of life forms.

_____ 8. Large extinction events separate the periods of the Paleozoic Era.

_____ 9. The first mammals evolved after the dinosaurs went extinct.

_____ 10. All dinosaurs were exothermic (cold-blooded).

Lesson 12.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Paleozoic Life

The Paleozoic Era follows the Precambrian and is the first era of the Phanerozoic Eon. The Paleozoic lasted from about 540 to 240 million years ago. It is divided into several periods, beginning with the Cambrian and ending with the Permian. Large extinction events separate the periods. After each extinction event, many new life forms evolved.

During the Cambrian Period, there was a tremendous diversification of marine life forms, commonly called the "Cambrian Explosion." At the start of the period, shallow seas covered most of the land, and every major type of marine organism evolved during this time. Animals also evolved shells and other hard parts in the Cambrian, so from the Cambrian forward, fossils are much more abundant and better preserved. For example, the Burgess Shale formation in the Rocky Mountains of British Columbia, Canada, contains an amazing diversity of Cambrian life forms.

During the remainder of the Paleozoic Era, several major evolutionary events occurred, beginning with the first fish about 500 million years ago. By about 425 million years ago, the first land plants and fungi had evolved. This was followed by the first insects (400 million years ago), first amphibians (360 million years ago), and first reptiles (300 million years ago).

As the Paleozoic was reaching its end about 250 million years ago, the largest mass extinction in Earth's history occurred. It is called the Permian mass extinction. More than 95 percent of marine species and 70 percent of land species went extinct. This was also the only known mass extinction of insects species. The Permian mass extinction appears to have taken place in three pulses with separate causes. Gradual environmental change, an asteroid impact, intense volcanism, and changes in the composition of the atmosphere may each have played a role.

Questions

1. What was the "Cambrian explosion"?
2. Why are there more and better-preserved fossils from the Cambrian forward?
3. List major evolutionary events that occurred during the Paleozoic Era.
4. Describe the Permian mass extinction, and identify possible causes.

Lesson 12.4: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. For a trait to increase in a population by natural selection, it must
   a. be controlled by genes.
   b. result from a new mutation.
   c. help organisms adapt to their environment.
   d. two of the above
2. Which of the following "firsts" occurred during the Mesozoic Era?
   a. first birds
   b. first fishes
   c. first reptiles
   d. two of the above
3. The Burgess shale formation in British Columbia, Canada, contains an amazing diversity of fossils from the
   a. Jurassic Period.
   b. Permian Period.
   c. Cambrian Period.
   d. Devonian Period.
4. The first plants to colonize the land lived during the
   a. Precambrian.
   b. Paleozoic.
   c. Mesozoic.
   d. Cenozoic.
5. Which of the following is a possible cause of the Cretaceous mass extinction?
   a. impact of a giant meteorite
   b. cold temperatures of the ice ages
   c. flooding of marine transgressions
   d. breakup of the supercontinent Pangaea
6. The genus Homo, to which modern humans belong, evolved about
   a. 200,000 years ago.
   b. 2 million years ago.
   c. 20 million years ago.

   d. 200 million years ago.

7. During the Pleistocene ice ages, the Bering land bridge allowed humans to migrate for the first time to
   a. North America.
   b. Europe.
   c. Africa.
   d. Asia.

Lesson 12.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. difference in a genetically controlled trait in a population

_____ 2. adaptation that allowed early reptiles to reproduce on land

_____ 3. random change in a gene

_____ 4. change in the frequency of a trait because it affects survival or reproduction

_____ 5. characteristic of an organism that helps it survive in a given environment

_____ 6. process in which many new species quickly evolve to fill available niches

_____ 7. change in the genetic makeup of a species over time

Terms

a. adaptation

b. adaptive radiation

c. natural selection

d. variation

e. evolution

f. amniotic egg

g. mutation

Lesson 12.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. __________ were a group of extremely diverse multicellular organisms that flourished toward the end of the Precambrian.
2. The era of the Phanerozoic in which the first insects evolved is the __________ Era.
3. The first mammals evolved in the __________ Era of the Phanerozoic.
4. A(n) __________ is an event in which large numbers of species go extinct within a short period of time.
5. Archaeopteryx, which lived during the late Jurassic, was the earliest known __________.

6. The largest mass extinction in Earth's history occurred at the end of the __________ Period.
7. The Cenozoic Era is referred to as the age of __________.

Lesson 12.4: Critical Writing

Name__________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how a population could evolve a new trait that helps its members adapt to a change in the environment. Describe an example.

CHAPTER 13 HS Earth's Fresh Water Worksheets

Chapter Outline

13.1 Water on Earth

Lesson 13.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Most of Earth's liquid fresh water is stored in the atmosphere.

_____ 2. Water is the only substance on Earth that naturally exists in all three states of matter.

_____ 3. Groundwater discharge is a process by which groundwater reaches the surface.

_____ 4. Water vapor enters the atmosphere only by the process of evaporation.

_____ 5. Water droplets in clouds always fall to the ground as precipitation.

_____ 6. Areas in the U.S. with the highest concentrations of soil moisture cluster in the geographic center of the country.

_____ 7. In the U.S., less water is used for agriculture than for industry.

_____ 8. When climate cools, there is less liquid water in the oceans so sea level falls.

_____ 9. Even fresh water contains some dissolved salts.

_____ 10. Some water molecules on Earth may be billions of years old.

Lesson 13.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

The Hydrologic Cycle

Water moves continuously around Earth's surface in the hydrologic (water) cycle. The sun provides the energy that drives the cycle. It supplies the energy needed for evaporation, in which liquid water changes to water vapor. The sun's energy evaporates water from the oceans and from bodies of water on land. When water evaporates, only the water molecules evaporate; any salts in the water stay behind.

Water vapor remains in the atmosphere until it undergoes condensation to become tiny droplets of liquid water. If the droplets gather in clouds and collide with other water droplets, they may grow large enough to fall from the clouds as precipitation. Precipitation may be liquid or frozen water. Types of precipitation include rain, snow, sleet, and hail. Most precipitation falls into the oceans; the rest falls on land.

Precipitation that falls on land as rain may runoff into streams, lakes, or the ocean; or it may infiltrate the ground and become soil moisture or groundwater. Water in soil is needed by plants to grow. Water that seeps more deeply into the ground may enter aquifers that store fresh water for centuries. Alternatively, groundwater may travel back to the surface through springs or find its way to the oceans. Precipitation that falls as snow may soon melt and follow one of the paths of liquid precipitation. When snow melts slowly, it provides a steady flow of fresh water to streams and lakes. Alternatively, snow may sit on a mountain for several months, or it may become part of the ice in a glacier, where it may remain for hundreds or even thousands of years. A small amount of snow may change directly to water vapor by sublimation and re-enter the atmosphere.

Plants and animals depend on water to live, and they also play roles in the water cycle. Animals take in liquid water in food and drink. They may release gaseous water when they exhale or liquid water when they sweat or urinate. Plants take up liquid water from the soil and release large amounts of water vapor into the air through their leaves. The process in which this occurs is called transpiration.

Questions

1. What role does the sun play in the water cycle?
2. How does water vapor in the air return to land as liquid or frozen water?
3. Trace possible paths of rainwater back to the atmosphere.
4. Identify ways that solid precipitation may re-enter the water cycle.
5. What roles do living organisms play in the water cycle?

Lesson 13.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Properties of water include
    a. polarity.
    b. low surface tension.
    c. contraction upon freezing.
    d. two of the above
2. Most fresh water on Earth occurs in
    a. lakes and ponds.
    b. rivers and streams.
    c. glaciers and ice sheets.
    d. soil and underground rocks.
3. The process in which water on the surface becomes groundwater is called
    a. infiltration.
    b. sublimation.
    c. precipitation.
    d. evapotranspiration.
4. The main source of energy that drives the hydrologic cycle is
    a. heat from Earth's interior.
    b. storms and other weather.
    c. the force of gravity.
    d. solar radiation.
5. Clouds form when water
    a. sublimates.
    b. evaporates.
    c. condenses.
    d. two of the above

6. Artificial sources of water include
    a. aquifers.
    b. aqueducts.
    c. springs.
    d. all of the above
7. In the U.S., the single biggest use of water is for
    a. drinking.
    b. bathing.
    c. farming.
    d. cooling.

Lesson 13.1: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. process in which a solid changes directly to a gas

_____ 2. process in which plants release water vapor into the air through their leaves

_____ 3. process in which a liquid changes to a gas

_____ 4. form in which 3 percent of water exists on Earth

_____ 5. water that falls from clouds toward the ground

_____ 6. storage location for a substance such as water

_____ 7. process in which a gas changes to a liquid

Terms

a. reservoir

b. fresh water

c. condensation

d. sublimation

e. evaporation

f. transpiration

g. precipitation

Lesson 13.1: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. Most fresh water on Earth exists in the __________ state.
2. The amount of time a molecule such as water stays in a reservoir is its __________ time.

3. Water in the gaseous state is known as __________.
4. The continuous movement of water around Earth is called the __________.
5. The single greatest use of water globally is __________.
6. Water stored in rocks beneath Earth's surface is called ___________.
7. The greatest reservoir of water on Earth is the __________.

Lesson 13.1: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate the hydrologic cycle to water's ability to exist in all three states of matter under normal Earth temperatures.

13.2 Surface Water

Lesson 13.2: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. The largest types of streams are rivers.

_____ 2. The river with the greatest flow in the world is the Mississippi.

_____ 3. Every continent has just one continental divide.

_____ 4. Water usually drains out of a lake through a stream.

_____ 5. Organisms that live in the aphotic zone of a lake include plants.

_____ 6. Only certain specialized plants are able to live in wetlands.

_____ 7. Wetlands generally have very little biological diversity.

_____ 8. Wetlands naturally purify water by filtering out pollutants.

_____ 9. Floods are not a natural part of the water cycle.

_____ 10. Lands with heavy vegetation are less likely to experience flooding.

Lesson 13.2: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Lakes

Lakes are relatively large bodies of still water. They are usually fed by streams and drained by streams as well. They also lose water by evaporation. Most lakes contain fresh water, but a few have salty water, including the Great Salt Lake in Utah. Large lakes have tides and currents, and they can affect local weather patterns. Lakes form in a variety of different ways. For example, they may form in a depression carved by a glacier or in a caldera at the top of a volcano.

The ecosystem of lakes is divided into several distinct zones, including surface, open-water, and deep-water zones.

- The surface (or littoral) zone is the relatively shallow region close to shore. In this zone, there is plenty of sunlight for photosynthesis by plants and algae. Animals in this zone include snails, insects, and small fish.
- The open-water zone (also called the photic or limnetic zone) is the top part of the water away from shore. It has abundant sunlight for photosynthesis by algae and plants. Many fish, such as bass and trout, live in this zone.
- The deep-water zone (also known as the aphotic or profundal zone) is the deep part of the water away from shore. It has little or no sunlight, so it has no photosynthesis. Most deep-water organisms are scavengers, such

as crabs and catfish, or decomposers, such as fungi or bacteria. They feed on dead organisms and other debris that fall to the bottom of the lake.

Lakes are not permanent features of the landscape. Some come and go with the seasons, as water levels rise and fall. Others disappear over longer time spans. They may fill with sediments, the springs or streams that feed them may diminish, or their outlets may expand due to erosion. When the climate of an area changes, lakes can either expand or shrink. For example, lakes may expand if precipitation increases, and they may shrink or even disappear if precipitation decreases.

Questions

1. Briefly describe bodies of surface water called lakes.
2. State two ways that lakes can form.
3. Identify three ecological zones found in lakes.
4. Explain why lakes are not permanent features of the landscape.

Lesson 13.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Types of streams include all of the following except
   a. brooks.
   b. bayous.
   c. rivers.
   d. estuaries.
2. Where the water in a stream slows and deepens, it forms a
   a. pond.
   b. pool.
   c. lake.
   d. wetland.
3. Where a river enters an ocean, it forms a(n)
   a. estuary.
   b. confluence.
   c. tributary.
   d. basin.
4. A small body of still, fresh water that has no outlet and is fed by an underground spring is most likely a
   a. lake.
   b. pond.
   c. wetland.
   d. swamp.
5. Which of the following statements about lakes is (are) false?
   a. Lakes always have fresh water.
   b. Lakes may be large enough to have tides.
   c. Lakes are not permanent features of the landscape.
   d. two of the above

6. More than half of the world's lakes are in Canada, and most of them were formed by
   a. faults.
   b. volcanoes.
   c. glaciers.
   d. rifts.
7. Zones of a lake in which photosynthesis can take place include the
   a. littoral zone.
   b. limnetic zone.
   c. profundal zone.
   d. two of the above

Lesson 13.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. any area that is wet for most or all of the year

_____ 2. wetland that contains brackish water

_____ 3. any body of water that is constantly flowing downhill

_____ 4. wetland where grasses and reeds are common but trees are not

_____ 5. place where two streams come together

_____ 6. wetland where trees and vines are common

_____ 7. point where a stream enters a body of still water

Terms

a. mouth

b. estuary

c. confluence

d. wetland

e. marsh

f. swamp

g. stream

Lesson 13.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. When two streams come together, the smaller stream is called a(n) __________.
2. A topographically high area that separates two different water basins is a(n) __________.

3. The study of bodies of fresh water and their organisms is known as __________.
4. An overflow of water in one place is called a(n) __________.
5. The lake zone that is closest to shore is the __________ zone.
6. The next largest bodies of still water after oceans are __________.
7. A wall built on a riverbank to prevent the river from overflowing is known as a(n) __________

Lesson 13.2: Critical Writing

Name__________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Wetlands are protected by law in the U.S. Make an argument in support of protecting them.

13.3 Groundwater

Lesson 13.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Water moves from wet soil to dry soil by capillary action.

_____ 2. A region can have only one aquifer beneath it.

_____ 3. The residence time of water in an aquifer is always thousands of years.

_____ 4. Surface water reaches an aquifer through the process of infiltration.

_____ 5. The only way water ever leaves an aquifer is through wells.

_____ 6. Groundwater is a nonrenewable natural resource.

_____ 7. Much more water is taken from the Ogallala aquifer each year than is replenished.

_____ 8. A spring always has a constant flow of water.

_____ 9. Water is attracted to soil particles.

_____ 10. The water table forms the base of an aquifer.

Lesson 13.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Groundwater

Groundwater is the largest reservoir of liquid fresh water on Earth. Most groundwater is located in aquifers. An aquifer is a layer of permeable rock, sand, or gravel that holds large amounts of groundwater. Aquifers are found at different depths. Some are located just below the surface, and others are found much deeper underground. Most regions have aquifers beneath them, and some regions have more than one. Even deserts are likely to have aquifers beneath them. However, the source of water for an aquifer beneath a desert is likely to be far from where the aquifer is located; for example, it may be in a distant mountainous area.

The amount of water that is available to enter groundwater in a region is influenced by many factors. They include the local climate, slope of land, type of surface rock, vegetation cover, land use in the area, and water retention. For example, more water goes into the ground where there is a lot of rain, the land is flat, surface rock is porous, the soil is devoid of vegetation, and water does not already fill the soil and the rock beneath the surface.

The residence time of groundwater in an aquifer is the length of time water remains there. It can range from just a few minutes to hundreds of thousands of years. In fact, groundwater is often called "fossil water" because it may have remained in the ground for so long, often since the end of the Pleistocene ice ages.

Questions

1. What is the significance of groundwater. Where is most groundwater located?
2. What is an aquifer? Where are aquifers located?
3. Identify factors that influence the amount of water that is available to enter groundwater in a region.
4. What is the residence time of groundwater in an aquifer?

Lesson 13.3: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Factors that influence the amount of water that is available to enter groundwater include
   a. local climate.
   b. slope of land.
   c. type of surface rock.
   d. all of the above
2. To be a good aquifer, the rock in an aquifer must be
   a. porous.
   b. permeable.
   c. impermeable.
   d. two of the above
3. More water goes into the ground where the
   a. soil is covered with plants.
   b. soil is already saturated.
   c. land is flat.
   d. two of the above
4. The water table
   a. is a layer of impermeable rock.
   b. always remains at the same level.
   c. falls when there is a lot of rainfall.
   d. may feed streams in a wet region.
5. If groundwater discharge from an aquifer is greater than recharge
   a. the water table will rise.
   b. subsidence may occur.
   c. wells may go dry.
   d. two of the above
6. Which statement about aquifers is false?
   a. They may lie beneath deserts.
   b. Their source regions may be far away.
   c. They are always deep below the surface.
   d. They may become contaminated by ocean water.
7. The Ogallala aquifer
   a. supplies almost all irrigation water used in the U.S.
   b. contains water that is mostly from the last ice age.
   c. lies beneath the Northeastern United States.
   d. all of the above

Lesson 13.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. largest reservoir of liquid fresh water on Earth

_____ 2. interconnectedness of pores within rock or sediment

_____ 3. layer of porous underground rock and sediment that stores groundwater

_____ 4. top of an aquifer

_____ 5. place where ground water bubbles to the surface

_____ 6. way in which water moves through a porous substance

_____ 7. sinking of the ground surface

Terms

a. aquifer

b. spring

c. capillary action

d. subsidence

e. water table

f. permeability

g. groundwater

Lesson 13.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Rock that forms the base of an aquifer is __________.
2. Water that enters an aquifer is called __________.
3. Water that leaves an aquifer is called __________.
4. __________ are small spaces between grains of rock.
5. The study of groundwater is known as __________.
6. A(n) __________ is created by digging or drilling into the ground to reach groundwater.
7. Groundwater is often called __________ water because it has remained in the ground for so long.

Lesson 13.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how people obtain and use groundwater and why this source of fresh water may be at risk.

CHAPTER 14 HS Earth's Oceans Worksheets

Chapter Outline

14.1 Introduction to the Oceans

Lesson 14.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. About 50 percent of Earth's surface is covered with water.

_____ 2. All of Earth's oceans are interconnected.

_____ 3. Ocean water heats up and cools down more quickly than land.

_____ 4. Earth's tallest mountain rises from the Pacific Ocean floor.

_____ 5. People have not yet visited the deepest place in Earth's oceans.

_____ 6. All phytoplankton in the ocean live in the photic zone.

_____ 7. The photic zone makes up the greatest volume of ocean water.

_____ 8. The neritic zone is the ocean zone that lies above the continental shelf.

_____ 9. Ocean water has greater salinity where evaporation is higher.

_____ 10. Land near an ocean has a wider range of temperatures because of the water.

Lesson 14.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Ocean Zones

To better understand regions of the ocean, scientists define ocean zones based on depth of water or distance from shore. By depth of water, the entire ocean is divided into two major zones: the photic zone and the aphotic zone.

- The photic zone consists of the top 200 meters of ocean water. This is the depth to which sunlight can penetrate ocean water. Organisms that photosynthesize depend on sunlight for food, so they are restricted to the photic zone. Tiny photosynthetic organisms known as phytoplankton supply nearly all of the energy and nutrients to the rest of the marine food web. Therefore, most other marine organisms live in, or at least visit, the photic zone.
- The aphotic zone includes all ocean water below the top 200 meters. In the aphotic zone, there is not enough sunlight for photosynthesis. The aphotic zone makes up the majority of the ocean. However, it contains a relatively small proportion of its organisms, both in diversity and in numbers.

By distance from shore, the ocean is divided into three major zones: the littoral, neritic, and oceanic zones.

- The littoral, or intertidal, zone is closest to shore. It comprises the region between high and low tide marks.

This zone is characterized by constant change, as the tides rise and fall and ocean waves crash on shore. By depth of water, the entire littoral zone is in the photic zone.
- The neritic zone extends from the low tide mark to the edge of the seaward side of the continental shelf. By depth, some of this zone is in the photic zone, and some of it is in the aphotic zone.
- The oceanic zone is the rest of the ocean beyond the continental shelf. The top part of the oceanic zone is in the photic zone, but the vast majority of it is not.

Questions

1. List ocean zones based on depth and ocean zones based on distance from shore.
2. How do the photic and aphotic zones differ?
3. Compare and contrast the littoral, neritic, and oceanic zones.

Lesson 14.1: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. About what percentage of ocean water mass is made up of salts?
   a. 0.35 percent
   b. 3.5 percent
   c. 35
   d. 55 percent
2. The density of ocean water increases as
   a. salinity increases.
   b. temperature increases.
   c. pressure decreases.
   d. all of the above
3. The average depth of ocean water is about
   a. 380 meters.
   b. 3800 meters.
   c. 38,000 meters.
   d. none of the above
4. Reasons that the deep ocean is a difficult environment for organisms include the
   a. extremely high salinity.
   b. complete absence of light.
   c. constantly changing temperatures.
   d. all of the above
5. Horizontal ocean zones include all of the following except the
   a. neritic zone.
   b. littoral zone.
   c. aphotic zone.
   d. oceanic zone.
6. Why would Earth be a very different planet without its oceans?
   a. Oceans help to keep temperatures fairly constant worldwide.

b. Oceans are an essential part of the hydrologic cycle.
c. Oceans contain the majority of Earth's biomass.
d. all of the above

7. Most of the salts in ocean water come from

a. deep-sea vents.
b. rocks and soil on land.
c. underwater volcanic eruptions.
d. decomposition of marine organisms.

Lesson 14.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. vertical arrangement of ocean zones by depth

_____ 2. ocean zone closest to shore

_____ 3. ocean zone farther from shore than the continental shelf

_____ 4. ocean zone where there is enough sunlight for photosynthesis

_____ 5. part of the ocean basin that lies between continental and oceanic crust

_____ 6. ocean zone between the low tide mark and the edge of the continental shelf

_____ 7. ocean zone where there is not enough sunlight for photosynthesis

Terms

a. continental margin

b. water column

c. aphotic zone

d. oceanic zone

e. neritic zone

f. photic zone

g. littoral zone

Lesson 14.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The total mass of living organisms in a given area is the area's __________.
2. The main salt in ocean water is __________.
3. The continental __________ is divided into the continental shelf, slope, and rise.
4. The salt content of ocean water is referred to as its __________.

5. The deepest place in the ocean is named the __________.
6. The photic zone of the ocean extends to about __________ meters below the surface.
7. The __________ zone of the ocean is the region between the high and low tide marks.

Lesson 14.1: Critical Writing

Name__________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

How might Earth be different without its oceans?

14.2 Ocean Movements

Lesson 14.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Thermohaline circulation refers to the movement of ocean water in surface currents.

_____ 2. Waves break when they become too tall to be supported by their base.

_____ 3. Tsunami are caused only by earthquakes.

_____ 4. Rip currents are deep currents that pass close to shore.

_____ 5. Earth's rotation is responsible for the Coriolis effect.

_____ 6. The direction of surface currents is influenced by the shape of ocean basins.

_____ 7. The Gulf Stream raises London's average air temperature.

_____ 8. Changes in temperature and salinity of ocean water take place on the ocean floor.

_____ 9. Adding salt to water makes it less dense.

_____ 10. Upwelling causes a decrease in marine organisms where it occurs.

Lesson 14.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Tides

Tides are the repeated rise and fall of sea level at any given place. The pull of the moon's gravity on Earth is the primary cause of tides. The pull of the sun's gravity is a secondary cause. Although the moon has much less mass than the sun, its effect on Earth's tides is greater because it is so much closer to Earth.

As the moon revolves around Earth, its gravity pulls Earth toward it. The lithosphere is unable to move much but ocean water can, and it bulges outward toward the moon. This creates a high tide on the side of Earth facing the moon. The moon's gravity pulling Earth toward it leaves behind water on the opposite side of the planet. This creates another high tide bulge on the opposite side of Earth from the moon. Because so much water is pulled into the two high tide bulges low tides occur at places in between. Earth rotates beneath the moon once each day, so any given place on the coast will experience two high tides and two low tides every day.

The difference in water levels between high and low tides is called the tidal range. This range is greatest during spring tides and least during neap tides.

- Spring tides occur when the gravitational pull of both the moon and the sun are in the same direction. This happens when the moon is in its new or full moon phase, so spring tides occur about twice a month. The high tides are higher and the low tides are lower than at other times of the month.

- Neap tides occur when the gravitational pull of the moon and the sun are at right angles to each other. This happens during the first and third quarter phases of the moon, so spring tides also occur about twice a month. The high tides are lower and the low tides are higher than at other times of the month.

Questions

1. Explain how the moon causes high and low tides.
2. Why are there two high tides and two low tides in a given place each day?
3. Why does the sun have only a secondary effect on Earth's tides?
4. Compare and contrast spring and neap tides.

Lesson 14.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. The largest wind waves in the ocean form when the wind
   a. is very strong.
   b. blows steadily for a long time.
   c. blows over a very long distance.
   d. all of the above
2. Waves cause individual water particles to
   a. travel toward shore.
   b. move in tiny circles.
   c. sink to the bottom.
   d. move in currents.
3. In most locations along the shore, a high tide occurs twice each
   a. year.
   b. month.
   c. week.
   d. day.
4. Which of the following factors has the greatest effect on surface currents?
   a. global winds
   b. Earth's revolution
   c. differences in water salinity
   d. differences in water temperature
5. The ocean water motions that most affect local climates on land are
   a. tides.
   b. waves.
   c. deep currents.
   d. surface currents.
6. Near the poles, ocean water is very dense because of its
   a. low temperature.
   b. low salinity.
   c. large volume.

d. two of the above

7. Which of the following statements about upwelling is false?
   a. It brings nutrients to the surface.
   b. It typically takes place along coasts.
   c. It causes cold, dense water to rise.
   d. It occurs when winds push water toward shore.

Lesson 14.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. type of ocean current caused by global winds

_____ 2. transfer of wind energy across the surface of ocean water

_____ 3. tide with the greatest difference between high and low tides

_____ 4. type of ocean current caused by differences in density

_____ 5. tide with the least difference between high and low tides

_____ 6. daily rise and fall of sea level at a given place along the shore

_____ 7. rise of cold water from the deep ocean to the surface

Terms

a. wave

b. tide

c. surface current

d. upwelling

e. spring tide

f. deep current

g. neap tide

Lesson 14.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. High water pushed ashore by storm winds is called __________.
2. A damaging wave caused by a sharp jolt to ocean water is a(n) __________.
3. Tides are caused primarily by the __________ gravity.
4. The difference between the ocean levels at high and low tides is the __________.
5. __________ tides occur at new moon and full moon phases.
6. The effect of Earth's rotation on the direction of surface currents is called the __________.

7. __________ is the event in which very cold, very saline water sinks to the bottom of the ocean.

Lesson 14.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how and why thermohaline circulation occurs.

14.3 The Seafloor

Lesson 14.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Samples of seawater from different depths are needed to understand ocean water chemistry.

_____ 2. A dredge is used to drill and gather samples from the solid seafloor.

_____ 3. Submersibles have arms for collecting samples of seawater and rocks.

_____ 4. The submersible named Alvin can dive up to 6500 meters beneath the ocean surface.

_____ 5. Alvin allows four people to stay deep underwater for up to 12 hours.

_____ 6. Fish are renewable natural resources only if they are not overharvested.

_____ 7. Bottom trawling is a fishing method that may severely disturb ecosystems.

_____ 8. Our only use of ocean organisms is for food.

_____ 9. Minerals in manganese nodules include iron, nickel, and copper.

_____ 10. Manganese nodules are currently being mined for their valuable minerals.

Lesson 14.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Studying the Seafloor

Scuba divers can dive only to about 40 meters beneath the surface, and they cannot stay at that depth for very long. Although this is a good way to research the ocean floor near a coast where the water is relatively shallow, researching most of the ocean floor requires accessing much greater depths. There are several other ways of studying the seafloor. For example, echo sounders and lasers can reveal the depth of the ocean and provide data to create bathymetric maps showing the three-dimensional shape of the seafloor.

Samples of seawater from different depths in the water column can be collected remotely. To do this, bottles are placed along a cable at regular depths and closed as a weight is dropped down the cable. The water trapped in the bottles can be analyzed later in a laboratory. Rock and sediment samples from the seafloor can be collected remotely with dredges or other equipment. A dredge is a giant rectangular bucket that is dragged along behind a ship to collect loose rocks from the seafloor. Gravity corers are metal tubes that fall to the seafloor and slice into the sediments to collect samples. The research vessel, the Joides Resolution, drills deep into the seafloor to collect samples of sediment and oceanic crust. Scientists analyze the samples for chemistry and paleomagnetism.

Another way samples of seawater and rocks can be collected is directly by scientists in a submersible. A submersible is a special underwater vehicle that can travel deep below the ocean surface to collect samples, make measurements, take photographs, or allow scientists to make direct observations. The submersible named Alvin is an HOV, or human-operated vehicle. Alvin can dive up to 4500 meters beneath the surface and has made more than 4000 dives since 1964. Some other submersibles can dive even deeper than Alvin.

To avoid the expense, dangers, and limitations of human deep-sea missions, remotely operated vehicles, or ROVs, can be used. ROVs are small vehicles carrying cameras and scientific instruments that scientists can operate remotely with sophisticated electronic operating systems. ROVs were used to study the famous sunken ship the Titanic, which would have been far too dangerous for a human-operated vehicle to enter.

Questions

1. Describe three ways that samples of water, sediments, or rocks can be gathered remotely from the ocean or seafloor.
2. What is a submersible? What has been achieved with the submersible HOV named Alvin?
3. What are ROVs? What are advantages of using ROVs instead of HOVs in researching deep-sea environment?

Lesson 14.3: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. Which statement about seafloor exploration is true?
    a. Scientists have directly visited most of the seafloor.
    b. Scientists have explored most of the seafloor remotely.
    c. About half of the seafloor has been explored by ROVs.
    d. Vast regions of the seafloor have not yet been explored.
2. Scuba divers can research the ocean directly. However, they can only
    a. dive to about 140 meters below the surface.
    b. research the seafloor at mid-ocean ridges.
    c. stay down for short periods of time.
    d. all of the above
3. Scientists can study the ocean floor from the surface with
    a. echo sounders.
    b. lasers.
    c. ROVs.
    d. all of the above
4. The research vessel the Joides Resolution collects samples from the seafloor by
    a. dredging.
    b. trawling.
    c. drilling.
    d. coring.
5. Submersibles that can dive the deepest can reach
    a. more than 4500 meters beneath the surface.
    b. up to 3500 meters beneath the surface.
    c. a maximum of 3000 meters beneath the surface.
    d. none of the above
6. Compared with studying the seafloor with an HOV, using an ROV is more

a. expensive.
b. dangerous.
c. economical.
d. two of the above

7. The sunken ship named the Titanic was explored by

a. Alvin.
b. HOVs.
c. ROVs.
d. scuba divers.

Lesson 14.3: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. metal tube that slices into, and collects sediments from, the seafloor

_____ 2. bucket dragged behind a ship to collect loose rock samples from the seafloor

_____ 3. lump of valuable minerals found on the seafloor

_____ 4. underwater vehicle that carries scientists deep beneath the ocean's surface

_____ 5. device used to map the ocean floor

_____ 6. method of fishing with a large net towed across the seafloor

_____ 7. remotely operated vehicle that can study the deep seafloor

Terms

a. echo sounder

b. gravity corer

c. bottom trawling

d. dredge

e. manganese nodule

f. ROV

g. HOV

Lesson 14.3: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. A bottle attached to a cable is used to collect samples of ___________ from different depths in the water column.
2. The submersible named ___________ is an HOV that has made more than 4000 dives since 1964.

3. The acronym HOV in question 3 stands for __________ vehicle.
4. The most valuable nonliving resources taken from the ocean are oil and __________.
5. Oil __________ are structures on the surface of the ocean from which oil wells are drilled into the ocean floor.
6. When fish are overharvested, their rate of __________ cannot keep up with the rate at which they are consumed.

Lesson 14.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Based on your knowledge of the seafloor, explain potential problems of obtaining nonliving natural resources from the seafloor.

14.4 Ocean Life

Lesson 14.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The world's smallest and largest animals live in the oceans.

_____ 2. Most plankton are about the size of small fish.

_____ 3. Zooplankton are responsible for about half of Earth's total primary productivity.

_____ 4. Many fish can create their own light through chemical reactions.

_____ 5. Most species of marine reptiles live in cold water.

_____ 6. Marine mammals have adaptations such as kidneys able to excrete salt.

_____ 7. Many animals that live in the intertidal zone have some means of anchoring to rocks.

_____ 8. The only photosynthesizers in the open ocean are phytoplankton.

_____ 9. There are no primary producers in the aphotic zone.

_____ 10. Fish adaptations in the deepest ocean include a slow metabolism.

Lesson 14.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Marine Ecosystems

A great abundance of life is found in the intertidal zone despite the very difficult conditions there. Intertidal organisms must adapt to high-energy, crashing waves. They also must be able to withstand repeated exposure to air during low tides. Hard shells protect many intertidal organisms from waves as well as drying out. The moving water also requires many of the organisms to have a means of attaching themselves to rocks or other stationary surfaces.

Corals are tiny animals that deposit calcium carbonate to create rock reefs near the shore. Many other organisms live in or around coral reefs. In fact, they are among the most densely inhabited and diverse ecosystems on Earth. Because coral reefs are close to shore, they are subject to pollution from land. Corals are also very sensitive to temperature and are stressed by rising ocean temperatures due to global warming.

Almost all of the food in the vast oceanic zone is created by phytoplankton that live near the water surface. Zooplankton and larger animals feed on the phytoplankton and on each other. The relatively few species that live at greater depths in the oceanic zone are very specialized. Food is relatively scarce, so they have adaptations that allow them to get by on less. These may include small body size, very low metabolic rate, and minimal bone structure. To maximize the chances of catching prey, some species have jaws that unhinge to accept a larger fish or backward-folding teeth to keep prey from escaping. Many fish that live in the absolute darkness of the deep ocean have the ability to produce light with chemical reactions. An example is the angler fish, which has a glowing "lure" to attract prey.

Hot, chemical-rich water pours out of hydrothermal vents at mid-ocean ridges. Unique ecosystems form around these vents. There is no sunlight for photosynthesis this far below the surface, so producers make food by chemosynthesis. They are bacteria that use chemicals in the hot water for energy to make food. Consumers in the vent ecosystem giant tube worms and certain species of shrimp, clams, and fish. The chemosynthetic bacteria live inside the tubeworms in a symbiotic relationship. The bacteria get a safe place to live, and the tubeworms get a reliable source of food.

Questions

1. What adaptations are needed by organisms in the intertidal zone?
2. Describe coral reef ecosystems. What threats do these ecosystems face?
3. Explain how fish in the oceanic zone adapt to conditions far below the surface.
4. Why are hydrothermal vent ecosystems unique?

Lesson 14.4: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Zooplankton may be
    a. tiny invertebrates.
    b. juvenile forms of vertebrates.
    c. tiny plants and algae.
    d. two of the above
2. Marine plants and seaweeds live mainly in the
    a. neritic zone.
    b. aphotic zone.
    c. oceanic zone.
    d. intertidal zone.
3. Marine invertebrates include
    a. starfish.
    b. jellyfish.
    c. lobsters.
    d. all of the above
4. Which of the following adaptations do most fish have?
    a. swim bladder
    b. high metabolic rate
    c. warm-bloodedness
    d. two of the above
5. Marine reptiles that return to land to lay eggs include all of the following except
    a. sea turtles.
    b. sea snakes.
    c. marine iguanas.
    d. saltwater crocodiles.

6. Seabirds that live on land and go to sea only to fish include all of the following except
   a. gulls.
   b. pelicans.
   c. albatrosses.
   d. frigate birds.
7. The world's coral reefs are threatened by
   a. pollution from land.
   b. rising ocean temperatures.
   c. extreme pressure in the deep ocean.
   d. two of the above

Lesson 14.4: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. tiny marine animals that eat phytoplankton

_____ 2. creation of food energy

_____ 3. any animal that lacks a backbone

_____ 4. tiny marine organisms that cannot swim and hang suspended in the water

_____ 5. fissure at a mid-ocean ridge where hot water pours out

_____ 6. tiny marine organisms that make food by photosynthesis

_____ 7. any animal that has a backbone

Terms

a. plankton

b. vertebrate

c. phytoplankton

d. hydrothermal vent

e. zooplankton

f. invertebrate

g. primary productivity

Lesson 14.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Because they photosynthesize, phytoplankton live in the _________ zone of the water column.
2. The ability of organisms to produce light is called __________.

3. Marine vertebrates with fins, scales, and gill are classified as __________.
4. Because of their tremendous species diversity, __________ are called the “rainforests of the oceans.”
5. An island called a(n) __________ forms when a coral reef grows around a volcano, which eventually erodes away.
6. Bacteria at hydrothermal vents make food by the process of __________.
7. Phytoplankton release __________ as a waste produce of photosynthesis.

Lesson 14.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify a class of marine vertebrates, examples of organisms in that class, and adaptations that help them live in their marine environment.

CHAPTER 15 HS Earth's Atmosphere Worksheets

Chapter Outline

15.1 The Atmosphere

Lesson 15.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Respiration is more-or-less the reverse of photosynthesis.

_____ 2. The atmosphere is a crucial part of the hydrologic cycle.

_____ 3. The ozone layer in the atmosphere allows complex life forms to live on Earth.

_____ 4. Without the atmosphere, Earth would always have the same temperature.

_____ 5. Warm air can hold less moisture than cooler air.

_____ 6. Particles in the atmosphere include metals and fecal matter.

_____ 7. Particles in the atmosphere are needed for clouds to form.

_____ 8. Gravity has no effect on the gases in Earth's atmosphere.

_____ 9. Virtually all weather takes place in the lower atmosphere.

_____ 10. Carbon dioxide is the only important greenhouse gas.

Lesson 15.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Significance of the Atmosphere

Earth's atmosphere, along with the abundant liquid water at Earth's surface, are the keys to our planet's unique place in the solar system. Much of what makes Earth exceptional depends on the atmosphere. Let's consider some of the reasons we are lucky to have an atmosphere.

Atmospheric gases, especially oxygen and carbon dioxide, are extremely important for living organisms. Plants use carbon dioxide to make food (sugar) by photosynthesis and they release oxygen as a waste product of photosynthesis. Photosynthesis is responsible for nearly all of the oxygen currently found in the atmosphere. By producing oxygen and food, plants have made an environment that is favorable for other organisms, including animals. Most organisms use respiration to break down food for energy. This process uses oxygen from the atmosphere and releases carbon dioxide as a waste product.

There are three other reasons we are lucky to have the atmosphere.

- A layer of ozone gas in the stratosphere absorbs high-energy ultraviolet (UV) radiation from the sun. This protects living things on Earth's surface from these harmful rays. Without ozone for protection, only the simplest life forms would be able to live on Earth.

- The atmosphere moderates Earth's climate and makes it more hospitable to living things. Greenhouse gases, such as carbon dioxide and water vapor, trap heat in the atmosphere. Without these gases, Earth's temperatures would be frigid at night and scorching during the day.
- Gas molecules in the atmosphere transmit sound waves to our ears and allow us to hear. Without the atmosphere, Earth would be a virtually silent place.

Questions

1. Explain how carbon dioxide and oxygen are used by living organisms.
2. Why is the ozone layer important to life on Earth?
3. How does the atmosphere moderate Earth's temperatures?
4. How does the atmosphere allow us to hear?

Lesson 15.1: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. The atmosphere is needed for people to
   a. fly planes.
   b. sail boats.
   c. hear birds sing.
   d. all of the above
2. How does the atmosphere change as altitude increases?
   a. The density of air decreases.
   b. The pressure of air increases.
   c. The percent of oxygen in air decreases.
   d. all of the above
3. Without the atmosphere, Earth would have no
   a. life.
   b. weather.
   c. soil.
   d. all of the above
4. The gas that organisms need for respiration is
   a. carbon dioxide.
   b. water vapor.
   c. oxygen.
   d. ozone.
5. Greenhouse gases include
   a. oxygen.
   b. nitrogen.
   c. ozone.
   d. two of the above
6. The amount of water vapor in the air
   a. is always constant.

b. varies by location.
c. varies by season.
d. two of the above

Lesson 15.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. important greenhouse gas

_____ 2. elevation above sea level

_____ 3. process in which organisms convert sugar into energy

_____ 4. long-term average weather at a specific place

_____ 5. amount of water vapor in the air

_____ 6. description of the atmosphere at a specific time and place

_____ 7. gas in the atmosphere that absorbs UV radiation

Terms

a. humidity

b. climate

c. altitude

d. respiration

e. carbon dioxide

f. weather

g. ozone

Lesson 15.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The thin blanket of gases and tiny particles that surrounds Earth is the __________.
2. The process of __________ is responsible for nearly all the oxygen in the atmosphere.
3. The molecule that consists of three oxygen molecules is called __________.
4. __________ gases trap heat in the atmosphere and help to moderate global temperatures.
5. The two gases that make up 99 percent of the atmosphere are nitrogen and __________.
6. Air density __________ as altitude increases.
7. The force of air pushing against a unit of area is called __________.

Lesson 15.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Relate air density and pressure to altitude.

15.2 Atmospheric Layers

Lesson 15.2: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. When gas molecules lose energy, their density decreases.

_____ 2. The stratopause occurs between the stratosphere and troposphere.

_____ 3. The air in the stratosphere does a lot of mixing because it is unstable.

_____ 4. Temperature inversions often trap pollutants close to Earth's surface.

_____ 5. Ultraviolet radiation harms living things by damaging the DNA in their cells.

_____ 6. About 99.9 percent of the atmosphere's mass lies below the stratosphere.

_____ 7. The troposphere rises to an altitude of about 10 kilometers above sea level.

_____ 8. The cause of ionization in the thermosphere is solar radiation.

_____ 9. The Van Allen radiation belts are located in the ionosphere.

_____ 10. There is no real outer limit to the exosphere.

Lesson 15.2: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Troposphere

The troposphere is the lowest layer of Earth's atmosphere. In this layer, the temperature of the air is generally highest near Earth's surface and decreases with altitude. Throughout the troposphere, the temperature falls by an average of 6.5 °C per 1000 meters of increase in altitude. Earth's surface is the major direct source of heat for the troposphere, but nearly all of that heat comes originally from the sun. Earth's surface absorbs sunlight and radiates it back into the atmosphere as heat. The temperature is also higher near the surface because of the greater density of gases there.

Because of the temperature gradient in the troposphere, warmer air is located below cooler air. This condition is unstable. Warmer air near the surface rises because it is less dense, and cooler air higher in the troposphere sinks because it is denser. As a result, air in the troposphere does a lot of mixing, which causes the temperature gradient to vary with time and place. The rising and sinking of air in the troposphere also causes weather, all of which takes place in the troposphere.

Under certain conditions, a temperature inversion may occur in the troposphere. This happens when warmer air sits over colder air, which is at the surface. Temperature inversions often occur during the winter when the ground is very cold at night. The cold ground cools the air directly above it, making this layer of air denser than the air above it. Temperature inversions may also occur near a coast where cold seawater cools the air above it. The cooler, denser air moves inland and slides beneath warmer air over the land. A temperature inversion is very stable, so it may last for several days or even weeks.

At the top of the troposphere is a thin layer of air in which the temperature does not change with altitude. This layer, called the tropopause, traps the cooler, denser air of the troposphere beneath the warmer, less dense air of the stratosphere. This prevents air in the troposphere and stratosphere from mixing.

Questions

1. Describe the temperature gradient in the troposphere. What is the major direct source of heat in the troposphere?
2. Explain why air in the troposphere does a lot of mixing.
3. What is a temperature inversion? Why does it occur, and why is it stable?
4. What prevents air in the troposphere and stratosphere from mixing?

Lesson 15.2: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. A change in temperature with distance is called a temperature
   a. gradient.
   b. inversion.
   c. reversal.
   d. none of the above
2. How temperature changes within each layer of the atmosphere is determined primarily by the
   a. heat source of the layer.
   b. ozone content of the layer.
   c. air density in the layer.
   d. air currents in the layer.
3. The major direct source of heat in the troposphere is
   a. the greenhouse effect.
   b. Earth's surface.
   c. the solar wind.
   d. UV rays.
4. In a temperature inversion, warmer air
   a. sits over cooler air.
   b. rises into the stratosphere.
   c. is less stable than cooler air.
   d. sinks to Earth's surface.
5. The thickness of the ozone layer in the atmosphere varies by
   a. season.
   b. latitude.
   c. longitude.
   d. two of the above
6. Most meteors burn up in the

a. mesosphere.
b. troposphere.
c. stratosphere.
d. thermosphere.

7. Temperatures increase with increasing altitude in the

a. troposphere.
b. mesosphere.
c. stratosphere.
d. two of the above

Lesson 15.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. layer of the atmosphere where the International Space Station orbits

_____ 2. lowest layer of the atmosphere

_____ 3. outermost layer of the atmosphere

_____ 4. layer of the atmosphere that contains the ozone layer

_____ 5. part of the thermosphere where electrons flow in electric currents

_____ 6. layer of the atmosphere with the coldest temperatures

_____ 7. zone of charged solar particles that cause the aurora

Terms

a. exosphere

b. ionosphere

c. magnetosphere

d. mesosphere

e. stratosphere

f. thermosphere

g. troposphere

Lesson 15.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The atmosphere is divided into layers based on the way that __________ changes with altitude.
2. Density and pressure of air are higher when air temperature is __________.
3. Temperatures in the troposphere __________ with higher altitude.

4. The direct source of heat for the stratosphere is the __________.
5. Temperatures in the mesosphere __________ with higher altitude.
6. At night, AM radio waves bounce off particles in the __________.
7. High-speed particles traveling outward from the sun make up solar __________.

Lesson 15.2: Critical Writing

Name__________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Describe and explain the temperature gradient in the mesosphere.

15.3 Energy in the Atmosphere

Lesson 15.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Less solar energy reaches lower latitudes than higher latitudes.

_____ 2. Differences in solar radiation by latitude cause winds and ocean currents.

_____ 3. Electromagnetic waves can travel through gases but not through solids.

_____ 4. The longest wavelengths of visible light appear red in color.

_____ 5. A candle flame contains more heat than a bathtub full of hot water.

_____ 6. If you continue heating a pot of boiling water, the temperature of the water keeps rising.

_____ 7. The angle of tilt of Earth's axis keeps changing as the planet revolves around the sun.

_____ 8. In the atmosphere, conduction is more effective at lower altitudes.

_____ 9. A molecule of carbon dioxide traps more heat in the atmosphere than a molecule of any other greenhouse gas.

_____ 10. Sources of methane gas include the decomposition of plant materials.

Lesson 15.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

How Solar Radiation Heats Earth's Surface and Atmosphere

Energy from the sun travels to Earth and heats the surface. Different parts of the surface receive different amounts of solar energy. Generally, the equator receives the most energy because the sun's rays strike the surface most directly at the equator. The amount of solar radiation received at higher latitudes depends on the season. The seasons are caused by the direction Earth's axis of rotation is pointing relative to the sun. The axis is always tilted 23.5 degrees relative to Earth' plane of orbit around the sun, but the north and south poles may tilt toward or away from the sun.

When it is summer in the Northern Hemisphere, the north pole tilts toward the sun. As a result, the sun's rays strike the Northern Hemisphere more directly at this time of year. Light from the sun is more concentrated where the rays are more direct, so the Northern Hemisphere is heated more during the summer than at other times of year. The opposite is true when it is winter in the Northern Hemisphere. The north pole tilts away from the sun, so the sun's rays strike the Northern Hemisphere less directly. Sunlight is less concentrated where the rays are less direct. As a result, Northern Hemisphere is heated less in the winter than at other times of year. The Southern Hemisphere has seasons for the same reasons, but the seasons are reversed relative to the Northern Hemisphere.

Much of the heat that Earth's surface receives by radiation from the sun is radiated back into the atmosphere where it heats the troposphere. Radiation is the transfer of energy between two objects by electromagnetic waves. Heat from Earth's surface also travels to the troposphere by conduction. In conduction, heat is transferred between two objects that are in direct contact. Molecules of the warmer object vibrate rapidly and collide with nearby molecules, transferring their energy. In the atmosphere, conduction is more effective at lower altitudes where air density is higher and gas molecules are closer together.

Heat is transferred throughout the troposphere by convection. Convection occurs when molecules of a substance—in this case, gases in the atmosphere—move in currents because of differences in density. Air near the surface warms because of heat transferred from the surface. The warm air is low in density, so it rises. The rising warm air cools, becomes denser, and sinks to the surface again. These air movements form convection currents that mix air throughout the troposphere.

Questions

1. Explain why the Northern Hemisphere is warmer in the summer than in the winter.
2. Describe how heat from Earth's surface is transferred to the atmosphere.
3. How is heat transferred throughout the troposphere?

Lesson 15.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Water in a lake stays cooler than nearby land on a hot sunny day because water has a higher
   a. albedo.
   b. insolation.
   c. latent heat.
   d. specific heat.
2. The UV waves that are completely absorbed by the ozone layer are called
   a. UVA.
   b. UVB.
   c. UVC.
   d. UVD.
3. Earth's seasons occur because of changes in the
   a. direction Earth is tilting.
   b. speed of Earth's revolution.
   c. distance of Earth from the sun.
   d. solar radiation produced by the sun.
4. Heat transfer by the movement of molecules in currents is called
   a. radiation.
   b. conduction.
   c. reflection.
   d. convection.
5. Only about half of the solar radiation that strikes the top of the atmosphere reaches the ground because of
   a. absorption.
   b. reflection.
   c. scattering.

   d. all of the above

6. Which of the following is the best analogy for how greenhouse gases affect Earth's climate?
   a. wool blanket
   b. heating pad
   c. radiator
   d. candle flame
7. All of the following greenhouse gases are naturally occurring in the atmosphere except
   a. CO_2.
   b. H_2O.
   c. NO_2.
   d. CFCs.

Lesson 15.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. heat that is taken in or released when matter changes state

_____ 2. amount of solar radiation that reaches a given area in a given time

_____ 3. measure of how fast atoms of a material are vibrating

_____ 4. transfer of energy by electromagnetic waves

_____ 5. measure of the total energy of a substance

_____ 6. measure of how well a surface reflects light

_____ 7. amount of energy needed to raise the temperature of 1 gram of a substance by 1 °C

Terms

a. albedo

b. heat

c. latent heat

d. specific heat

e. insolation

f. temperature

g. radiation

Lesson 15.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Most objects radiate infrared energy, which we feel as __________.

2. The moon appears to glow in the night sky because it __________ sunlight.
3. About 44 percent of solar radiation falls in the range of wavelengths called __________ light.
4. Of the solar energy that reaches the outer atmosphere, __________ radiation has the greatest energy.
5. During the __________ solstice in the Northern Hemisphere, the sun's rays are most direct on the Tropic of Cancer.
6. During the equinoxes, the sun's rays shine most directly on the __________.
7. In the process of __________, heat moves by direct contact from a warmer to a cooler object.

Lesson 15.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain the relationship between temperature and heat.

15.4 Air Movement

Lesson 15.4: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Convection in the atmosphere creates Earth's weather.

_____ 2. Water vapor condenses out of air when it is heated.

_____ 3. Water heats up and cools down more slowly than land.

_____ 4. Water has a very low specific heat.

_____ 5. A seasonal land breeze blows during the summer.

_____ 6. Katabatic winds form over high plateaus.

_____ 7. Chinook winds bring moisture to the leeward side of a mountain range.

_____ 8. Santa Ana winds often spread wildfires in Southern California.

_____ 9. You might see dust devils in an haboob.

_____ 10. A Hadley cell forms between 30 and 60 degrees north latitude.

Lesson 15.4: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Atmospheric Circulation and Global Winds

Because more solar energy strikes the equator, the air over the equator is warmer than elsewhere on the planet. Warm air has low density, so it rises and forms a low pressure zone. At the top of the troposphere, half of the warm air moves toward the north pole and half toward the south pole along the top of the troposphere. At about 30 degrees north latitude, the air from the equator meets air flowing toward the equator from higher latitudes and descends to the ground, creating a high pressure zone. Once on the ground, the air returns to the equator. These air movements form a convection cell, called a Hadley cell, which is found between 0 and 30 degrees north latitude. A similar Hadley cell is also found between 0 and 30 degrees south latitude, except the air flows in the opposite directions.

In addition to Hadley cells, there are two other major convection cells in each hemisphere. A Ferrell cell is located between 30 and about 60 degrees north or south latitude. In the Northern Hemisphere, air in this cell moves from north to south; it moves in the opposite direction in the Southern Hemisphere. A polar cell is located between about 60 and 90 degrees north or south latitude. In the Northern Hemisphere, the air in this cell moves from south to north and descends at the north pole. It moves in the opposite direction in the Southern Hemisphere and descends at the south pole.

Global circulation cells cause global wind belts. Global wind belts are enormous. They occur because of the flowing air at the bottom of the major circulation cells. In both hemispheres, the global wind belts are the trade winds, westerlies, and polar easterlies. In the Northern Hemisphere, the trade winds flow from northeast to southwest at the bottom of the Hadley cell; the westerlies blow from southwest to northeast at the bottom of the Ferrell cell; and the polar easterlies blow from northeast to southwest at the bottom of the polar cell. The winds blow in the opposite directions in the Southern Hemisphere. The winds do not blow due north or south because of the Coriolis effect. It deflects winds to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

Questions

1. Identify and briefly describe the three major convection cells in the Northern Hemisphere.
2. Identify and describe the three global wind belts in the Northern Hemisphere.
3. Relate the wind belts in question 2 to the convection cells in question 1.

Lesson 15.4: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Where cool air descends to the ground there is a
   a. high-pressure zone.
   b. Foehn wind.
   c. valley breeze.
   d. polar front.
2. Winds blow when air flows from areas of higher to lower
   a. elevation.
   b. pressure.
   c. temperature.
   d. altitude.
3. When warm air cools it
   a. becomes less dense.
   b. becomes denser.
   c. can hold more moisture.
   d. two of the above
4. Land and sea breezes
   a. may occur daily and seasonally.
   b. are types of local winds.
   c. occur because of differences in specific heat.
   d. all of the above
5. India is well known for its local winds called
   a. katabatic winds.
   b. monsoon winds.
   c. Chinook winds.
   d. Santa Ana winds.
6. A rainshadow occurs
   a. on the leeward size of a mountain.
   b. where moist air sinks to the ground.

c. in a low-pressure zone.
d. all of the above

7. In global atmospheric circulation
   a. warm air sinks at the equator.
   b. warm air flows north from the equator.
   c. warm air flows south from the equator.
   d. two of the above

Lesson 15.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. wind that blows from a mountain to a valley during the night

_____ 2. wind that blows from land to sea

_____ 3. Hot, dry wind that blows from the interior of California to the Pacific Ocean

_____ 4. wind that is a larger scale version of a land or sea breeze

_____ 5. wind that blows from sea to land

_____ 6. wind that blows where air is forced up over a mountain range

_____ 7. wind that blows from a valley to a mountain during the day

Terms

a. land breeze

b. Santa Ana

c. valley breeze

d. Chinook

e. sea breeze

f. mountain breeze

g. monsoon

Lesson 15.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Warm air rising creates a(n) __________ pressure zone on the ground.
2. The horizontal flow of air through the troposphere is called __________.
3. A wind called a(n) __________ forms in the downdrafts at the front of a thunderstorm.
4. Global winds deflect to the east or west because of the __________ effect.
5. The global winds that blow across most of the continental U.S. are called __________.

6. Rain is common in a(n) __________ pressure region.
7. A(n) __________ is a fast-flowing river of air at the boundary between the troposphere and stratosphere.

Lesson 15.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast land and sea breezes.

CHAPTER 16 HS Weather Worksheets

Chapter Outline

16.1 Weather and Atmospheric Water

Lesson 16.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. When air temperature falls, the air can hold more water vapor.

_____ 2. Cloudy days tend to have a greater range of temperatures than clear days.

_____ 3. Water vapor condenses when air temperature reaches the dew point.

_____ 4. A cloud consists of billions of individual water droplets.

_____ 5. Dust or other particles are needed for clouds to form.

_____ 6. Only high clouds consist of ice crystals.

_____ 7. Stratocumulus clouds rarely bring precipitation.

_____ 8. Advection fog forms when warm humid air travels up a hillside and cools.

_____ 9. All precipitation falls from clouds.

_____ 10. Hail forms in cumulonimbus clouds with strong updrafts.

Lesson 16.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Clouds

Clouds have a big influence on weather. They are a necessary precursor of precipitation, although not all of them produce precipitation. Clouds also prevent some solar radiation from reaching the ground and absorb some of the heat that is re-radiated from the surface. As a result, cloudy days are likely to be cooler and cloudy nights warmer than clear days and nights.

Water vapor condenses out of the air when the temperature reaches the dew point. Air may reach its dew point when humidity increases or air temperature decreases. The latter commonly happens when warm, moist air rises. For clouds to form, water vapor must condense around tiny particles called nuclei (singular, nucleus). A nucleus might be a speck of dust or smoke, or it might be a salt crystal. The condensation of many water molecules around a nucleus forms a tiny droplet of liquid water. If billions of these water droplets come together, they make a cloud.

Clouds are classified in several ways. The most common classification used today divides clouds into groups based on altitude.

- High clouds form at high altitudes and consist of ice crystals. Examples of high clouds include cirrus, cirrostratus, and cirrocumulus clouds.

- Middle clouds form at middle altitudes and consist of ice crystals, water droplets, or both. Examples of middle clouds include altocumulus and altostratus clouds.
- Low clouds form at low altitudes and consist entirely or mainly of water droplets. Examples of low clouds include stratus, stratocumulus, and nimbostratus clouds.
- Vertical clouds grow upward and have their bases at low altitude and their tops at middle or high altitude. They form when strong air currents carry warm air upward. Examples of vertical clouds include cumulus and nimbocumulus clouds.

Questions

1. How do clouds influence weather?
2. Explain how clouds form.
3. Outline how clouds are classified by altitude.

Lesson 16.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Weather factors include
   a. average air temperature.
   b. annual precipitation.
   c. humidity.
   d. two of the above
2. The dew point is the temperature at which
   a. dew forms on surfaces.
   b. water vapor starts to condense.
   c. relative humidity is 100 percent.
   d. all of the above
3. Relative humidity may decrease if
   a. water vapor condenses out of the air.
   b. water evaporates into the air.
   c. air temperature decreases.
   d. two of the above
4. Which type of cloud forms at high altitudes?
   a. cirrocumulus
   b. altocumulus
   c. stratocumulus
   d. nimbostratus
5. Which type of cloud forms when strong air currents carry warm air upward?
   a. cirrus
   b. stratus
   c. cumulus
   d. cirrostratus
6. The type of fog that forms when cool air moves over a warm lake is called

a. radiation fog.
b. advection fog.
c. steam fog.
d. upslope fog.

7. Rain that passes through a layer of freezing air near the ground becomes

a. glaze.
b. hail.
c. sleet.
d. snow.

Lesson 16.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. amount of water vapor in the air in a particular place

_____ 2. percentage of water vapor in a given volume of air relative to the maximum amount the air can hold

_____ 3. type of middle-altitude cloud

_____ 4. temperature at which air becomes saturated with water vapor

_____ 5. type of low-altitude cloud

_____ 6. type of cloud that grows vertically

_____ 7. type of high-altitude cloud

Terms

a. dew point

b. humidity

c. cirrostratus cloud

d. relative humidity

e. altostratus cloud

f. stratus cloud

g. cumulus cloud

Lesson 16.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. __________ is the condition of the atmosphere at a particular place and time.
2. Weather depends on the amount and location of __________ in the atmosphere.
3. The average weather of a region over a long period of time is the region's __________.

4. Basic cloud types are defined on the basis of their __________.
5. A cloud located at ground level is called __________.
6. __________ is a type of precipitation that forms when moist air cools on contact with a cold surface.
7. __________ is dew that forms when the air temperature is below freezing.

Lesson 16.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why relative humidity depends on air temperature.

16.2 Changing Weather

Lesson 16.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. An air mass acquires the temperature and humidity of its source region.

_____ 2. Temperate zones are ordinarily too stable for air masses to form.

_____ 3. Storms may arise if an air mass and the region it moves over have different characteristics.

_____ 4. A temperature inversion forms when a cold air mass travels over warmer ground.

_____ 5. You would expect an air mass that forms near the north pole to flow south.

_____ 6. Fronts between air masses are the main cause of stormy weather.

_____ 7. At a stationary front, winds usually blow parallel to the front.

_____ 8. A squall line forms along an occluded front.

_____ 9. The weather along a front varies with the season.

_____ 10. The stormiest weather usually occurs along a warm front.

Lesson 16.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Air Masses

An air mass is a very large batch of air that has nearly the same temperature and humidity throughout. An air mass acquires its characteristics from the region over which it forms, called its source region. When the air mass sits over the source region for several days, it picks up the temperature and humidity of that region. Air masses form in high pressure zones. They may form over continents, in which case they are dry, or over oceans, in which case they are moist. They most commonly form over polar or tropical regions. Polar air masses have cold temperatures, and tropical air masses have warm temperatures. Temperate zones are typically too unstable for air masses to form.

After air masses form, they are slowly pushed along by high-level winds. Cold air masses tend to flow toward the equator, and warm air masses tend to flow toward the poles. This movement of air masses brings heat to cold areas and cools down warm areas. Movement of air masses is one several processes that help balance out the planet's temperatures.

When an air mass moves over a region, it shares its temperature and humidity with that region. Storms may arise if an air mass moves over a region with different characteristics. For example, when a cold air mass moves over warmer ground, the bottom layer of air is heated. The heated air rises, forming clouds, rain, and sometimes thunderstorms. When a warm air mass travels over colder ground, the bottom layer of air cools. The cool air is dense, so it stays near the ground below the warm air above it. This forms a temperature inversion.

Questions

1. What is an air mass?
2. What gives an air mass its characteristics? Where might a warm, moist air mass form?
3. Why do air masses move? How do they influence weather in the regions over which they move?

Lesson 16.2: Multiple Choice

Name____________________ **Class**_______________ **Date**________

Circle the letter of the correct choice.

1. An air mass gets its characteristics from the
   a. regions over which it passes.
   b. atmospheric layers above it.
   c. other air masses it meets.
   d. area where it forms.
2. An air mass that forms over a polar land mass is likely to have
   a. low temperature and high humidity.
   b. low temperature and low humidity.
   c. moderate temperature and high humidity.
   d. moderate temperature and low humidity.
3. Air masses are slowly pushed along by
   a. Earth's rotation.
   b. the Coriolis effect.
   c. high-level winds.
   d. Earth's gravity.
4. What generally happens at any front?
   a. An air mass rises.
   b. The temperature falls.
   c. A high-pressure zone forms.
   d. two of the above
5. After a cold front passes, the weather is likely to be
   a. drier.
   b. cooler.
   c. warmer.
   d. two of the above
6. One air mass is lifted above two others at a(n)
   a. stationary front.
   b. occluded front.
   c. warm front.
   d. cold front.
7. The source region of an air mass labeled mP might be
   a. the northern Atlantic Ocean.

b. northern Canada.
c. the Caribbean Sea.
d. northern Africa.

Lesson 16.2: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. line where two air masses meet

_____ 2. front in which air masses do not move for several days

_____ 3. line of thunderstorms along a front

_____ 4. front that involves three air masses

_____ 5. large batch of air that all has about the same temperature and humidity

_____ 6. front in which a cold air mass overtakes a warm air mass

_____ 7. front in which a warm air mass slides over a cold air mass

Terms

a. air mass

b. front

c. cold front

d. stationary front

e. warm front

f. squall line

g. occluded front

Lesson 16.2: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. Air masses typically form in ___________ pressure zones.
2. Cold air masses tend to flow toward the ___________.
3. Warm air masses tend to flow toward the ___________.
4. Air masses do not mix at a front because they have different ___________.
5. At a front, one air mass rises above another, causing a ___________ pressure zone.
6. A cold air mass has greater ___________ than a warm air mass.
7. An air mass that forms over the ocean will have ___________ humidity.

Lesson 16.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast warm and cold fronts.

16.3 Storms

Lesson 16.3: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Anticyclones are cyclones that occur in the Southern Hemisphere.

_____ 2. Cyclones can be the most intense storms on Earth.

_____ 3. Hurricanes can produce higher winds than tornadoes.

_____ 4. It is easier to predict the path of a hurricane than a tornado.

_____ 5. Tornado activity in the U.S. is greatest along the East Coast.

_____ 6. A category 5 hurricane is described as "strong" on the Saffir-Simpson scale.

_____ 7. There are about 40,000 hurricanes around the world each year.

_____ 8. Blizzards can produce sleet or freezing rain.

_____ 9. Heat waves are the deadliest weather phenomena.

_____ 10. Heat waves have increased in frequency and duration in recent years.

Lesson 16.3: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Cyclones and Anticyclones

A cyclone is a large system of winds that are rotating around a low-pressure center. The winds rotate because of the Coriolis effect. They rotate counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. Low pressure occurs because the swirling air rises. The rising air cools, creating clouds and precipitation. Stormy weather is likely. There are two types of cyclones: mid-latitude cyclones and tropical cyclones.

- Mid-latitude cyclones are the main cause of mid-latitude winter storms, such as blizzards and nor-easters.
- Tropical cyclones are very large storms that are also known as hurricanes, typhoons, or other local names.

The opposite of a cyclone is an anticyclone. An anticyclone is a large system of winds that are rotating around a high-pressure center. The winds rotate in the opposite direction to a cyclone, and the air sinks to the ground instead of rising. Anticyclones generally bring fair weather rather than storms.

Questions

1. Describe a Northern Hemisphere cyclone. How would a cyclone in the Southern Hemisphere be different?
2. Identify storms caused by mid-latitude cyclones and tropical cyclones.

3. Compare and contrast cyclones and anticyclones.

Lesson 16.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Which type of storm is most common worldwide?
    a. blizzard
    b. tornado
    c. hurricane
    d. thunderstorm
2. Lightning may move
    a. from a cloud to the ground.
    b. from one cloud to another.
    c. within a cloud.
    d. all of the above
3. Characteristics of a Southern Hemisphere anticyclone include
    a. winds rotating clockwise.
    b. a high-pressure center.
    c. rising air.
    d. all of the above
4. The Fujika scale measures storm intensity by
    a. wind speed.
    b. duration of storm.
    c. damage done by storm.
    d. two of the above
5. Tropical cyclones may be called
    a. nor-easters.
    b. typhoons.
    c. tornadoes.
    d. thunderstorms.
6. Storm surge caused by a hurricane occurs when the
    a. low-pressure center of the storm comes on land.
    b. leading edge of the storm reaches the coast.
    c. trailing edge of the storm goes ashore.
    d. none of the above
7. To be a blizzard, a storm must have
    a. temperatures below -7 °C.
    b. winds faster than 56 km per hour.
    c. visibility of 2/5 km or less for at least 3 hours.
    d. all of the above

Lesson 16.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. storm that develops from a tropical depression

_____ 2. huge release of electricity from a cumulonimbus cloud

_____ 3. mid-latitude cyclone in the mid-Atlantic and New England states

_____ 4. large system of rotating winds around a low pressure center

_____ 5. storm with low temperatures, high winds, and reduced visibility

_____ 6. twirling whirling funnel cloud with high-speed winds

_____ 7. large system of rotating winds around a high pressure center

Terms

a. anticyclone

b. tornado

c. blizzard

d. cyclone

e. lightning

f. hurricane

g. nor'easter

Lesson 16.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Tornadoes form at the front of severe __________.
2. Cyclones rotate __________ in the Northern Hemisphere.
3. Most winter storms in New England are caused by __________ cyclones.
4. The low-pressure zone of a tropical cyclone is known as a tropical __________.
5. __________ are measured on the Fujita scale.
6. __________ are measured on the Saffir-Simpson scale.
7. Heavy snow that falls on the leeward side of the Great Lakes is called __________ snow.

Lesson 16.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Both tornadoes and hurricanes cause death and destruction, but the two types of storms have many differences. Explain how they differ and how the differences relate to their potential destructiveness.

16.4 Weather Forecasting

Lesson 16.4: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Weather forecasts are more accurate than ever before.

_____ 2. A change in barometric pressure indicates that a change in weather is coming.

_____ 3. Weather stations are located only on land.

_____ 4. Weather radar detects water in the atmosphere when it reflects radio waves.

_____ 5. Weather satellites detect only visible and infrared light.

_____ 6. Numerical weather prediction uses complex mathematical models to forecast weather.

_____ 7. Numerical weather prediction is not as accurate as prediction by experienced meteorologists.

_____ 8. Closed isobars on a weather map represent high and low pressure cells.

_____ 9. Weather map symbols include symbols for cloud type and wind speed.

_____ 10. The first weather satellite was launched in 1992.

Lesson 16.4: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Collecting Weather Data

A great deal of weather data must be collected in order to forecast the weather. Examples of devices used to measure specific weather factors include thermometers and barometers. Thermometers measure temperature, and barometers measure air pressure. Measurements of barometric pressure are especially important for weather forecasting. A change in barometric pressure indicates that a change in weather is coming. If air pressure rises, clear weather can be expected. If air pressure falls, storms are likely. Barometric pressure data from a large area can be used to identify pressure systems, fronts, and other weather systems.

Thermometers and barometers are found in weather stations. These are small collections of weather instruments, which may also include devices for measuring wind speed, wind direction, humidity, and precipitation. About 10,000 weather stations are located on land all over the world. In addition, weather stations are located on about 15 satellites, 700 buoys, 3000 aircraft, and 7300 ships. All of these weather stations constantly collect data on the condition of the atmosphere where they are located.

Other devices that measure atmospheric conditions include radiosondes, weather radar, and weather satellites.

- Radiosondes measure atmospheric characteristics such as temperature and air pressure as they travel through the atmosphere after being launched by a balloon or airplane. Radiosondes use radios to communicate the data they collect to a computer.

- Weather radar sends out radio waves that bounce off precipitation in the atmosphere and then return to the radar device. Weather radar can sense many characteristics of precipitation, such as its location, intensity, and movement.
- Weather satellites observe all wavelengths of electromagnetic radiation. They can create visible light images of features such as storms, clouds, fires, and smog. They can create infrared images of characteristics such as water and land temperatures.

Questions

1. Identify two weather instruments and the weather factors they measure.
2. What are weather stations? Where are they located?
3. Explain how radiosondes, weather radar, and weather satellites add to our knowledge of atmospheric conditions.

Lesson 16.4: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. A thermometer may detect changes in temperature with
    a. a coil of metal.
    b. infrared radiation.
    c. electrical resistance.
    d. any of the above
2. Weather instruments that may contain a column of mercury include
    a. barometers.
    b. radar devices.
    c. thermometers.
    d. two of the above
3. Weather maps always show
    a. weather for a particular area.
    b. multiple weather factors.
    c. data from computer models.
    d. two of the above
4. Barometric pressure can be used to
    a. identify pressure systems.
    b. locate fronts.
    c. predict weather.
    d. all of the above
5. All of the weather stations around the world number in the
    a. tens.
    b. hundreds.
    c. thousands.
    d. millions.

6. Tracking the movement of a radiosonde in flight produces data on
    a. air pressure.
    b. air temperature.
    c. wind direction.
    d. precipitation.
7. Weather satellites take infrared images to record
    a. smog.
    b. clouds.
    c. storms.
    d. temperatures.

Lesson 16.4: Matching

Name____________________ **Class**_______________ **Date**_________

Match each definition with the correct term.

Definitions

_____ 1. device that measures atmospheric conditions as it moves through the air

_____ 2. line connecting places with the same air pressure

_____ 3. device containing a temperature-sensitive indicator such as mercury

_____ 4. line connecting places with the same wind speed

_____ 5. device used to measure air pressure

_____ 6. visual depiction of one or more weather factors for a particular area

_____ 7. radio detection and ranging device

Terms

a. weather map

b. barometer

c. isotach

d. radar

e. thermometer

f. isobar

g. radiosonde

Lesson 16.4: Fill in the Blank

Name____________________ **Class**_______________ **Date**_________

Fill in the blank with the appropriate term.

1. If air pressure ___________, stormy weather is on its way.
2. Weather ___________ uses radio waves to detect water in the atmosphere.

3. Weather __________ are the best way to monitor large-scale weather systems such as cyclones.
4. Numerical weather prediction is carried out using __________.
5. Lines of equal temperature on a weather map are called __________.
6. A rising barometric reading suggest that __________ weather is coming.
7. A weather __________ may be used to launch a radiosonde into the atmosphere.

Lesson 16.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

How has the accuracy of weather forecasting changed? What role do you think technology has played in this change?

CHAPTER 17 HS Climate Worksheets

Chapter Outline

17.1 Climate and Its Causes

Lesson 17.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Weather is more predictable than climate.

_____ 2. The main determinant of a location's climate is the amount of solar radiation it receives.

_____ 3. Early sailors called the ITCZ the doldrums because of the lack of steady wind.

_____ 4. The ITCZ migrates slightly with the seasons.

_____ 5. Sinking air warms and causes condensation.

_____ 6. The jet stream is always located at exactly 60 degrees north latitude.

_____ 7. Climate is based on the weather of a place for at least 30 years.

_____ 8. Climate includes only the average temperature and humidity of a region.

_____ 9. The horse latitudes commonly have windy, stormy weather.

_____ 10. Local winds have no influence on the climate of a place.

Lesson 17.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Influences on Climate

The climate of a location is influenced mainly by its latitude, but several other factors may also be important. These include the location's position relative to an ocean or mountain range.

When a location is near an ocean or even a large lake, the body of water is likely to have a major impact on the climate.

- A place near an ocean has a maritime climate if winds usually blow in off the ocean. This type of climate is moderate, with relatively little variation in temperatures seasonally or daily. Surface currents and upwelling may contribute to the influence of the water on a coastal climate. For example, the cold waters of the California current bring cool temperatures to the California coast, whereas the warm waters of the Gulf Stream bring warm temperatures to the coast of England.
- A place too far inland to be influenced by an ocean has a continental climate. This type of climate is more extreme, with greater variation in temperatures seasonally and daily.

Mountain ranges may also have a big impact on climate. Places with higher altitudes have lower temperatures because density of air decreases with altitude. When the air is less dense, air molecules are less likely to collide and generate heat. Mountain ranges may also create a rainshadow effect. This causes the leeward side of the range to have a warm, dry climate. If a mountain range separates a coastal region from the rest of the continent, maritime air masses may have trouble rising over the mountain range. As a result, the coastal area will have a maritime climate but the inland area on the leeward side of the range will have a continental climate.

Questions

1. Compare and contrast maritime and continental climates.
2. How can surface currents influence a coastal climate?
3. Explain two ways that a mountain range may influence climate.

Lesson 17.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The climate of a region depends on its position relative to
   a. an ocean.
   b. the equator.
   c. a mountain range.
   d. all of the above
2. Beneath a Hadley cell, the prevailing winds generally blow toward the
   a. horse latitudes.
   b. polar front.
   c. equator.
   d. none of the above
3. In an area where the air is mostly rising or sinking, there is not much
   a. wind.
   b. humidity.
   c. precipitation.
   d. stormy weather.
4. Air is mostly sinking over the
   a. equator.
   b. ITCZ.
   c. horse latitudes.
   d. polar fronts.
5. Ocean motions that influence coastal climates include
   a. upwellings.
   b. surface currents.
   c. waves and tides.
   d. two of the above
6. The climate along the ITCZ is
   a. rainy.
   b. cool.
   c. dry.
   d. two of the above

7. At about 30 degrees north and south latitude, the climate is generally
   a. humid.
   b. frigid.
   c. windy.
   d. arid.

Lesson 17.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. low-pressure area between two Hadley cells

_____ 2. boundary between Ferrell and polar cells

_____ 3. climate with extreme temperature differences

_____ 4. high-pressure area between Hadley and Ferrell cells

_____ 5. base of an atmospheric circulation cell

_____ 6. long-term average weather for a given location

_____ 7. moderate climate influenced by the ocean

Terms

a. climate

b. polar front

c. continental climate

d. prevailing wind

e. maritime climate

f. horse latitude

g. ITCZ

Lesson 17.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The major factor determining an area's climate is its __________.
2. The meeting of two different air masses along the polar front causes the polar __________.
3. Directly beneath the jet stream, the weather is often __________.
4. When molecules of air collide, the collisions give off __________.
5. The rainshadow effect results in a dry climate on the __________ side of a mountain range.
6. A circulation cell called a(n) __________ cell lies between the ITCZ and horse latitudes.
7. The global wind belt between the horse latitudes and polar front are called the __________.

Lesson 17.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Most of Earth's major deserts are located at about 30 degrees north or south latitude. Explain why.

17.2 World Climates

Lesson 17.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Vegetation can be used as an indicator of climate type.

_____ 2. Tropical climates occur only at the equator (0 degrees latitude).

_____ 3. All tropical climates are wet year round.

_____ 4. Dry climate zones cover about one-quarter of the world's land area.

_____ 5. Moist subtropical mid-latitude climates are continental climates.

_____ 6. Mediterranean climates are found on the western sides of continents.

_____ 7. Polar climates are found along the polar front in North America.

_____ 8. Most tundra biomes are found in the area surrounding the Arctic Ocean.

_____ 9. The north- and south-facing sides of a hill are likely to have different microclimates.

_____ 10. A marine west coast climate has cold temperatures and light precipitation.

Lesson 17.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Climate Zones

Climate zones are classified by the Köppen classification system. This system is based on the temperature, amount of precipitation, and times of year when precipitation falls. The Köppen classification system recognizes five major climate groups, represented by the letters A through E.

A. Tropical moist climates. These climates are found between the equator and about 25 degrees north and south latitude. They have intense sunshine, high year-round temperatures, and abundant rainfall. Rain may fall year-round or seasonally.

B. Dry climates. These climates are found at about 30 degrees north and south latitude. They are also found at higher latitudes in rainshadows and within continents. They have plenty of sunshine, with hot summers and cool winters. Rainfall is irregular and infrequent, and there is less precipitation than evaporation.

C. Moist subtropical mid-latitude climates. These climates are found in mid-latitude coastal areas, such as the southeastern Unites States and western Europe. They have distinct seasons with cool to cold winters and mild summers. Rainfall is plentiful.

D. Continental climates. These climates are found within continents in the Northern Hemisphere, between about 40 and 70 degrees north latitude. They are not found in the Southern Hemisphere because the southern continents are too narrow. Continental climates have extreme temperatures, with very cold winters and relatively warm summers. They are relatively dry climates with stormy winters.

E. Polar climates. These climates are found in areas around the Arctic Ocean and to a lesser extent in Greenland and Antarctica. Winters are long, dark, and bitterly cold. Summers are short and cool. The climates are dry, with most of the limited precipitation falling in the summer.

Questions

1. What is the Köppen classification system? What are the major climate groups in this system?
2. Which of the major climate groups are moist? Why are they moist?
3. Where are group B dry climates found? What other climate groups are dry? Why?

Lesson 17.2: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Continental climates are found in
   a. North America.
   b. South America.
   c. South Africa.
   d. all of the above
2. The Köppen classification system classifies climates based on
   a. amount of precipitation.
   b. timing of precipitation.
   c. temperature.
   d. all of the above
3. The five major climate groups in the Köppen system include all of the following except
   a. moist subtropical mid-latitude climates.
   b. Mediterranean climates.
   c. tropical moist climates.
   d. dry climates.
4. Which type of vegetation would you expect to be dominant in a tropical wet and dry climate?
   a. grasses
   b. cacti
   c. evergreen trees
   d. mosses
5. The southeastern United States has a
   a. humid subtropical climate.
   b. Mediterranean climate.
   c. dry-summer subtropical climate.
   d. humid continental climate.
6. Boreal forests are found in
   a. polar climates.

b. subpolar climates.
c. tundra climates.
d. marine west coast climates.

7. Climate zones change with changes in latitude. This may be mimicked by changes in

a. biome.
b. altitude.
c. longitude.
d. precipitation.

Lesson 17.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. coniferous forest found in a subpolar continental climate

_____ 2. tropical grassland

_____ 3. climate type and its plants and animals

_____ 4. type of biome in a mid-latitude semi-arid desert

_____ 5. main type of biome found in wet tropical regions

_____ 6. measure of the number of different species in a region

_____ 7. scrubby, woody vegetation that grows in a dry-summer subtropical climate

Terms

a. steppe

b. tropical rainforest

c. chaparral

d. biodiversity

e. taiga

f. savanna

g. biome

Lesson 17.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Dry climates include semi-arid climates and __________.
2. The biome with the highest biodiversity is the __________.
3. The Köppen classification system recognizes a total of __________ major climate groups.
4. __________ is a sub-surface layer of permanently frozen ground in an area with a polar climate.

5. A biome with a polar climate and small plants such as mosses is called __________.
6. A thick layer of ice found mostly on Greenland and Antarctica is called a(n) __________.
7. The climate of a small area that differs from the surrounding climate is called a(n) __________.

Lesson 17.2: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why the natural vegetation in an area can be used to identify the area's climate zone.

17.3 Climate Change

Lesson 17.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Earth's climate has been relatively stable for most of the past 2000 years.

_____ 2. Earth's temperature has risen about 14 °C since the end of the Pleistocene ice ages.

_____ 3. Short-term climate changes such as the ENSO have only local effects on climate.

_____ 4. Sunspots reduce the amount of solar radiation given off by the sun.

_____ 5. Plate tectonics may change the way that heat is distributed around the planet.

_____ 6. Milankovitch cycles produce a climate pattern that repeats every 100,000 years.

_____ 7. Carbon dioxide levels in the atmosphere have been rising only since the end of World War II.

_____ 8. Current carbon dioxide levels are the highest they have been in more than half a million years.

_____ 9. China now releases more carbon dioxide per person than any other nation in the world.

_____ 10. In Arctic climates, permafrost is melting and its extent is decreasing.

Lesson 17.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

El Niño and La Niña

The largest and most important short-term climate changes are the oscillations between an El Niño and a La Niña. This cycle is called the El Niño southern oscillation, or ENSO, and it repeats every 2 to 7 years. To understand the ENSO, it is important to know what happens during a normal year. Normally, the trade winds blow across the Pacific Ocean near the equator from east to west. This causes warm water to pile up in the western Pacific. In the eastern Pacific, along the west coast of South America, the water is cold, and upwelling occurs offshore.

During an El Niño, surface water temperature in the Pacific is warmer than usual, and the trade winds weaken or reverse direction. The winds blow east instead of west, so warm water piles up off the west coast of South America. With warm, low-density water at the surface, upwelling does not occur. By altering atmospheric and oceanic circulation, an El Niño changes global climate patterns. Some regions receive more rainfall than normal, including the west coasts of North and South America. Other regions receive less rainfall than normal, including parts of South America, Australia, and Indonesia. An El Niño typically lasts for one or two years.

Following an El Niño, the normal circulation pattern may resume. Often, however, an El Niño is followed by an exaggeration of the normal pattern. When the reaction is extreme, this is a La Niña. During a La Niña, trade winds blow from east to west and warm water piles up in the western Pacific, the same as occurs during a normal year.

However, ocean temperatures along coastal South America are colder than normal, and cold water reaches farther into the western Pacific than usual. These events change global climate patterns as well. In many locations, a La Niña produces the opposite climate variations from an El Niño. For instance, parts of Australia and Indonesia that are drier than normal during an El Niño are typically wetter than normal during a La Niña.

Questions

1. What is the ENSO? How often does it repeat?
2. Explain how an El Niño differs from what happens during a normal year.
3. How does an El Niño affect global climates?
4. What is a La Niña? Compare its effects on global climates with the effects of an El Niño.

Lesson 17.3: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Which statement about Earth's climate is false?
    a. Climate has changed throughout Earth's history.
    b. Earth has never been as warm as it is today.
    c. Short-term climate changes are common.
    d. Plate tectonics can alter climate.
2. Scientists think that the Pleistocene ice ages were caused by
    a. sunspots.
    b. human activities.
    c. greenhouse gases.
    d. Milankovitch cycles.
3. Processes that add greenhouse gases to the atmosphere include
    a. volcanic eruptions.
    b. rice production.
    c. organic decay.
    d. all of the above
4. Volcanic eruptions may affect Earth's climate by
    a. adding carbon dioxide to the atmosphere.
    b. releasing dust that blocks solar radiation.
    c. causing Earth to wobble on its axis.
    d. two of the above
5. Greenhouse gases raise Earth's temperature by
    a. absorbing heat that reaches the atmosphere from the sun.
    b. trapping heat that radiates off Earth's surface.
    c. reducing circulation in the atmosphere.
    d. all of the above
6. All of the following are greenhouse gases except
    a. chlorofluorocarbons.
    b. methane.
    c. oxygen.

   d. ozone.

7. Other changes that are likely to occur as Earth gets warmer include
   a. worse droughts.
   b. less biodiversity.
   c. more severe hurricanes.
   d. all of the above

Lesson 17.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. variations in Earth's position relative to the sun that may cause ice ages

_____ 2. warm period from the 10th to 14th centuries A.D.

_____ 3. period with normal but exaggerated trade winds

_____ 4. cold period from the 14th to 19th centuries A.D.

_____ 5. short-term climate cycle between El Niño and La Niña

_____ 6. period in which trade winds weaken or reverse direction

_____ 7. magnetic storm on the sun's surface

Terms

a. medieval warm period

b. little ice age

c. El Niño

d. ENSO

e. Milankovitch cycle

f. La Niña

g. sunspot

Lesson 17.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Most of the recent global warming is caused by human activities that release __________ gases into the atmosphere.
2. Warmer global temperatures cause sea level to __________.
3. An El Niño occurs when the temperature of the Pacific Ocean is __________ than normal.
4. The major reason for the recent increase in atmospheric carbon dioxide is the burning of __________.
5. In __________ agriculture, trees are cut and burned to clear land for agriculture.

6. Forests __________ the level of carbon dioxide in the atmosphere.
7. As greenhouse gases increase in the atmosphere, the acidity of the ocean __________.

Lesson 17.3: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Make an argument to support the claim that human actions are causing the current period of global warming.

CHAPTER 18 HS Ecosystems and Human Populations Worksheets

Chapter Outline

18.1 Ecosystems

Lesson 18.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. All ecosystems that have a similar climate and similar organisms belong to the same biome.

_____ 2. All ecosystems have the same general roles that living things fill.

_____ 3. Scavengers are animals that kill and eat other animals.

_____ 4. Energy flows through an ecosystem in just one direction.

_____ 5. Food chains generally have a maximum of four or five trophic levels.

_____ 6. Nutrients are food molecules such as carbohydrates and proteins.

_____ 7. Each niche in an ecosystem can be inhabited by only one species.

_____ 8. Species that are parasites usually kill their host species.

_____ 9. Without decomposers, life on Earth would have died out long ago.

_____ 10. Matter flows through an ecosystem in exactly the same way as energy.

Lesson 18.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Roles and Feeding Relationships in Ecosystems

There are many different types of ecosystems. Climate factors determine which type of ecosystem is found in any given location. Different organisms live in different types of ecosystems, but every ecosystem has the same general roles and feeding relationships.

Two basic roles that are found in all ecosystems are the roles of producer and consumer. Every ecosystem has producers, which are organisms that produce food in the form of chemical energy. The major producers are algae in the oceans, plants on land, and bacteria at hydrothermal vents. Plants and algae use the energy in sunlight to produce food by photosynthesis. Bacteria at hydrothermal vents use the energy in chemicals to produce food by chemosynthesis.

All other organisms in an ecosystem are consumers. Consumers are organisms that obtain food energy by consuming other organisms. There are many different types of consumers. Herbivores are organisms that eat plants or other producers. These organisms break down plants or other producers to get the matter and energy they need. Deer are herbivores. Carnivores are organisms that eat other animals. They may eat herbivores or other carnivores. Lions are carnivores. Omnivores may eat plants and animals as well as fungi, bacteria, and organisms from other kingdoms. Raccoons are omnivores.

The various ways in which organisms obtain food from other living things are called feeding relationships. There are a variety of different feeding relationships. For example, predators such as lions kill and eat prey organisms, such as antelope and zebra. Scavengers eat organisms that are already dead. For example, a hyena might eat the remains of an animal that was killed but not completely consumed by a lion. Decomposers break down dead organisms or the waste products of living organisms. In the process, they return nutrients to the ecosystem. Bacteria and fungi are examples of decomposers.

Questions

1. Describe the role of producer, and identify major types of producers.
2. What are consumers? List and define three different types of consumers.
3. Compare and contrast predation and scavenging, and give examples of organisms in each type of feeding relationship.
4. How do decomposers obtain food energy? List two examples of decomposers

Lesson 18.1: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Organisms that are producers include
   a. plants.
   b. bacteria.
   c. phytoplankton.
   d. all of the above
2. Consumers that eat only producers are called
   a. omnivores.
   b. carnivores.
   c. herbivores.
   d. predators.
3. The first trophic level in an ecosystem is made up only of
   a. primary consumers.
   b. producers.
   c. herbivores.
   d. two of the above
4. Organisms that can interbreed and produce fertile offspring belong to the same
   a. species.
   b. population.
   c. community.
   d. ecosystem.
5. Abiotic factors in a forest ecosystem include
   a. trees.
   b. nutrients.
   c. sunlight.
   d. two of the above
6. Organisms that break down dead organisms and return the nutrients to the ecosystem are classified as

a. prey.
b. predators.
c. scavengers.
d. decomposers.

7. What percentage of energy at one tropic level is available to the next higher trophic level?

a. 10 percent
b. 25 percent
c. 50 percent
d. 90 percent

Lesson 18.1: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. relationship between species that try to use the same resources

_____ 2. way a species makes a living

_____ 3. relationship between species in which one species benefits and the other species is not harmed

_____ 4. place where an organism lives

_____ 5. relationship between species in which both species benefit

_____ 6. any relationship between species in which at least one species benefits

_____ 7. relationship between species in which one species benefits and the other species is harmed

Terms

a. commensalism

b. competition

c. habitat

d. mutualism

e. niche

f. parasitism

g. symbiosis

Lesson 18.1: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. A(n) __________ consists of all the living things in an area together with the nonliving things that they need.
2. All the individuals of a single species that live together at a given place and time make up a(n) __________.
3. All the populations living together in the same area make up a(n) __________.

4. __________ factors are all the living organisms in an ecosystem.
5. __________ factors are all the nonliving components of an ecosystem.
6. Any organism that makes its own food is called a(n) __________.
7. Any organism that obtains its food from other organisms is called a(n) __________.

Lesson 18.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

A food chain is a very simple model. What does a food chain represent, and why is it much simpler than reality?

18.2 The Carbon Cycle and the Nitrogen Cycle

Lesson 18.2: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Carbon is constantly recycled through ecosystems.

_____ 2. Plants take in nitrogen gas in the process of respiration.

_____ 3. Soil is a major reservoir of carbon.

_____ 4. A living forest is a carbon sink.

_____ 5. The carbon dioxide concentration in the atmosphere has leveled off since the year 2000.

_____ 6. Greenhouse gases are like the glass walls and roof of a greenhouse.

_____ 7. Nitrogen is the second most abundant gas in the atmosphere after oxygen.

_____ 8. When organic remains decompose, their nitrogen is released into the atmosphere as nitrogen gas.

_____ 9. Nitrogen from fertilizers prevents bacteria from growing in pond or lake water.

_____ 10. Plants can use nitrogen in the form of nitrates in the soil.

Lesson 18.2: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

The Nitrogen Cycle

Nitrogen is vital for life on Earth as an essential component of organic compounds such as amino acids, nucleic acids, and chlorophyll. Nitrogen gas is plentiful in the atmosphere, but plants cannot use nitrogen in the gaseous form. To be useful to plants, nitrogen must be "fixed," or converted into certain nitrogen compounds. Some nitrogen is fixed by lightning or blue-green algae, but most is fixed by bacteria in soil. Soil bacteria combine nitrogen gas with oxygen or hydrogen and create nitrogen-containing compounds such as ammonia. Nitrogen-fixing bacteria live either freely in the soil or in a symbiotic relationship with leguminous plants (peas, beans, peanuts). The symbiotic bacteria use carbohydrates from the plants to produce ammonia that the plants can use as a source of nitrogen. When the legumous plants die, their nitrogen compounds are returned to the soil, where other plants can use them.

Animals obtain nitrogen by eating plants. They use the nitrogen to grow animal tissues. After a plant or animal dies or produces wastes, bacteria and fungi in the soil fix the organic nitrogen in the remains or wastes and return it to the soil as ammonia. Nitrifying bacteria oxidize the ammonia to nitrites and nitrates, which can be used by the next generation of plants.

When there are few usable nitrogen compounds in soil, this can curtail plant growth. Modern agricultural practices increase plant productivity by adding nitrogen fertilizers to soil. This can have unintended consequences:

- Nitrogen from fertilizers may return to the atmosphere as nitrous oxide or ammonia, both of which may have deleterious effects. Nitrous oxide contributes to the breakdown of the ozone layer, and ammonia contributes to smog and acid rain.
- Excess fertilizers run off the land and end up in ponds, lakes, and coastal areas of the ocean. The nitrogen causes enormous numbers of bacteria and algae to grow. When these organisms die, their decomposition uses up all the available oxygen. Without oxygen, fish and most other organisms cannot survive. On a large scale, this creates an area called a dead zone.

Questions

1. How is nitrogen fixed, and why is fixing nitrogen important?
2. Explain how the nitrogen in a deceased organism is recycled.
3. Describe two adverse environmental consequences of using nitrogen fertilizers.

Lesson 18.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Compounds that contain carbon include
   a. calcium carbonate.
   b. carbon dioxide.
   c. glucose.
   d. all of the above
2. The chemical reaction for cellular respiration is represented by the equation
   a. $6\ CO_2 + 6\ H_2O + \text{energy} \rightarrow C_6H_{12}O_6 + 6\ O_2$.
   b. $6\ O_2 + 6\ H_2O + \text{energy} \rightarrow C_6H_{12}O_6 + 6\ CO_2$.
   c. $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + \text{energy}$.
   d. $C_6H_{12}O_6 + 6\ H_2O \rightarrow 6\ CO_2 + 6\ O_2 + \text{energy}$.
3. Carbon reservoirs include
   a. forests.
   b. fossil fuels.
   c. oceans.
   d. all of the above
4. Nitrogen may be fixed by
   a. lightning.
   b. plants called legumes.
   c. animals that eat plants.
   d. all of the above
5. Carbon dioxide is released into the atmosphere in all of the following processes except
   a. decomposition.
   b. volcanic eruption.
   c. cellular respiration.
   d. photosynthesis.
6. Anywhere carbon is stored is a carbon

a. sink.
b. source.
c. reservoir.
d. compound.

7. Processes involved in the long-term cycling of carbon include

a. photosynthesis.
b. respiration.
c. carbon fixing.
d. sedimentation.

Lesson 18.2: Matching

Name____________________ Class_______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. element that is the basis of all life

_____ 2. changing nitrogen gas to a form that plants can use

_____ 3. reservoir where more carbon is stored than released

_____ 4. type of organic compound that includes sugar

_____ 5. changing ammonia to nitrites or nitrates

_____ 6. most abundant gas in the atmosphere

_____ 7. reservoir where more carbon is released than stored

Terms

a. carbohydrate

b. carbon sink

c. carbon

d. nitrification

e. nitrogen

f. carbon source

g. nitrogen fixing

Lesson 18.2: Fill in the Blank

Name____________________ Class_______________ Date________

Fill in the blank with the appropriate term.

1. The process of __________ changes inorganic carbon in carbon dioxide to organic carbon in food using energy in sunlight.
2. The removal of forests from the landscape is called __________.

3. Nitrogen is fixed in the soil by __________.
4. The process in question 3 occurs when nitrogen is combined with oxygen or __________.
5. By the process of oxidation, nitrites can be changed to __________.
6. Nitrous oxides released from fertilizers contribute to the breakdown of the __________ layer in the atmosphere.
7. A __________ zone results when fish and other larger water organisms die because of lack of oxygen.

Lesson 18.2: Critical Writing

Name__________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

How do human actions change carbon sinks to carbon sources? How does this affect the environment?

18.3 Human Populations

Lesson 18.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. A population has exceeded its carrying capacity if it uses up resources faster than they can be replenished.

_____ 2. The same factors limit human population growth all over the world.

_____ 3. The rate at which the human population is growing is still increasing.

_____ 4. The development of agriculture allowed people to settle down in one place for the first time.

_____ 5. Subsistence farmers grow only enough food to support their own families.

_____ 6. Every major advance in agriculture has allowed the global human population to increase.

_____ 7. Experts agree that the worldwide human population has not yet reached its carrying capacity.

_____ 8. Modern agricultural practices allow people to produce more food without harming the environment.

_____ 9. Human actions have increased the rate of species extinctions to at least 100 times the normal rate.

_____ 10. An important step in achieving sustainable development is to reduce human population growth.

Lesson 18.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Sustainable Development

A topic generating a great deal of discussion these days is sustainable development. Sustainable development is any economic development that allows people to escape a life of poverty while conserving resources and protecting the environment. Many different approaches must be adopted to achieve these goals.

One of the most important steps to achieving sustainable development is reducing the rate of human population growth. If there were a smaller number of people, fewer resources would be needed and smaller amounts of pollution and greenhouse gases would be released. One way to slow human population growth is to provide education for girls and women in countries where they typically go without education. Studies have shown that as women become educated, they tend to have fewer children.

Advances in science and technology are likely to be an important part of sustainable development. If scientists had a better understanding of how Earth's natural systems work, they would also have a better understanding of how people are affecting them. Technologies could also be developed to help solve problems created by overpopulation and overuse of resources. An example of a technology that could aid sustainable development is fish farming, as long as it is done in environmentally sound ways. Raising fish on farms rather than relying solely on wild fish could reduce the risk of overharvesting wild fish populations. Another example is the development of cleaner energy sources that would reduce pollution and greenhouse gas emissions.

Individuals can also play a role in achieving sustainable development. This applies primarily to people in the developed nations. They could change their behavior to reduce the impact they have on the planet. They could consume only what they need and avoid wasting resources. They could also try to limit their purchases to products that are produced sustainably. For example, they could choose to purchase wood products only from companies that plant new trees to replace those that are cut down.

Questions

1. What is sustainable development?
2. How would reducing the rate of human population growth help achieve sustainable development? Why does education play a role in slowing population growth?
3. Give examples of technologies could help reduce resource depletion or harm to the environment.
4. What can individuals do to promote sustainable development?

Lesson 18.3: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Generally, when a population reaches its carrying capacity, the population
   a. stops growing.
   b. expands its habitat.
   c. quickly goes extinct.
   d. no longer has limiting factors.
2. Over the past 50 years, the size of the human population
   a. stayed about the same.
   b. increased by 1 billion.
   c. more than doubled.
   d. none of the above
3. Human beings developed the ability to grow their own food about
   a. 200 years ago.
   b. 2000 years ago.
   c. 10,000 years ago.
   d. 2 million years ago.
4. The Green Revolution increased agricultural productivity by
   a. improving crops.
   b. increasing access to water.
   c. expanding use of chemical pesticides.
   d. all of the above
5. What percentage of Earth's ice-free lands have been converted to human uses?
   a. 90 percent
   b. 50 percent
   c. 30 percent
   d. 20 percent
6. Goals of sustainable development include

a. protecting the environment.
b. helping people get out of poverty.
c. using resources only as quickly as they are replaced.
d. all of the above

7. Which of the following statements about carrying capacity is (are) true?

   a. The carrying capacity of a population never changes.
   b. The carrying capacity is the same for all populations in a habitat.
   c. The carrying capacity depends on biotic and abiotic factors.
   d. all of the above

Lesson 18.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. factor that determines the carrying capacity for a species

_____ 2. chemical used to kill organisms that harm plants

_____ 3. use of more resources than needed or than can be sustained in the long term

_____ 4. use of resources in ways that do not deplete them or harm the environment

_____ 5. maximum population size of a species that a habitat can support

_____ 6. organism that moves into a new environment where it may harm native species

_____ 7. situation in which a population exceeds its carrying capacity

Terms

a. carrying capacity

b. limiting factor

c. invasive species

d. overpopulation

e. over-consumption

f. sustainable development

g. pesticide

Lesson 18.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. During the __________ Revolution, products were first mass produced and fossil fuels were first widely used for power.

2. The __________ Revolution was a dramatic increase in agricultural productivity that occurred in the 20th century.
3. A population grows when the number of births is __________ than the number of deaths.
4. Factors that may limit population growth include __________ factors such as water.
5. A population generally stops growing when it reaches the size called the __________.
6. The current global human population size is about __________ billion people.
7. Species ordinarily produce __________ offspring than their habitat can support.

Lesson 18.3: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Do you think that the global human population has reached its carrying capacity? Why or why not?

CHAPTER 19 HS Human Actions and the Land Worksheets

Chapter Outline

19.1 Loss of Soils

Lesson 19.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Soil loss can permanently degrade farmland.

_____ 2. The natural vegetation of prairies is deciduous forests.

_____ 3. The "black blizzards" of the Dust Bowl were mid-latitude snowstorms.

_____ 4. Human activities can greatly increase the rate of soil erosion.

_____ 5. The agents of soil erosion are different from the agents of other erosion.

_____ 6. Most of the best land for farming has not yet been cultivated.

_____ 7. The rate of topsoil loss is currently greater in developing than developed nations.

_____ 8. Hills are especially prone to erosion.

_____ 9. Parking lots with special permeable pavement can reduce runoff and erosion.

_____ 10. Soil erosion is a natural process.

Lesson 19.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Causes of Soil Erosion

The agents of soil erosion, like other types of erosion, include water, wind, ice, and gravity. Running water is the leading cause of soil erosion, because water is abundant and has a lot of power. Wind is another important cause, because wind can pick up fine particles of soil and carry them long distances. Soil erosion is as natural as any other type of erosion, but human activities have greatly accelerated soil erosion. Any activities that remove vegetation, disturb the soil, or allow the soil to dry out are likely to increase the rate of soil erosion. Such activities include farming, livestock grazing, logging, mining, construction, and recreation.

- Farming is the most significant activity that accelerates soil erosion because of the amount of land that is farmed and how greatly farming disturbs the soil. If farmers use traditional farming methods, they remove native vegetation and plow the soil before planting. Because most crops grow only in spring and summer, the soil is left bare and exposed during the rest of the year.
- Grazing animals expose soil by eating the plant cover. They also disturb the ground with their sharp hooves. If too many animals graze the same area, it becomes overgrazed and subject to serious erosion.
- Logging removes trees that protect the ground from soil erosion. Tree roots hold soil, tree canopy protects soil from hard rain, and dead leaves cover the forest floor and protect the soil. Heavy logging equipment

contributes to soil erosion by wearing down vegetation and disturbing the soil.
- Surface mining removes ground cover and disturbs the soil, leaving it vulnerable to erosion.
- Construction of buildings and roads churns up the ground and exposes soil to erosion. Paved areas such as parking lots also contribute to erosion by not allowing rain to soak into the ground, thereby increasing runoff.
- Recreational activities may accelerate soil erosion. Off-road vehicles kill plants and make ruts in soil. In some delicate habitats, even hikers' boots can leave the ground bare and exposed to agents of erosion.

Questions

1. What are natural agents of soil erosion?
2. Identify human activities that are likely to increase the rate of soil erosion.
3. Why is farming the most significant activity that accelerates soil erosion?

Lesson 19.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Causes of the Dust Bowl include
   a. farming practices.
   b. mining activities.
   c. overgrazing.
   d. logging.
2. Some of the topsoil from the Dust Bowl was carried to
   a. southern California.
   b. Washington State.
   c. the East Coast.
   d. all of the above
3. Human actions that increase soil erosion are those that
   a. remove vegetation.
   b. disturb the soil.
   c. allow the soil to dry out.
   d. all of the above
4. Which percentage of topsoil has been lost in the U.S. since Europeans first arrived?
   a. 99 percent
   b. 66 percent
   c. 33 percent
   d. 1 percent
5. Which statement about soil is true?
   a. Soil sustains natural habitats.
   b. Soil is a nonrenewable resource.
   c. Soil is needed only for agriculture.
   d. Soil loss is due solely to human actions.
6. How do trees help protect soil from erosion?
   a. Their roots hold soil in place.

b. Their canopy shields soil from hard rain.
c. Their fallen leaves cover soil.
d. all of the above

7. Soil erosion could be reduced on a construction site by

a. building on a steep hill.
b. landscaping with plants.
c. paving all the bare ground.
d. two of the above

Lesson 19.1: Matching

Name____________________ Class_______________ Date_________

Match each definition with the correct term.

Definitions

_____ 1. primary agent of Dust Bowl erosion

_____ 2. leading agent of soil erosion

_____ 3. plants grown in the winter to hold the soil in place

_____ 4. major human activity that accelerates soil erosion

_____ 5. area of severe soil erosion in the U.S. in the 1930s

_____ 6. layer of soil most likely to be eroded

_____ 7. layer of organic debris on the forest floor

Terms

a. Dust Bowl

b. leaf litter

c. agriculture

d. wind

e. running water

f. cover crop

g. topsoil

Lesson 19.1: Fill in the Blank

Name____________________ Class_______________ Date_________

Fill in the blank with the appropriate term.

1. Prior to World War I, the soil of the Great Plains was naturally held in place by __________.
2. Agents of soil erosion include water, wind, ice, and __________.
3. In __________ agriculture, forests are cut and burned to make way for agriculture.
4. __________ exposes soil to erosion when too many livestock are kept in a given area.

5. Paved parking lots generally speed up soil erosion from nearby land by increasing __________.
6. The rate of topsoil loss in the U.S. has __________ recently.
7. To reduce soil erosion, you should use __________ irrigation instead of sprinklers.

Lesson 19.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Describe the Dust Bowl, and explain what it taught us about protecting the soil.

19.2 Pollution of the Land

Lesson 19.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Hazardous chemicals in Love Canal were cleaned up before they made people sick.

_____ 2. Hazardous wastes include medical wastes and agricultural chemicals.

_____ 3. The effects of contamination at Love Canal included higher-than-normal rates of miscarriages.

_____ 4. Every case of cancer should be investigated for possible toxic waste contamination.

_____ 5. Lead is no longer considered to be toxic to human beings.

_____ 6. Nations that have more industry produce more hazardous waste.

_____ 7. Love Canal was designated as a Superfund site in the 1960s.

_____ 8. The greatest concentration of Superfund sites is in the northeastern U.S.

_____ 9. By law, companies now must keep records showing how they have disposed of any hazardous wastes.

_____ 10. The safest way to dispose of household hazardous wastes is down the toilet.

Lesson 19.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Hazardous Waste and Its Effects

Hazardous waste is any waste material that is dangerous to human health or that degrades the environment. Hazardous wastes include substances that are toxic, chemically active, corrosive, or flammable. Many different types of materials are hazardous, and there are many possible sources of hazardous wastes. Most households, for example, have substances that could become hazardous wastes if not stored and disposed of properly. These include cleaning chemicals such as drain cleaners and lawn chemicals such as herbicides. Other common sources of hazardous wastes include automotive chemicals such as motor oil and brake fluid, batteries, medical wastes, paints, dry cleaning chemicals, and agricultural chemicals such as fertilizers and pesticides.

Exposure to hazardous wastes may cause illness or even death in people or other organisms. The chemical wastes at Love Canal, for example, caused high rates of cancer in children and higher-than-normal numbers of miscarriages and birth defects. Fetuses, infants, and young children are more susceptible to damage by hazardous wastes because they are growing rapidly. Therefore, for their size, they tend to take in more of the toxic chemicals. However, it is important to realize that just one person with cancer is not enough to suspect contamination by hazardous wastes. Cancer occurs fairly often and has many possible causes. Contamination is suggested by more than the normal number of cancers in a particular area. This is called a cancer cluster. The presence of a cancer cluster was how groundwater contamination was discovered in Woburn, Massachusetts. High rates of childhood leukemia and certain other illnesses were diagnosed in children in this community. As a result of concern by parents, well water was analyzed and shown to have high levels of a toxic chemical called trichloroethylene.

Two other chemicals that are especially toxic to humans are lead and mercury. Lead was once a common ingredient in gasoline and paint, but it was banned for these uses after it was shown to damage the human nervous system, especially in young children. Mercury is produced naturally in volcanic eruptions. Other sources of mercury are batteries, electronics, and the burning of coal. Like exposure to lead, exposure to mercury damages the human nervous system.

Questions

1. What is hazardous waste? What are some examples?
2. Identify health problems commonly associated with exposure to hazardous wastes.
3. Why is a single cancer case not enough to suspect contamination by hazardous wastes?

Lesson 19.2: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Hazardous wastes include substances that are
   a. toxic.
   b. corrosive.
   c. flammable.
   d. any of the above
2. The hazardous waste problem discovered in Woburn, Massachusetts, involved contamination of
   a. air.
   b. soil.
   c. streams.
   d. groundwater.
3. Which age group is generally most susceptible to the ill effects of hazardous chemicals?
   a. infants
   b. adolescents
   c. young adults
   d. middle-aged adults
4. The Superfund Act established a trust fund to clean up hazardous waste sites for which a responsible company could not be identified. Money for the trust fund comes from
   a. taxpayers.
   b. fines paid by polluters.
   c. city and state governments.
   d. petroleum and chemical industries.
5. At Love Canal, a school and many homes were built on soil that covered
   a. an old petroleum refinery.
   b. an abandoned chemical mine.
   c. barrels full of used car batteries.
   d. steel drums of hazardous chemicals.
6. The problem of Love Canal was finally addressed when

a. government surveys discovered high cancer rates in residents.
b. local residents organized and demanded government action.
c. the responsible company volunteered to clean up the area.
d. the Resource Conservation and Recovery Act was passed.

7. Hazardous items commonly found in households include

a. batteries.
b. herbicides.
c. paints.
d. all of the above

Lesson 19.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. any waste material that is dangerous to human health or that degrades the environment

_____ 2. U.S. law requiring companies to keep track and properly dispose of any hazardous materials they produce

_____ 3. hazardous element that was previously added to paints and gasoline

_____ 4. having the ability to destroy other things by chemical reactions

_____ 5. U.S. law requiring companies to pay to clean up sites they have polluted with hazardous wastes

_____ 6. hazardous element that is released in volcanic eruptions and the burning of coal

_____ 7. having the ability to easily catch fire

Terms

a. Superfund Act

b. flammable

c. Resource Conservation and Recovery Act

d. corrosive

e. lead

f. hazardous waste

g. mercury

Lesson 19.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. __________ is an abandoned waterway in Niagara Falls, New York, that was contaminated in the 1950s by toxic chemicals.
2. The site described in question 1 was instrumental in the passage of the __________ Act in 1980.

3. Toxic chemicals called __________ are used to kill organisms that attack plants.
4. A __________ is a group of higher-than-average cancer rates in a particular area.
5. Both lead and mercury can cause damage to the human __________ system.
6. Currently, the nation that is the world's largest producer of hazardous wastes is the __________.
7. Contaminated sites that must be cleaned up per the Superfund Act are designated as __________ sites.

Lesson 19.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Summarize the story of Love Canal and how it led to passage of the Superfund Act of 1980.

CHAPTER 20 HS Human Actions and Earth's Resources Worksheets

Chapter Outline

20.1 Use and Conservation of Resources

Lesson 20.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. All renewable natural resources are living things.

_____ 2. Plant nutrients may be lost from soil because of air pollution.

_____ 3. Forests may be either renewable or non-renewable resources.

_____ 4. Fossil fuels can be renewable resources if we conserve them.

_____ 5. Electricity can be generated only from non-renewable resources.

_____ 6. Non-renewable resources may be very abundant or very rare.

_____ 7. Nearly 80 percent of the world's oil is found in Japan, China, and the U.S.

_____ 8. Much of the electronic waste from the U.S. ends up in developing countries.

_____ 9. More natural resources are wasted in developing than developed countries.

_____ 10. Recycling is the only way to conserve non-renewable natural resources.

Lesson 20.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Resource Availability

Many of the resources we depend on are non-renewable. Non-renewable resources vary in their availability. Some are very abundant, whereas others are very rare. Resources such as gravel and sand are technically non-renewable but are so abundant that running out is not an issue. Other resources are truly limited in quantity, including many minerals. When they are gone, they are gone, and something must be found to replace them. Some non-renewable resources, such as diamonds and rubies, are costly in part because they are very rare.

Besides abundance, the cost of a resource is determined by how easy it is to locate and extract. If a resource is difficult to find or obtain, it may go unused unless there are no other cheaper alternatives. For example, the oceans are filled with an abundant supply of water, but removing salt from ocean water (desalination) is very costly, so this source of water mainly goes unused. However, if the cost of desalination were to decrease, more ocean water would likely be used.

Politics may also affect resource availability and cost. Nations that have a desired resource in abundance will often export that resource to other countries. Countries that need the resource must import it from one of the countries that produces it. This situation is a potential source of political conflict. Oil is a good example of this. Only 11 countries have nearly 80 percent of all of the world's oil. They are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. However, the biggest users of oil are the United States, China, and Japan. This leads to a situation in which the availability and price of oil is determined largely by oil-producing countries, which have their own interests to look out for. They may raise the price of oil for reasons that have nothing to do with the cost of obtaining it. Wars may even be fought over oil or other resources that are not evenly distributed.

Questions

1. Describe variability in the abundance of non-renewable resources.
2. Besides abundance, what factors determine the cost of natural resources?
3. Which countries have the most oil reserves, and which countries use the most oil? Why is this situation a potential source of political conflict?

Lesson 20.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Forests are natural resources that may be used for
   a. timber.
   b. habitat.
   c. recreation.
   d. all of the above
2. Examples of potentially renewable resources include all of the following except
   a. soil.
   b. water.
   c. wildlife.
   d. fossil fuels.
3. Which of the following items is made only from renewable resources?
   a. cotton tee shirt
   b. bottled water
   c. wood house
   d. cell phone
4. The cost of non-renewable resources depends on how
   a. abundant they are.
   b. easy it is to find them.
   c. difficult it is to extract them.
   d. all of the above
5. The biggest users of oil in the world include
   a. the United Arab Emirates.
   b. the United States.
   c. Saudi Arabia.
   d. all of the above
6. Electronic wastes such as old computers
   a. are hazardous wastes.
   b. contain only harmless materials.

c. can be disposed of safely in landfills.
d. two of the above

7. Which of the following non-renewable resources is least likely to run out?

a. coal
b. gravel
c. diamond
d. petroleum

Lesson 20.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. any natural resource that is limitless or can be regenerated as quickly as it is used

_____ 2. to obtain a resource or other product from another country

_____ 3. trees that are cut for wood to use for building or other purposes

_____ 4. anything useful to people that comes from the natural environment

_____ 5. to reduce the use of a natural resource so it will last longer

_____ 6. any natural resource that cannot be regenerated at all or not as quickly as it is used

_____ 7. to send a resource or other product to another country

Terms

a. timber

b. conserve

c. renewable resource

d. non-renewable resource

e. export

f. natural resource

g. import

Lesson 20.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. When we practice __________, we make sure that natural resources will be available in the future.
2. Natural resources are usually classified as either renewable or __________.
3. A forest is an a example of a(n) __________ resource if it is used wisely.
4. Minerals are examples of __________ resources.
5. __________ is the use of more resources than people actually need.

6. Discarded materials produce __________ that degrades the environment.
7. __________ is the process of collecting and processing of used materials and turning them into new products.

Lesson 20.1: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

For many natural resources, the categories of renewable and non-renewable are not completely separate. Instead, they are more like two ends of a continuum. Explain why, and illustrate your answer with examples.

20.2 Energy Conservation

Lesson 20.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. We must use energy to get energy from fossil fuels.

_____ 2. Drilling for oil far from shore is more expensive than drilling close to shore.

_____ 3. If the net-energy ratio is less than one, it takes less energy to get an energy resource than the resource provides.

_____ 4. No energy is used to obtain solar energy.

_____ 5. The net-energy ratio of coal varies depending on the cost of transporting it.

_____ 6. Boats are a less energy-efficient means of transportation than airplanes.

_____ 7. A light bulb that gives off less heat is more energy efficient than one that gives off more heat.

_____ 8. Less than half the energy used in the United States is used for transportation and residential uses.

_____ 9. You generally can conserve energy by driving a smaller car.

_____ 10. Using fans rather than air conditioners saves energy.

Lesson 20.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Obtaining Energy

Net energy is the amount of useable energy available from a resource after subtracting the amount of energy needed to make it available. For example, for every five barrels of oil that are made available for use, it requires one barrel for extracting and refining the petroleum. Therefore, the net energy available is only four barrels. The energy needed to obtain an energy resource increases when the easy deposits of that resource have already been consumed. For example, if all the near-shore petroleum in a region has been extracted, more costly drilling must take place farther offshore. If the energy cost of obtaining energy increases, the resource will be used even faster because a larger share of the energy obtained is used to obtain it.

The ratio of energy obtained to the energy needed to obtain it is called the net-energy ratio. For example, if it takes 2 units of energy to make available 10 units of energy, then the net-energy ratio is 10/2 or 5.0. A net-energy ratio larger than 1 means that there is a net gain in usable energy. A net-energy ratio smaller than one means there is an overall energy loss. Solar energy has a relatively high net-energy ratio of 5.8. For natural gas, the net-energy ratio is 4.9, and for petroleum it is 4.5. Coal has a range of net-energy values, from 2.5 to 5.1, because of differing costs of transporting coal. Solar energy yields more net energy than fossil fuel sources because sunshine is abundant and does not need to be located, extracted, or transported very far.

Questions

1. What is net energy? How is it calculated?
2. Define net-energy ratio, and give an example.
3. Why does solar energy have a higher net-energy ratio than fossil fuels do?

Lesson 20.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. To obtain useable energy, energy is generally needed to
   a. find an energy source.
   b. extract the energy.
   c. transport the energy.
   d. all of the above
2. For every five barrels of oil that are obtained, about how many barrels of oil are needed to obtain them?
   a. one
   b. two
   c. three
   d. four
3. If it takes 10 units of energy to make available 12 units of energy, what is the net-energy ratio?
   a. 0.83
   b. 1.00
   c. 1.20
   d. 1.33
4. Which use of energy in the United States accounts for 17 percent of the total energy used?
   a. transportation
   b. residential
   c. commercial
   d. industrial
5. Outcomes of energy conservation include
   a. higher energy costs.
   b. longer lasting resources.
   c. greater environmental impacts.
   d. all of the above
6. If all the near-shore petroleum in a region has been extracted, drilling must take place further offshore. How does this affect the energy resource?
   a. Its net-energy ratio will increase.
   b. It will be more costly to obtain.
   c. It will be used more quickly.
   d. two of the above

Lesson 20.2: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. amount of useful work done by a unit of energy

_____ 2. saving energy by using less of it or using it more efficiently

_____ 3. amount of useable energy available from an energy resource

_____ 4. less energy-efficient type of light bulb

_____ 5. amount of useable energy in a resource divided by the amount of energy needed to obtain it

_____ 6. more energy-efficient type of light bulb

Terms

a. energy efficiency

b. net-energy ratio

c. energy conservation

d. net energy

e. compact fluorescent light bulb

f. incandescent light bulb

Lesson 20.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. There is a net gain in useable energy if the net-energy ratio is greater than __________.
2. Solar energy has net-energy ratio that is __________ than the net-energy ratio of natural gas.
3. In any energy transfer, some energy is nearly always lost as __________.
4. Transportation by car is __________ energy efficient than transportation by train.
5. Halogen light bulbs are __________ energy efficient than incandescent light bulbs.
6. The single greatest use of energy in the United States is for __________.

Lesson 20.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain what energy efficiency means and how using energy-efficient devices conserves energy.

CHAPTER 21 HS Human Actions and Earth's Water Worksheets

Chapter Outline

21.1 Humans and the Water Supply

Lesson 21.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. All forms of life on Earth depend on water for survival.

_____ 2. You can live longer without water than you can without food.

_____ 3. Everywhere in the world, people use more water for irrigation than for any other single purpose.

_____ 4. Water that goes down the drain in most homes is lost from the ecosystem.

_____ 5. There is so much water on Earth that there is no need to recycle it.

_____ 6. Using overhead sprinklers for irrigation is a consumptive use of water.

_____ 7. Some of the world's farmers still grow crops without irrigation.

_____ 8. A drip irrigation system is less expensive to install than an overhead sprinkler system.

_____ 9. Raising some species by aquaculture can cause environmental problems.

_____ 10. Most environmental uses of water are consumptive uses.

Lesson 21.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Using Water for Irrigation

Agriculture is the single greatest use of water worldwide, and most of the water used in agriculture is used to irrigate fields of crops. Common irrigation methods include:

- sprinkler irrigation, in which water is sprayed onto the fields from overhead.
- trench irrigation, in which canals carry water from a water source to the fields and through the fields along rows of crops.
- flood irrigation, in which water is allowed to flow over the fields, like flood water of a river overflowing its floodplain.

All three of these irrigation methods waste water. More than a third of the water may never reach the crops because it evaporates or runs off the fields. Water that runs off a field often carries valuable soil with it.

A much more efficient way to water crops is by drip irrigation. With drip irrigation, pipes and tubes deliver small amounts of water directly to the soil at the roots of each plant. The water is not sprayed into the air or allowed to run over the ground so nearly all of it goes directly into the soil near plant roots. Very little water is lost to evaporation or runoff. However, drip irrigation systems are relatively expensive to install and maintain, so they are not used as widely as they could be. Where farmers do not have to pay the full cost of their water use, they may lack financial incentives to use less water. In these situations, farmers may not be motivated to install more expensive drip irrigation systems.

Questions

1. Identify three common irrigation methods that waste water. Why do these methods waste water?
2. What is drip irrigation? What are its pros and cons relative to the irrigation methods you identified in answer 1?
3. What might be ways to motivate farmers to use more water-efficient irrigation systems?

Lesson 21.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. What percentage of water use is environmental use?
   a. 1 percent
   b. 15 percent
   c. 28 percent
   d. 50 percent
2. Which use of water is greatest in the Americas?
   a. agricultural use
   b. municipal use
   c. industrial use
   d. personal use
3. Municipal uses of water include
   a. drinking.
   b. lawn watering.
   c. clothes washing.
   d. all of the above
4. Non-consumptive uses of water include
   a. swimming.
   b. flood irrigation.
   c. trench irrigation.
   d. two of the above
5. Power plants use water for
   a. cooling.
   b. making steam.
   c. dissolving wastes.
   d. processing chemicals.
6. Flushing a toilet is a
   a. non-consumptive use of water.
   b. consumptive use of water.
   c. municipal use of water.
   d. two of the above

7. Industrial water use makes up the greatest percentage of water use in
    a. Asia.
    b. Africa.
    c. Oceania.
    d. Europe.

Lesson 21.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. irrigation method in which water is sprayed on the fields from overhead

_____ 2. use of water for power plants, oil refineries, and manufacturing

_____ 3. irrigation method in which water flows over the fields

_____ 4. use of water in a way that keeps it in the ecosystem

_____ 5. farming to raise fish or other water organisms

_____ 6. use of water in a way that removes it from the ecosystem

_____ 7. irrigation method in which drops of water are applied directly to the soil

Terms

a. aquaculture

b. consumptive use

c. drip irrigation

d. non-consumptive use

e. sprinkler irrigation

f. flood irrigation

g. industrial use

Lesson 21.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The single largest use of water worldwide is for __________.
2. The least wasteful method of irrigation is __________ irrigation.
3. A greater percentage of water is used for agriculture in __________ than any other continent.
4. __________ use of water includes water that is recycled and reused.
5. In __________ irrigation, canals carry water from the source to the fields.
6. Raising algae in ponds is an example of a type of farming called __________.
7. Less than __________ percent of all the water we use is used for recreation.

Lesson 21.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast consumptive and non-consumptive uses of water, and give an example of each type of water use.

21.2 Problems with Water Distribution

Lesson 21.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. All people have access to enough water but not necessarily to clean water.

_____ 2. People in more developed countries use a smaller proportion of the world's water than people in less developed countries.

_____ 3. Water scarcity is likely to become a less important problem in the near future.

_____ 4. Much of northern Africa receives too little rain to supply the population with enough water.

_____ 5. People in some other countries use less water in a year than people in the U.S. use in a day.

_____ 6. Many people in the world have no choice but to drink polluted water.

_____ 7. Disease-causing agents in water may include bacteria, toxic chemicals, and parasites.

_____ 8. Millions of people use the Ganges River for both drinking and bathing.

_____ 9. Only people under age five ever die from drinking unsafe water.

_____ 10. Water resources are not yet scarce enough to causes international disputes.

Lesson 21.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

World Water Distribution and Supply

Fresh water that people can use is distributed unevenly around the world. Large portions of the world receive very little water from rainfall or rivers. This includes much of northern Africa and central Asia. Even areas that normally receive enough rain may periodically receive too little. If an area receives lower-than-normal levels of rain for several months or a year, a drought may occur. During a drought, there is not enough water to meet all the needs of the people. Human activities can contribute to the frequency and duration of droughts. For example, deforestation keeps trees from returning water to the atmosphere by transpiration. This decreases the amount of water vapor in the air and the potential for clouds to form and precipitation to fall.

Global warming is changing worldwide patterns of rainfall and water distribution. As the planet warms, regions that currently receive an adequate supply of rain may receive less. Regions that rely on snowmelt for water may find that there is less snow and that it melts earlier and faster in the spring. Water from the melted snow may run off and not be available through the dry summers.

Over time, as global temperatures increase and human populations grow, there will be less water per person. Scientists predict that by the year 2025, nearly half of the world's people will not have enough water to meet their daily needs. Nearly one-quarter of the world's people will have less than 500 m3 of water to use in an entire year. That's less water than some people in the United States currently use in a single day! As water supplies become scarcer, more conflicts will arise between nations that have enough clean water and those that do not. As with energy resources today, wars are likely to erupt in the future over limited water resources.

Questions

1. How is water distributed around the world?
2. What are droughts? How can human actions make droughts more likely?
3. Relate global warming to the world water supply.
4. Why are future conflicts over water likely to occur?

Lesson 21.2: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Compared with the amount of water humans used 100 years ago, today humans use about
   a. two times as much.
   b. three times as much.
   c. six times as much.
   d. ten times as much.
2. Reasons why water scarcity will become a bigger problem in the future include
   a. continued global warming.
   b. larger human population.
   c. greater pollution of water sources.
   d. all of the above
3. Which statement(s) about the worldwide distribution of water is (are) true?
   a. Useable water resources are very evenly distributed around the planet.
   b. Large areas of the world receive very little water from rainfall or rivers.
   c. Water resources are well matched to human population size worldwide.
   d. all of the above
4. How many people worldwide currently lack access to safe drinking water?
   a. approximately 1.1 million
   b. fewer than 0.5 million
   c. more than 1.1 billion
   d. about 0.5 billion
5. Of all cases of disease, about what percentage are caused by drinking unsafe water?
   a. 28 percent
   b. 48 percent
   c. 68 percent
   d. 88 percent
6. Possible consequences of water scarcity include
   a. livestock dying.
   b. development halting.
   c. human hunger increasing.

d. all of the above

7. According to the United Nations, water scarcity
   a. is a problem for only a few populations worldwide.
   b. is a problem that is improving worldwide.
   c. is a worldwide crisis.
   d. none of the above

Lesson 21.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. disease-causing organism

_____ 2. example of a waterborne disease

_____ 3. period of lower-than-normal rainfall that creates or worsens water scarcity

_____ 4. periodic or chronic shortage of water

_____ 5. any disease caused by unsafe drinking water

_____ 6. general cause of changing patterns of rainfall and water distribution

_____ 7. human action that decreases the amount of water entering the atmosphere

Terms

a. drought

b. water scarcity

c. waterborne disease

d. pathogen

e. global warming

f. deforestation

g. cholera

Lesson 21.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. By 2025, scientists predict that nearly __________ percent of the world's people will not have enough water.
2. Deforestation has a major impact on the __________ cycle.
3. __________ diseases, which are caused by unsafe drinking water, are the leading causes of death of young children in many nations.
4. Dracunculiasis is a disease caused by drinking water containing __________ of the guinea worm.
5. One way to avoid contaminated surface waters is to drill __________.

6. The Helsinki Rules are international laws regarding rights to __________.
7. As safe water becomes scarcer in the future, __________ may erupt over water resources just as with energy resources today.

Lesson 21.2: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why water distribution problems include problems with both the quantity and the quality of water.

21.3 Water Pollution

Lesson 21.3: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Diseases caused by polluted water kill millions of people every year.

_____ 2. Water pollution contributes to water shortages by making some water sources unsafe to use.

_____ 3. Water pollution affects human and environmental health only in less developed countries.

_____ 4. Municipal water pollution comes only from households and businesses.

_____ 5. Industrial water pollutants include heavy metals and organic toxins.

_____ 6. All industrial water pollutants come from factories and power plants.

_____ 7. Fertilizers that run off lawns and farm fields are extremely harmful to the environment.

_____ 8. The Mississippi is the only river that causes a dead zone.

_____ 9. Ships at sea empty their wastes directly into ocean water.

_____ 10. The most polluted areas of the ocean are coastal waters.

Lesson 21.3: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Sources of Water Pollution

Water pollution is any contaminant that gets into lakes, streams, or oceans. Water pollution is a worldwide problem. In less developed countries, the main source of water pollution is raw sewage that is dumped into water that people must use for drinking and bathing. In more developed countries, sources of water pollution include municipal, industrial, and agricultural sources.

- Municipal sources of water pollution come from the wastewater of cities and towns. The wastewater contains many different contaminants from homes and businesses. The contaminants come from inadequately treated sewage, storm drains, septic tanks, boat sewage, and yard runoff, among other sources.
- Industrial pollution comes from factories, power plants, and even hospitals. Some of the most hazardous industrial pollutants include radioactive substances, heavy metals, organic toxins, chemicals, oil and other petroleum products, and heated water.
- Agricultural pollution comes mainly from runoff water. Water running over farm fields and animal pens picks up fertilizers, pesticides, and animal wastes and carries them to bodies of water such as streams, lakes, and oceans.

Fertilizers deserve special mention as sources of water pollution. They are found in runoff from lawns, golf courses, and farm fields. Nutrients such as nitrates in fertilizers promote the growth of algae, so bodies of water polluted with fertilizers become clogged with algae. When the algae die, they decompose, and decomposition uses up all the dissolved oxygen in the water. Without oxygen, the water can no longer support aquatic organisms, including plants and fish. This creates dead zones, or areas of water in lakes and oceans that lack fish and most other aquatic organisms.

Questions

1. What is water pollution?
2. Identify the main cause of polluted water in less developed countries.
3. List the three major sources of water pollution in more developed countries.
4. Explain how fertilizers can negatively affect bodies of water such as lakes and oceans.

Lesson 21.3: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. Contaminants in municipal wastewater may come from
   a. boats that dump sewage.
   b. storm drains.
   c. yard runoff.
   d. all of the above
2. Industrial pollutants may include all of the following except
   a. radioactive substances from hospitals.
   b. chemicals from burning fossil fuels.
   c. heated water from power plants.
   d. sewage from home septic tanks.
3. Most ocean pollution comes from
   a. natural processes.
   b. floating oil rigs.
   c. large ships.
   d. land.
4. Which statement is false about the April, 2010 explosion of the Deepwater Horizon drilling rig?
   a. It caused the largest oil spill to date.
   b. It happened in the Gulf of Mexico.
   c. It occurred very close to shore.
   d. It killed 11 workers.
5. Thermal pollution occurs when
   a. hot water is released into a body of water.
   b. very cold water is released from a reservoir.
   c. the sun heats ocean water to higher-than-normal temperatures.
   d. two of the above
6. The purpose of spraying chemical dispersants on an oil spill in the ocean is to
   a. help the oil mix with the water.

b. absorb the oil from the surface of the water.
c. prevent the oil from sticking to aquatic animals.
d. cause the oil to clump together for easier removal.

7. Where do dead zones occur?

a. only in ocean water
b. in all bodies of still water
c. only in the Gulf of Mexico
d. in many bodies of water

Lesson 21.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. any contaminant that gets into lakes, streams, or oceans

_____ 2. potent neurotoxin that contaminates water in San Francisco Bay

_____ 3. major source of water pollution in developing countries

_____ 4. area in a body of water where nothing lives because of lack of oxygen

_____ 5. how most ocean pollution enters ocean water

_____ 6. any change in water temperature that is unrelated to weather

_____ 7. water contaminant that may leads to dead zones

Terms

a. dead zone

b. thermal pollution

c. mercury

d. water pollution

e. nitrate

f. sewage

g. runoff

Lesson 21.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Runoff containing fertilizer nutrients promotes the growth of __________ in bodies of water.
2. The decomposition of algae uses up dissolved __________ in the water.
3. A large dead zone in the Gulf of Mexico occurs because of pollutants carried there mainly by the __________-_ River.

4. __________ is the method of cleaning up oil spills by corralling and burning the oil.
5. Floating containment __________ are placed on the surface of water to trap spilled oil.
6. Heated water from power plants that is returned to the environment causes __________ pollution.
7. In developed countries, sources of water pollution include municipal, industrial, and __________ sources.

Lesson 21.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Some people think that the ocean is too large to be seriously affected by pollution. Using information in the lesson, explain why this is not true.

21.4 Protecting the Water Supply

Lesson 21.4: True or False

Name__________________ Class_____________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The goal of all water treatment is to make water safe to drink.

_____ 2. Many developed nations have no water treatment facilities.

_____ 3. Wastewater generally contains just a few contaminants.

_____ 4. A wastewater treatment plant must use multiple processes to produce useable water.

_____ 5. Water purification removes organisms such as bacteria and fungi from water.

_____ 6. Water pollution can be reduced by preventing water pollution and treating polluted water.

_____ 7. The EPA has the authority to finance wastewater treatment plants.

_____ 8. The long-term effects of oil spills are well understood.

_____ 9. Lawn watering is a good way to conserve water because all the water sinks into the ground.

_____ 10. In the future, water conservation will become less important.

Lesson 21.4: Critical Reading

Name__________________ Class_____________ Date________

Read this passage based on the text and answer the questions that follow.

Reducing Water Pollution

Water pollution can be reduced in two general ways:

- Prevent water from becoming polluted in the first place.
- Treat water that has already become polluted.

In the U.S., the Clean Water Act gives the Environmental Protection Agency (EPA) the authority to address water pollution in both ways. The agency is charged with setting standards for water quality, reducing the discharge of pollution into waterways, and managing runoff. The EPA is also charged with financing construction of wastewater treatment plants. Since the passage of the Clean Air Act in 1972, more wastewater treatment plants have been built and the release of wastes into the water supply is better controlled.

Internationally, the United Nations and other international groups are working to improve global water quality. They provide technology for treating water. They also educate people on how to protect and improve the quality of the water they use.

There are several things that individuals can do to protect water quality:

- Find approved recycling or disposal facilities for motor oil and household chemicals rather than pouring them down the drain or into a gutter.
- Use lawn and garden chemicals sparingly and according to directions.
- Repair automobile and boat engine leaks immediately.
- Keep pet litter and wastes, leaves, and grass clippings out of street gutters and storm drains.

Questions

1. Identify two general ways of reducing water pollution.
2. Explain how the EPA protects water quality in the U.S.
3. What is being done internationally to improve global water quality?
4. What can you do to protect water quality?

Lesson 21.4: Multiple Choice

Name____________________ **Class**_______________ **Date**_________

Circle the letter of the correct choice.

1. Types of contaminants in wastewater may include
   a. harmful bacteria.
   b. suspended solids.
   c. inorganic compounds.
   d. all of the above
2. The agency that sets standards for water quality in the U.S. is the
   a. Clean Water Agency.
   b. National Standards Agency.
   c. Environmental Protection Agency.
   d. National Oceanic and Atmospheric Agency.
3. Methods used to treat contaminated water depend on
   a. which contaminants the water contains.
   b. how clean the water needs to be.
   c. how the water will be used.
   d. all of the above
4. Which of the following is the best way to dispose of pet wastes?
   a. Throw them in the trash.
   b. Flush them down the toilet.
   c. Toss them in a street gutter.
   d. Wash them down a storm drain.
5. What does a wastewater treatment plant use to remove impurities from water?
   a. filters
   b. chemicals
   c. biological agents
   d. all of the above
6. Water that has been treated by any process
   a. contains fewer contaminants.

b. is no longer contaminated.
c. is safe to drink.
d. all of the above

7. The Clean Water Act was passed in

a. 1952.
b. 1972.
c. 1992.
d. 2012.

Lesson 21.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. U.S. agency that monitors pollution of the oceans and atmosphere

_____ 2. U.S. law controlling the pollution of water

_____ 3. taking steps to avoid wasting and polluting water

_____ 4. removal of contaminants such as solids from sewage

_____ 5. U.S. agency that protects the environment

_____ 6. removal of pollutants in order to make water safe to drink

Terms

a. sewage treatment

b. NOAA

c. water purification

d. EPA

e. Clean Water Act

f. water conservation

Lesson 21.4: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Water purification makes water suitable for __________.
2. __________ is the general term for contaminated water from municipal uses.
3. Wastewater is treated in a series of steps, each of which produces water with fewer __________.
4. In the U.S., the __________ regulates the discharge of pollution into waterways.
5. __________ showerheads reduce the amount of water used during showers.
6. __________ from the Exxon Valdez still coats rocks and sand beneath beaches in Alaska.

Lesson 21.4: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Write a brief public service announcement that explains how to conserve water in and around the home.

CHAPTER 22 HS Human Actions and the Atmosphere Worksheets

Chapter Outline

22.1 Air Pollution

Lesson 22.1: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Ozone is a gas that both protects and harms human beings.

_____ 2. All air pollutants are the result of human activities.

_____ 3. Air pollution became a crisis in the developed nations in the mid-1900s.

_____ 4. Pollutants regulated by the U.S. Clean Air Act include particulates and lead.

_____ 5. Air quality in a region depends only on the amounts of pollutants released into the atmosphere in that location.

_____ 6. The state in the U.S. with the most polluted air is New York State.

_____ 7. Secondary pollutants are pollutants that are less harmful than primary pollutants.

_____ 8. Particulates in the air may include ash, dust, and fecal matter.

_____ 9. In the presence of sunlight, nitrogen dioxide forms ozone.

_____ 10. At least three-quarters of air pollution in the U.S. comes from transportation.

Lesson 22.1: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Primary Air Pollutants

There are two basic types of air pollutants: primary air pollutants and secondary air pollutants. Primary air pollutants enter the atmosphere directly. Secondary air pollutants form in the atmosphere from chemical reactions involving other pollutants. Some primary air pollutants have natural sources. Volcanic ash is an example. Dust is also a primary pollutant with natural sources, but humans also put dust into the air with activities such as plowing fields and building roads. Most other primary pollutants are the result of human activities alone. The majority of them enter the air directly from vehicles exhaust systems and smokestacks. These primary pollutants include carbon, nitrogen, and sulfur oxides; particulates; lead; and volatile organic compounds.

- Carbon oxides include carbon monoxide and carbon dioxide. Both are colorless, odorless gases. Carbon monoxide is toxic to both plants and animals. Both carbon monoxide and carbon dioxide are greenhouse gases.
- Nitrogen oxides are produced when nitrogen and oxygen in the atmosphere come together at high temperatures. This occurs in hot exhaust gases from vehicles, power plants, and factories. Nitrogen oxides are greenhouse gases and also contribute to the formation of acid rain and ozone.

- Sulfur oxides include sulfur dioxide and sulfur trioxide. These compounds enter the air when coal is burned. Sulfur oxides contribute to the formation of acid rain.
- Particulates are solid particles, such as ash, dust, and fecal matter. Other particulates form from the combustion of fossil fuels. Particulates can produce smog and contribute to health problems such as asthma and heart disease.
- Lead is a heavy metal that was once widely used in automobile fuels, paints, and pipes. It is now banned for these uses. Lead can cause brain damage and blood poisoning.
- Volatile organic compounds (VOCs) are mostly hydrocarbons. The major VOC is methane, which occurs naturally but is increasing because of human activities, such as livestock raising. Methane is a greenhouse gas.

Questions

1. Distinguish between primary air pollutants and secondary air pollutants.
2. Identify two natural sources of primary pollutants.
3. List three primary pollutants that enter the air due to human actions. Describe their sources and adverse effects.

Lesson 22.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Where and when did photochemical smog first become a problem?
   a. in Pennsylvania in 1948
   b. in London, England, in 1952
   c. in New York City in the late 1800s
   d. in southern California after World War II
2. Pollutants regulated by the U.S. Clean Air Act include
   a. sulfur dioxide.
   b. nitrogen dioxide.
   c. carbon monoxide.
   d. all of the above
3. What is the result of the Clean Air Act in the U.S.?
   a. There is no more air pollution.
   b. The air is much cleaner.
   c. Visibility is better.
   d. two of the above
4. The smoggiest city in the U.S. in 2012 was
   a. Houston, Texas.
   b. Chicago, Illinois.
   c. San Diego, California.
   d. Los Angeles, California.
5. Examples of primary air pollutants include all of the following except
   a. carbon monoxide.
   b. nitrogen dioxide.
   c. sulfur trioxide.

   d. ozone.

6. Most air pollutants come from
   a. burning.
   b. farming.
   c. building.
   d. volcanoes erupting.
7. The most common VOC is
   a. dioxin.
   b. methane.
   c. carbon monoxide.
   d. chlorofluorocarbon.

Lesson 22.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. type of air pollution that forms when car exhaust is exposed to sunlight

_____ 2. any pollutant released directly into the environment

_____ 3. cutting and burning forests to make way for planting crops

_____ 4. any pollutant that forms from another pollutant by a chemical reaction

_____ 5. any type of solid particle that pollutes the air

_____ 6. type of chemical that pollutes the air when it evaporates

_____ 7. major component of photochemical smog

Terms

a. ozone

b. primary pollutant

c. photochemical smog

d. volatile organic compound

e. secondary pollutant

f. slash-and-burn agriculture

g. particulate

Lesson 22.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Earth's organisms are protected from ultraviolet radiation by the __________ layer.

2. Air pollution started to become a serious problem when fossil fuels began to be burned during the __________.
3. In the U.S., the 1970 __________ Act regulates almost 190 air pollutants.
4. Air pollutants may be trapped close to the ground within a cool air mass by a temperature __________.
5. A mountain range can trap air pollutants on its __________ side.
6. The main source of sulfur oxides in the air is the burning of __________.
7. __________ is the total amount of living material in an ecosystem.

Lesson 22.1: Critical Writing

Name__________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain conditions that led to passage of the U.S. Clean Air Act. Also explain how passage of the act changed U.S. air quality.

22.2 Effects of Air Pollution

Lesson 22.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The Clean Air Act regulates global air pollution.

_____ 2. Millions of Americans must breathe unhealthy air.

_____ 3. All air pollution causes some damage to living things.

_____ 4. The effects of ozone pollution accumulate in plants.

_____ 5. The only danger of nitrogen dioxide is that it causes acid rain.

_____ 6. Asthma attacks increase when particulate levels rise.

_____ 7. Normal rainwater has a neutral pH of 7.0.

_____ 8. No fish can live in water with a pH below 5.6.

_____ 9. CFC molecules create ozone from oxygen in the stratosphere.

_____ 10. The ozone hole forms over Antarctica in the winter.

Lesson 22.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Acid Rain

Acid rain is caused by sulfur and nitrogen oxides emanating from power plants or metal refineries. Tall smokestacks allow the emissions to rise high into the atmosphere and travel up to 1,000 km (600 miles) downwind. As the pollutants move, they combine with water vapor in the atmosphere to form sulfuric and nitric acids. The acid droplets form acid fog, rain, or snow; or they may be deposited dry. Most typical is acid rain.

Acid rain is rainwater that is more acidic than normal rainwater. Acidity is measured on the pH scale. Neutral substances have a pH of 7.0. Acidic substances have lower pH values, and basic (or alkaline) substances have higher pH values. Normal rain is somewhat acidic with a pH of 5.6. To be considered acid rain, rainwater must have a pH of less than 5.0. A small change in pH represents a large change in acidity. For example, rain with a pH of 4.6 is 10 times more acidic than normal rain with a pH of 5.6, and rain with a pH of 3.6 is 100 times more acidic than normal rain.

Acid precipitation ends up in soil and bodies of water. Some forest soils in the northeastern U.S. that receive a lot of acid rain are five to ten times more acidic than they were two or three decades ago. Acid rain that soaks into soil strips the soil of metals and nutrients. Soils may no longer have enough nutrients for plants to grow. Runoff from the soils carries the metals and nutrients to streams and lakes, and it makes these bodies of water even more acidic.

When lakes become too acidic, aquatic organisms die off. No fish can live if the pH of the water drops below 4.5, and organic material also cannot decay. Wildlife that depends on the lakes for drinking water may suffer population declines.

Plants—including food crops—that are exposed to acids in soils and rainwater become weak. They are more likely to be damaged by bad weather, insect pests, or disease. Snails and some other small soil organisms die in acid soils, so many birds do not have as much food to eat. Young birds and mammals do not build bones as well and may not be as strong. Eggshells may also be weak and break more easily.

Questions

1. What is acid rain? What causes it?
2. How does acid rain affect soils and bodies of water?
3. Explain the effects of acid rain on living things.

Lesson 22.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. When air contains high levels of particulates
   a. precipitation may decrease.
   b. air temperature may increase.
   c. photosynthesis may be reduced.
   d. all of the above
2. Effects on human health of nitrogen and sulfur oxides include increased rates of
   a. asthma.
   b. emphysema.
   c. viral infections.
   d. all of the above
3. Air pollutants that cause lung disease include
   a. lead.
   b. mercury.
   c. particulates.
   d. two of the above
4. Which statement about bioaccumulation is false?
   a. Compounds that bioaccumulate are usually stored in fat.
   b. Bioaccumulation is usually greatest in large predatory animals.
   c. Substances that bioaccumulate include mercury, lead, and VOCs.
   d. none of the above
5. The pH of acid rain is
   a. about 5.6.
   b. at least 7.0.
   c. less than 5.0.
   d. greater than 5.5.
6. Acid rain may

a. increase the pH of lakes.
b. add nutrients to soils.
c. damage buildings.
d. all of the above

7. The ozone hole can affect human health by increasing

a. sunburns.
b. cataracts.
c. skin cancers.
d. all of the above

Lesson 22.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. precipitation that forms when the air contains sulfur and nitrogen oxides

_____ 2. type of air pollutant that reduces visibility

_____ 3. measure of acidity

_____ 4. buildup of toxins in organisms throughout life

_____ 5. opposite of acidic

_____ 6. stratospheric cloud of frozen nitric acid molecules

_____ 7. area where the stratospheric ozone layer is dangerously thin

Terms

a. alkaline

b. particulate

c. bioaccumulation

d. ozone hole

e. pH

f. acid rain

g. PSC

Lesson 22.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The most common toxic material in the environment is the heavy metal __________.
2. Mercury bioaccumulates in organisms as the compound called __________.
3. Ozone is a pollutant when it occurs in the atmospheric layer known as the __________.

4. Ozone is beneficial when it occurs in the atmospheric layer called the __________.
5. The primary chemicals creating the ozone hole are __________.
6. Air pollutants called __________ reduce the amount of sunlight that reaches the ground.
7. Acid rain is caused by air pollution with nitrogen and sulfur __________.

Lesson 22.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Summarize how air pollution affects human health.

22.3 Reducing Air Pollution

Lesson 22.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. The Clean Air Act has decreased the emissions of six major air pollutants by more than 50 percent.

_____ 2. Solar and wind energy are now less expensive to use than fossil fuels.

_____ 3. Catalytic converters break down VOCs to harmless compounds.

_____ 4. The use of clean coal releases large amounts of carbon dioxide into the atmosphere.

_____ 5. The battery of a hybrid car is charged by sunlight hitting the car's roof.

_____ 6. A hydrogen fuel cell uses biofuel to produce energy and hydrogen gas.

_____ 7. It takes much less energy to use clean coal than regular coal.

_____ 8. More chlorofluorocarbons are used today than at any time in the past.

_____ 9. Carbon is naturally captured and sequestered in a forest.

_____ 10. A carbon tax reduces carbon dioxide emissions by encouraging conservation.

Lesson 22.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Reducing Greenhouse Gases

Climate scientists agree that climate change is a global problem that must be attacked by a unified world with a single goal. All nations must come together to reduce greenhouse gas emissions. However, getting nations to agree on useful measures has been difficult. The first attempt to control greenhouse gas emissions was the 1997 Kyoto Protocol, which was not very successful in getting nations to participate or in cutting emissions.

The easiest and quickest way is to reduce greenhouse gas emissions is to increase energy efficiency and conservation. An effective way to encourage conservation is a carbon tax placed on carbon dioxide emissions. The tax is placed on gasoline, carbon dioxide emitted by factories, and energy bills so people or businesses that emit more carbon pay more taxes. The money collected from a carbon tax can be used for research into alternative energy resources.

Another approach to reducing greenhouse gases is the development of energy alternatives, including biofuels. Biofuels can replace gasoline in vehicles. They reduce greenhouse gas emissions, but they have other problems. So far, most biofuels are produced from food crops such as corn. When food crops are used for fuel, the price of food goes up. Modern agriculture is also extremely reliant on fossil fuels for pesticides, fertilizers, and the physical work of farming. Therefore, not much energy is gained from using these biofuels instead of fossil fuels. More promising biofuel crops—including algae—are now being researched. Algae can be grown in areas that are not useful for agriculture, and they contain much more usable oil than crops such as corn.

Removing greenhouse gases from the atmosphere after they are emitted is another option. Carbon capture and sequestration occurs naturally when carbon dioxide is removed from the atmosphere by trees in forests. An obvious way to remove more carbon is to plant more trees. Unfortunately, more forests are currently being lost than gained. Carbon can also be artificially sequestered. For example, carbon can be captured from the emissions of gasification plants and then stored underground. Some small sequestration projects are in development, but large-scale sequestration has not yet been attempted.

Questions

1. What is a carbon tax? How would a carbon tax reduce greenhouse gas emissions?
2. What are the pros and cons of using biofuels instead of gasoline to power motor vehicles?
3. Explain carbon sequestration and how it tackles the problem of greenhouse gases.

Lesson 22.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Energy resources that do not create greenhouse gas emissions include
   a. wind.
   b. gasoline.
   c. clean coal.
   d. two of the above
2. Ways to reduce air pollution from motor vehicles include
   a. using catalytic converters.
   b. making vehicles more fuel-efficient.
   c. using fuel cells instead of fossil fuels.
   d. all of the above
3. The success of the Montreal Protocol means that
   a. there will be fewer cases of skin cancer in the future.
   b. global warming will slow down and start to reverse.
   c. there will be less carbon in Earth's atmosphere.
   d. two of the above
4. The Kyoto Protocol
   a. set limits on CFC production.
   b. devised a cap-and-trade system.
   c. placed a ban on all fossil fuel use.
   d. controlled emissions of lead and mercury.
5. Which statement about hydrogen fuel cells is false?
   a. They produce no pollutants.
   b. They are extremely efficient.
   c. They use hydrogen and oxygen.
   d. They are widely used in hybrid cars.
6. Scrubbers reduce the formation of acid rain by

a. gasifying high-sulfur coal to create syngas.
b. filtering particulates out of industrial emissions.
c. using catalysts to break down sulfur and nitrogen oxides.
d. capping the amount of carbon dioxide released in exhaust gases.

7. Carbon sequestration can be increased by

a. planting trees.
b. using less coal.
c. driving electric cars.
d. all of the above

Lesson 22.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. vehicle that runs on both electricity and gasoline

_____ 2. technology that turns coal to gas so it is less polluting when burned

_____ 3. any means of storing carbon so there is less carbon dioxide in the atmosphere

_____ 4. device on motor vehicles that breaks down harmful pollutants before they are emitted in exhaust

_____ 5. system that provides financial incentives to cap greenhouse gas emissions

_____ 6. battery that converts chemical energy into electrical energy to run a vehicle

_____ 7. device that removes particles and waste gases from factory or power plant exhaust

Terms

a. catalytic converter

b. hybrid car

c. fuel cell

d. scrubber

e. gasification

f. cap-and-trade

g. carbon sequestration

Lesson 22.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. A tax placed on carbon dioxide emissions to help reduce greenhouse gases is called a(n) __________ tax.
2. A(n) __________ is a fuel made from plants or algae that can replace gasoline and reduce fossil fuel use.
3. A chemical that speeds up chemical reactions is a(n) __________.

4. The __________ Protocol is an international agreement to reduce CFCs.
5. The __________ Protocol is an international agreement to reduce greenhouse gases.
6. The goal of the Montreal Protocol is to protect the __________ layer.
7. The goal of the Kyoto Protocol is to prevent __________ change.

Lesson 22.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Identify and explain three ways to reduce air pollution from motor vehicles.

CHAPTER 23 HS Observing and Exploring Space Worksheets

Chapter Outline

23.1 Telescopes

Lesson 23.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Light travels faster than anything else in the universe.

_____ 2. It takes 1 light-year for light from the sun to reach Earth.

_____ 3. When we look at stars, we are seeing back in time.

_____ 4. Visible light makes up most of the electromagnetic spectrum.

_____ 5. EM waves with longer wavelengths have higher frequencies.

_____ 6. The color of visible light is determined by its wavelength.

_____ 7. Hotter stars give off light with longer wavelengths.

_____ 8. Scientists can see more clearly with space telescopes because they are closer to stars.

_____ 9. With his telescope, Galileo discovered that Jupiter has orbiting moons.

_____ 10. From the spectrum of a star, an astronomer can determine the star's temperature.

Lesson 23.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Optical Telescopes

Optical telescopes are telescopes that gather and focus visible light from distant objects and make the objects appear bigger and closer. The earliest true optical telescopes, which were made in Europe in the late 16th century, were optical telescopes. They used a combination of two curved lenses to focus light. The term telescope was coined by the Italian scientist and mathematician Galileo Galilei (1564–1642). Galileo built his first telescope in 1608 and subsequently made many improvements to telescope design, which allowed him to make important observations of our solar system and galaxy.

Optical telescopes that use lenses focus light by refracting, or bending, it. These optical telescopes are called refracting telescopes. The earliest telescopes, including Galileo's, were all refracting telescopes. Many of the small telescopes used by amateur astronomers today are refracting telescopes. The largest refracting telescope in the world is at the University of Chicago's Yerkes Observatory in Wisconsin and was built in 1897. Its largest lens has a diameter of 102 cm.

Around 1670, another famous scientist and mathematician—Sir Isaac Newton (1643–1727)—built a new kind of optical telescope using mirrors instead of lenses. The mirrors were curved to reflect and focus light. This type of telescope is called a reflecting telescope. Reflecting telescopes have advantages over refracting telescopes. One advantage is that mirrors are easier than lenses to make precisely. The mirrors in a reflecting telescope are also much lighter than the heavy glass lenses in a refracting telescope, so reflecting telescopes can be larger without becoming too heavy. Larger telescopes can collect more light, so they allow scientists to view dimmer or more distant objects. The largest optical telescopes in the world today are reflecting telescopes.

Questions

1. What is an optical telescope? When were optical telescopes first invented?
2. Compare and contrast refracting and reflecting telescopes.
3. Describe contributions to telescope technology that were made by Galileo and Newton.

Lesson 23.1: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. The main source of information used by astronomers to learn about objects in space is
   a. comets.
   b. meteorites.
   c. constellations.
   d. electromagnetic waves.
2. The speed of light through space is
   a. 9.5 million m/s.
   b. 300 million m/s.
   c. 4.2 billion m/s.
   d. 3 billion m/s.
3. Higher frequency electromagnetic waves have
   a. less energy.
   b. longer wavelengths.
   c. greater speeds.
   d. none of the above
4. EM radiation from the faintest, most distant objects in the universe are in the form of
   a. X-rays.
   b. gamma rays.
   c. infrared light.
   d. radio waves.
5. The first telescopes were made in Europe in the late
   a. 1300s.
   b. 1500s.
   c. 1700s.
   d. 1900s.
6. All of the following are optical telescopes except
   a. radio telescopes.
   b. reflecting telescopes.
   c. refracting telescopes.
   d. catadioptric telescopes.

7. NASA's four space-based Great Observatories were designed to view the universe
    a. in different seasons of the year.
    b. at different angles from Earth's axis.
    c. in different ranges of the EM spectrum.
    d. at different distances from Earth's surface.

Lesson 23.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. energy that is transmitted across space as waves

_____ 2. device that uses both mirrors and lenses to make distant objects appear larger

_____ 3. type of EM radiation emitted by very cool stars

_____ 4. type of EM radiation with the lowest frequencies

_____ 5. device that bends light with lenses to make distant objects appear larger

_____ 6. type of EM radiation with the shortest wavelengths

_____ 7. device that breaks down light into its component colors

Terms

a. spectrometer

b. gamma waves

c. catadioptric telescope

d. radio waves

e. electromagnetic radiation

f. refracting telescope

g. infrared light

Lesson 23.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Scientists who study the universe beyond Earth are called __________.
2. The distance that light travels in one year is a unit called the __________.
3. A pattern in the sky made by stars as seen from Earth is known as a(n) __________.
4. The Hubble telescope is an example of a(n) __________ telescope.
5. Some very hot stars emit primarily __________ light.
6. Isaac Newton used mirrors to create the first __________ telescope.
7. Telescopes that collect radio waves instead of visible light are called __________ telescopes.

Lesson 23.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain what astronomers can learn about distant objects in the universe from electromagnetic radiation.

23.2 Early Space Exploration

Lesson 23.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The first rockets ever used were launched in the 20th century.

_____ 2. The first liquid-fuel rockets to be built were designed by Robert Goddard.

_____ 3. Wernher von Braun joined NASA and helped design rockets for space travel.

_____ 4. The first satellite ever to orbit Earth was put into space by the United States.

_____ 5. The scientist who first explained how satellites stay in orbit was Hermann Oberth.

_____ 6. Over the past 50 years, thousands of artificial satellites have been put into orbit around Earth.

_____ 7. The speed of a satellite depends on how high it is above the object it is orbiting.

_____ 8. U.S. Mariner missions sent space probes to the outer solar system.

_____ 9. U.S. Voyager probes are now traveling toward the sun.

_____ 10. The U.S.S.R. sent probes to Venus and landed some of them on the surface.

Lesson 23.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Types of Satellites and Their Orbits

Since the first artificial Earth satellite was launched more than 50 years ago, thousands of artificial satellites have been put into orbit around our planet. We have even put satellites into orbit around the Moon, the Sun, and several other planets. Depending on their purpose, there are four main types of satellites: imaging satellites, communications satellites, navigational satellites, and the International Space Station.

- Imaging satellites take pictures of Earth's surface that are used for military or scientific purposes. For example, meteorologists use imaging satellites to study Earth's weather. Astronomers use them to study the Moon and other planets.
- Communications satellites are designed to receive and send signals for telephone, television, or other types of communications.
- Navigational satellites are used for navigation systems, such as the Global Positioning System (GPS).
- The International Space Station (ISS), the largest artificial satellite, allows humans to live in space while conducting scientific research.

The speed of a satellite depends on how high it is above Earth's surface. Satellites that are relatively close to Earth are said to be in low-Earth orbit (LEO). Satellites in LEO are often in polar orbit. This means that they travel over the North and South Poles and move in a direction that is perpendicular to the direction of Earth's rotation. Because Earth rotates beneath a polar-orbit satellite, the satellite is over a different part of Earth's surface each time it circles the planet. Imaging satellites and weather satellites are often put in low-Earth, polar orbits. A satellite placed at just the right distance above Earth—35,786 km (22,240 miles)—orbits Earth at the same rate of speed that Earth spins on its axis. When such a satellite orbits Earth in the same direction as Earth's rotation, it is always over the same position on Earth's surface. This type of orbit is called a geostationary orbit (GEO). Many communications satellites are in geostationary orbits.

Questions

1. Identify four main types of satellites based on their purpose.
2. Describe a polar orbit, and explain why a satellite in a polar orbit is over a different part of Earth's surface each time it circles the planet.
3. What is a geostationary orbit? What is required for a satellite to be in this type of orbit? Which of the four main types of satellites have geostationary orbits?

Lesson 23.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The scientist who first developed the idea of multi-stage rockets was
   a. Tsiolkovsky.
   b. Goddard.
   c. Oberth.
   d. von Braun.
2. Newton's law of universal gravitation explains
   a. how the moon stays in orbit around Earth.
   b. why objects on Earth always fall toward the ground.
   c. why objects in motion stay in motion unless acted upon by a net force.
   d. two of the above
3. Human beings have put satellites into orbit around
   a. Earth.
   b. the sun.
   c. the moon.
   d. all of the above
4. Satellites in low-Earth orbit generally orbit over the
   a. poles.
   b. equator.
   c. same place on Earth's surface.
   d. two of the above
5. The space race was a competition to explore space that occurred after World War II between the U.S. and
   a. Germany.
   b. Saudi Arabia.
   c. the Soviet Union.
   d. the European Union.

6. The first human being to travel into space was the U.S. astronaut
   a. John Glenn.
   b. Buzz Aldrin.
   c. Alan Shepherd.
   d. Neil Armstrong.
7. The U.S. Viking missions landed space probes on
   a. Mars.
   b. Venus.
   c. Jupiter.
   d. Mercury.

Lesson 23.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. any object that orbits a larger object

_____ 2. name of the force that pushes a rocket forward

_____ 3. type of spacecraft that does not have human occupants

_____ 4. law that explains how satellites stay in orbit

_____ 5. vehicle propelled by particles flying out of one end

_____ 6. law that explains how a rocket works

_____ 7. circular or elliptical path around an object

Terms

a. rocket

b. law of universal gravitation

c. orbit

d. thrust

e. satellite

f. space probe

g. third law of motion

Lesson 23.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. According to Newton's __________ law of motion, to every action there is an equal and opposite reaction.
2. To escape Earth's gravity, rockets must use fuels in the __________ state.

3. One of the first uses of rockets in space was to launch __________.
4. Satellites that take pictures of Earth's surface are called __________ satellites.
5. Earth's largest artificial satellite is the __________.
6. An artificial satellite that orbits Earth at the same speed that Earth rotates has a(n) __________ orbit.
7. The first artificial satellite ever put into orbit around Earth was named __________.

Lesson 23.2: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how a rocket works and why multi-stage rockets are needed to escape Earth's gravity.

23.3 Recent Space Exploration

Lesson 23.3: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The first space station was put into orbit by the United States.

_____ 2. Skylab studied the effects on humans of living in space.

_____ 3. The ISS was constructed piece by piece over time.

_____ 4. The Soviets put a total of three Salyut space stations into orbit.

_____ 5. Early space exploration was driven by competition between the U.S. and U.S.S.R. during the cold war.

_____ 6. There have been eight American space shuttles.

_____ 7. The American space shuttle program was terminated in 2011.

_____ 8. The Mars Pathfinder was a rover that explored the surface of Mars.

_____ 9. The Cassini mission has been studying the rings and moons of Saturn.

_____ 10. The stardust mission collected tiny dust particles from the surface of Jupiter.

Lesson 23.3: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Recent Space Missions

The U.S. and other nations have had many missions around the solar system in recent years. For example, the U.S. has sent several rovers—essentially spacecraft on wheels—to roam over the surface of Mars in order to collect data. The Mars Pathfinder spacecraft, which landed on Mars in 1997, carried the rover named Sojourner. Sojourner moved over the Martian surface collecting data on rocks, soils, and weather factors such as wind. This was the first of a series of missions to Mars that included rovers. Sojourner was followed by two rovers, named Spirit and Opportunity, which landed on Mars in 2003. They explored the Martian surface and the planet's geology. The goal of their mission was to search for and characterize a wide range of rocks and soils that hold clues to past water activity on Mars. Another Mars rover, named Curiosity, is currently exploring the Martian surface. Curiosity is a car-sized robotic rover that was launched in 2011 and landed on Mars in 2012. Curiosity's goals include investigating Martian climate and geology and whether life ever could have existed on Mars.

Other planets and bodies of our solar system are also being explored. For example, the Cassini mission has been studying Saturn, including its rings and moons, since 2004. The Huygens probe, built by the European Space Agency, is studying Saturn's moon Titan. They are interested in Titan because it has some of the conditions that are needed to support life. Other missions are studying the smaller objects in our solar system. For example, the Deep Impact probe was sent to collide with a comet and collect particles from it. The Stardust mission collected particles from another comet. Missions are currently underway to study some of the larger asteroids and the dwarf planet Pluto. Studies of these smaller objects in the solar system may help us to understand how the solar system formed.

Questions

1. Identify some of the rovers that have explored Mars and what they have investigated.
2. List three recent non-Martian missions and their objectives.
3. What might we learn by studying smaller objects in the solar system?

Lesson 23.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Which statement about Skylab is false?
   a. It was launched in 1973.
   b. It was a U.S. space station.
   c. Astronauts never lived on it.
   d. It was used to study the sun.
2. Which statement about Mir is false?
   a. It was launched by the U.S.
   b. It fell into the Pacific Ocean.
   c. It was a modular space station.
   d. American astronauts lived on it.
3. Countries sponsoring the ISS include
   a. Japan.
   b. Brazil.
   c. Canada.
   d. all of the above
4. The International Space Station
   a. was begun in 1987.
   b. was completed in 2011.
   c. was first occupied in 1995.
   d. all of the above
5. People have been transported to and from the International Space Station mainly by
   a. Russian space shuttles.
   b. American space shuttles.
   c. Russian Soyuz spacecraft.
   d. American Apollo spacecraft.
6. The part(s) of a space shuttle that is (are) reused include the
   a. orbiter.
   b. fuel tank.
   c. booster rockets.
   d. two of the above
7. Which of the following craft has (have) explored the surface of Mars?

a. Spirit
b. Atlantis
c. Explorer
d. two of the above

Lesson 23.3: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. first space station ever put into orbit

_____ 2. space station that is a joint project of the U.S. and several other nations

_____ 3. any large spacecraft on which humans can live for extended periods

_____ 4. part of a space shuttle that can be navigated like an airplane

_____ 5. first space station launched by the U.S.

_____ 6. reusable spacecraft for carrying people and cargo

_____ 7. first space station designed for long-term use

Terms

a. space station

b. Salyut 1

c. Skylab

d. Mir

e. International Space Station

f. orbiter

g. space shuttle

Lesson 23.3: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Early space exploration was driven by competition between the U.S. and the __________.
2. The first space station that involved international cooperation was the __________.
3. The primary purpose of the International Space Station is __________.
4. The part of a space shuttle that astronauts land back on Earth is the __________.
5. The space shuttles named Challenger and __________ exploded or burned up, killing all aboard.
6. NASA's __________ satellites take detailed images of Earth's continents and coasts.
7. Spacecraft on wheels that explore planets are called __________.

Lesson 23.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how the end of the Cold War changed space exploration.

CHAPTER 24 HS Earth, Moon, and Sun Worksheets

Chapter Outline

24.1 Planet Earth

Lesson 24.1: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Earth's diameter is longer through the poles than through the equator.

_____ 2. Earth's magnetic field extends several thousands of kilometers into space.

_____ 3. Earth's axis of rotation passes through the north and south poles.

_____ 4. One complete rotation of Earth requires a little more than 24 hours.

_____ 5. A swinging pendulum appears to change direction because of Earth's revolution.

_____ 6. Earth's speed of rotation is greatest at the equator.

_____ 7. Earth has seasons because its orbit around the sun is elliptical.

_____ 8. Earth travels about 150 million kilometers during one revolution.

_____ 9. Earth revolves around the sun at a constant speed.

_____ 10. Earth's axis is tilted 23 $\frac{1}{2}$ degrees relative to a line drawn perpendicular to the equator.

Lesson 24.1: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Earth's Motions

Imagine a line passing through the center of Earth that goes through both poles. This imaginary line is called an axis. Earth spins around its axis in a movement called rotation. Earth also orbits, or revolves around, the sun. This movement is called revolution.

In 1851, long before Earth could be viewed from space, a French scientist named Léon Foucault determined that Earth rotates. He did this by watching the movement of a pendulum. A pendulum is a heavy weight that swings back and forth on a string. Foucault knew that after a pendulum is set in motion, it will keep moving in the same direction. When Foucault observed his pendulum, it seemed to change direction, so he concluded that Earth must be moving beneath the swinging pendulum.

Earth requires 23 hours, 56 minutes, and 4 seconds to make one complete rotation on its axis. However, because Earth revolves around the sun at the same time that it is rotating, the planet must turn a little bit more to reach the same position relative to the sun. This explains why the length of a day on Earth is actually 24 hours. At the equator, Earth rotates at its maximum speed of about 1,700 km/h. It rotates more slowly at high latitudes, down to a speed of little more than zero km/h at the poles.

For Earth to make one complete revolution around the sun takes 365.24 days. The amount of time Earth—or any planet—takes to revolve around the sun is the definition of a year. The gravitational pull of the sun keeps Earth and the other planets in orbit around it. Like the orbits of the other planets, Earth's orbit is elliptical rather than circular, so the planet is farther away from the sun at some points in its orbit than others. The closest Earth gets to the sun each year is about 147 million km, which is called perihelion. It occurs on about January 3rd. The farthest Earth gets from the sun each year is about 152 million km, which is called aphelion. It occurs on about July 4th. Earth revolves around the sun at an average speed of about 27 km/s, but it moves more slowly at aphelion and more quickly at perihelion.

Questions

1. Define and describe Earth's rotation and revolution.
2. Why did Foucault conclude that Earth rotates?
3. Why does a day last slightly longer than it takes Earth to make one complete rotation?
4. Compare and contrast Earth's perihelion and aphelion.

Lesson 24.1: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Earth is similar to the other inner planets in the solar system in its
   a. size.
   b. shape.
   c. composition.
   d. all of the above
2. When a ship sails away from shore, people watching from shore see the bottom of the ship disappear first. This is because the
   a. atmosphere obscures it.
   b. surface of Earth is curved.
   c. planet is rotating on its axis.
   d. ship sinks deeper into the water.
3. Earth's magnetic field resembles the magnetic field of a
   a. bar magnet.
   b. spherical magnet.
   c. horseshoe magnet.
   d. none of the above
4. Earth's magnetic field
   a. extends far out into space.
   b. shields the planet from solar radiation.
   c. is small in comparison with the size of Earth.
   d. two of the above
5. Earth is farthest from the sun during
   a. summer in the Northern Hemisphere.
   b. winter in the Northern Hemisphere.
   c. summer in the Southern Hemisphere.
   d. different seasons from year to year.

6. Compared with Earth when it is at its aphelion, when the planet is at its perihelion, it is
    a. closer to the sun.
    b. moving more quickly around the sun.
    c. rotating on its axis at a slower speed.
    d. two of the above
7. Earth has seasons because of changes in
    a. its distance from the sun.
    b. the direction its axis tilts.
    c. the angle at which its axis tilts.
    d. its direction of rotation on its axis.

Lesson 24.1: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. place in Earth's orbit where it is farthest from the sun

_____ 2. spinning of an object around an axis

_____ 3. imaginary line through Earth between the poles

_____ 4. half of a sphere such as Earth

_____ 5. movement of an object in an orbit around another object

_____ 6. place in Earth's orbit where it is closest to the sun

_____ 7. shape of Earth's orbit

Terms

a. hemisphere

b. ellipse

c. revolution

d. perihelion

e. rotation

f. aphelion

g. axis

Lesson 24.1: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Earth has a magnetic field because of convection of molten metals in its __________ core.
2. In 1851, the French scientist Foucault observed a swinging __________ and concluded that Earth rotates.

3. Earth rotates __________ quickly at its poles than it does at its equator.
4. The amount of time it takes Earth to revolve around the sun is the definition of a(n) __________.
5. During summer in the Southern Hemisphere, the __________ tilts toward the sun.
6. The exact shape of Earth is not a perfect sphere but a(n) __________.
7. Earth is one of the __________ planets of our solar system.

Lesson 24.1: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain two ways that people knew Earth was spherical long before they could observe the shape of Earth from space.

24.2 Earth's Moon

Lesson 24.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Astronauts first walked on the moon in 1969.

_____ 2. The moon is about one-third the size of Earth.

_____ 3. The same side of the moon always faces Earth.

_____ 4. The far side of the moon has a thinner crust and more maria.

_____ 5. The moon gives off no light of its own.

_____ 6. The far side of the moon has been seen only by spacecraft.

_____ 7. The moon's surface temperature is always very low.

_____ 8. Volcanic activity ceased on the moon more than a billion years ago.

_____ 9. The moon has several high mountain ranges.

_____ 10. There is evidence of ancient life on the moon.

Lesson 24.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

The Lunar Surface

The moon has no atmosphere. Because an atmosphere moderates temperature, the moon's average surface temperature has a lot of variation. During the day, the surface temperature averages about 225 degrees F, but it drops to -243 degrees F at night. The coldest temperatures on the moon, at around -397 degrees F, occur in craters in the permanently shaded south polar basin. These are among the coldest temperatures recorded in the entire solar system.

The landscape of the moon is unchanging. With no plate tectonics, new surface features are not built. With no atmosphere, existing surface features are not weathered away. A major type of surface feature on the moon is craters, which are caused by meteorite impacts. Most of these occurred at least a billion years ago, but because there is no weathering, the craters still look as they did when they first formed.

Even without a telescope, you can see from Earth that the moon has dark-colored areas and light-colored areas. The dark-colored areas are called maria, and they cover about 16 percent of the moon's surface, mostly on the near side of the moon. The term maria means "seas," because people long ago thought the dark areas were seas of water, like those on Earth. However, the maria are not areas of water but areas of flat basaltic rock. From about 3.0 to 3.5 billion years ago the moon was continually bombarded by meteorites. Some of these meteorites were so large that they broke through the moon's newly formed surface. Then magma flowed out and filled the craters, forming the basaltic maria. Scientists estimate that this activity ceased about 1.2 billion years ago.

The light-colored parts of the moon are called terrae, or highlands. Terrae have higher elevations than maria and include several high mountain ranges. Terrae consist of light silicate minerals that precipitated out of the ancient magma ocean and formed the early lunar crust.

There are no lakes, rivers, or even small puddles of liquid water anywhere on the moon's surface. However, this doesn't mean that the moon lacks water. Frozen water has been found in the extremely cold craters of the moon and also bound up in the lunar soil.

Questions

1. Explain why surface temperatures on the moon vary from extremely hot to extremely cold.
2. Why is the landscape of the moon unchanging?
3. Compare and contrast maria and terrae on the moon's surface, including how each type of feature formed.
4. Where and in what state is water found on the moon?

Lesson 24.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Areas on the moon called maria
   a. are seas of water.
   b. consist of basaltic lava.
   c. formed a million years ago.
   d. two of the above
2. The surface of the moon includes
   a. craters.
   b. mountains.
   c. polar ice caps.
   d. two of the above
3. The moon's core
   a. is relatively small.
   b. contains very little iron.
   c. consists mostly of nickel.
   d. is composed of igneous rock.
4. The mantle of the moon
   a. is composed of two layers.
   b. may have high levels of iron.
   c. contains the mineral olivine.
   d. all of the above
5. The moon's crust is rich in the elements
   a. silicon.
   b. oxygen.
   c. magnesium.
   d. all of the above

6. For the moon to make one complete rotation, it takes about 4
   a. hours.
   b. days.
   c. weeks.
   d. none of the above
7. The moon has no
   a. water.
   b. atmosphere.
   c. plate tectonics.
   d. two of the above

Lesson 24.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. dark-colored, flat areas on the surface of the moon

_____ 2. relating to the moon

_____ 3. the moon's innermost layer

_____ 4. amount of time it takes the moon to make one complete revolution

_____ 5. bowl-shaped depression caused by a meteorite impact

_____ 6. light-colored, highland areas on the surface of the moon

_____ 7. the moon's outermost layer

Terms

a. orbital period

b. crust

c. crater

d. lunar

e. maria

f. core

g. terrae

Lesson 24.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Earth's only natural satellite is the __________.
2. The moon orbits Earth because of the force of __________.

3. The moon is __________ dense than Earth.
4. Earth's gravity is __________ times greater than the moon's gravity.
5. The moon's orbital period is __________ days.
6. We can see the moon from Earth only because it __________ light from the sun.
7. Features on the moon's surface do not wear down because the moon has no __________.

Lesson 24.2: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

The footprints of astronauts in dust on the moon will remain undisturbed for as long as the moon exists unless they are struck by a meteorite. Explain why.

24.3 The Sun

Lesson 24.3: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. The sun is divided into definite internal layers.

_____ 2. The hottest part of the sun has a temperature of about 27 million °C.

_____ 3. During nuclear fusion inside the sun, helium combines to form hydrogen.

_____ 4. A photon may travel through the radiative zone in just a few seconds.

_____ 5. Material that rises through the convective zone cools at the sun's surface.

_____ 6. The photosphere has a grainy appearance because it has several different colors.

_____ 7. The sun's corona has a much cooler temperature than its photosphere.

_____ 8. The sun's atmosphere consists of three layers.

_____ 9. A sunspot occurs where a loop of the sun's magnetic field breaks through the solar surface.

_____ 10. Sunspots usually occur in cycles that repeat every 21 years.

Lesson 24.3: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Surface Features of the Sun

The most noticeable surface features of the sun are dark spots known as sunspots. Sunspots are located where loops of the sun's magnetic field break through the surface. This disrupts the smooth transfer of heat from lower layers of the sun, making sunspots cooler and darker than the rest of the surface. Sunspots are also marked by intense magnetic activity. Sunspots usually occur in pairs. When a loop of the sun's magnetic field breaks through the surface, a sunspot is created where the loop comes out of the surface. Another sunspot is created where the loop goes back into the surface.

There are other types of interruptions of the sun's magnetic field that are apparent on the surface. If a loop of the sun's magnetic field snaps and breaks, it creates a solar flare, which is a violent explosion that releases huge amounts of energy. A solar flare releases streams of highly energetic particles that make up solar wind. Solar wind sends out large amounts of radiation that can harm the human body, so it can be dangerous to astronauts in spacecraft. On Earth, solar flares have knocked out entire power grids and disturbed radio, satellite, and cell phone communications.

Another highly visible feature on the sun's surface is a solar prominence. A solar prominence is a glowing arch that forms where plasma flows along a loop of the sun's magnetic field from sunspot to sunspot. A solar prominence may reach thousands of kilometers into the sun's atmosphere. Prominences can last for a day to several months. They are clearly visible during a total solar eclipse.

Questions

1. Explain how sunspots form. Describe how they look and why they look this way.
2. Why do sunspots usually occur in pairs?
3. What is a solar flare. How do solar flares cause solar wind?
4. Describe a solar prominence. Explain how a solar prominence is related to sunspots.

Lesson 24.3: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. About what percent of the total mass of the solar system consists of the sun?
   a. 1 percent
   b. 15 percent
   c. 75 percent
   d. 99 percent
2. Convective movement in the sun helps to create
   a. solar flares.
   b. sunspots.
   c. photons.
   d. two of the above
3. Which of the following layers of the sun has the highest temperature?
   a. photosphere
   b. chromosphere
   c. radiative zone
   d. corona
4. Solar flares can
   a. knock out power grids.
   b. be dangerous to astronauts.
   c. disturb radio communications.
   d. all of the above
5. Which statement about solar prominences is true?
   a. They can reach thousands of kilometers into the sun's atmosphere.
   b. They are never visible, even during a total solar eclipse.
   c. They last at most for a few minutes.
   d. all of the above
6. NASA's Solar Dynamics Observatory is
   a. landing rovers on the sun's surface.
   b. providing high clarity images of the sun.
   c. examining the sun's innermost core.
   d. two of the above
7. The matter of the sun

a. is made of superheated gas.
b. has a negative electrical charge.
c. forms a defined outer boundary.
d. has a maximum temperature of 1 million °C.

Lesson 24.3: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. outermost plasma layer of the sun that forms a halo around the sun

_____ 2. layer of the sun just outside the core through which energy from the core travels very slowly

_____ 3. glowing arch formed when plasma flows along a loop from sunspot to sunspot

_____ 4. layer of the sun just outside the radiative zone through which hot material rises

_____ 5. thin layer of the sun that glows red when heated by energy from the photosphere

_____ 6. violent explosion that occurs when a loop of the sun's magnetic field snaps and breaks

_____ 7. relatively cool visible surface of the sun that emits sunlight

Terms

a. chromosphere

b. corona

c. photosphere

d. solar flare

e. solar prominence

f. convection zone

g. radiative zone

Lesson 24.3: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The sun's energy comes from the type of reaction called nuclear __________.
2. Light energy travels as particles called__________.
3. Most atoms in the sun exist in the state of matter referred to as __________.
4. The sun is composed almost entirely of the elements hydrogen and __________.
5. Relatively cool, dark areas on the surface of the sun are known as __________.
6. A stream of highly magnetic particles from a solar flare makes up solar __________.
7. The innermost layer of the sun is called the __________ of the sun.

Lesson 24.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why the sun has so much energy and how this energy travels from the sun's core to its surface.

24.4 The Sun and the Earth-Moon System

Lesson 24.4: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. If the moon is full on March 1st, it will be full again on March 15th.

_____ 2. From Earth, the moon appears to rise in the west and set in the east.

_____ 3. Earth is closest to the sun when it is summer in the Northern Hemisphere.

_____ 4. The sun rises earlier and sets later in the summer than in the winter.

_____ 5. During a solar eclipse, the moon casts a shadow on the sun.

_____ 6. During a lunar eclipse, Earth casts a shadow on the moon.

_____ 7. A lunar eclipse occurs only when Earth, the moon, and the sun are in the ecliptic.

_____ 8. During a full moon, the far side of the moon is completely dark.

_____ 9. The waning gibbous phase of the moon occurs after the first quarter phase.

_____ 10. A high tide occurs only on the side of Earth facing the moon.

Lesson 24.4: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Earth's Tides

Earth's tides are the regular rising and falling of Earth's surface waters in response to the gravitational attraction of the moon and sun. The moon's gravity pulls most strongly on Earth's waters on the side of Earth facing the moon. This causes the water to bulge out from the surface in the direction of the moon. At the same time, another high tide occurs on the opposite side of Earth. This high tide occurs because the moon pulls Earth slightly away from the overlying surface water. The overlying water bulges out from the surface because it is pulled by the moon less strongly. The places in between the two high tides experience low tides because some of the water is drawn away to the high tide locations. There are two high tides and two low tides each day in a given location. Because Earth is rotating on its axis, the tidal cycle moves around the globe in a 24-hour period.

The gravity of the sun also pulls Earth's surface waters toward it, but the sun's pull is weaker than the moon's pull because the sun is so much farther away. When the sun and moon are in a straight line with respect to Earth, which occurs during the new and full moon phases, their gravities combine to create a spring tide. During a spring tide, high tides are at their highest and low tides are at their lowest, creating the greatest tidal range during each two-week period. When the sun and moon are at right angles with respect to Earth, which occurs during the first and third quarter moon phases, their gravities pull in different directions to create a neap tide. During a neap tide, high tides are at their lowest and low tides are at their highest, creating the least tidal range during each two-week period.

Questions

1. Explain how the moon causes high and low tides.
2. What is a spring tide? When and why does it occur?
3. What is a neap tide? When and why does it occur?

Lesson 24.4: Multiple Choice

Name____________________ Class_______________ Date_________

Circle the letter of the correct choice.

1. Motions of the moon and sun relative to Earth are responsible for
   a. tides.
   b. eclipses.
   c. moon phases.
   d. all of the above
2. The sun appears to move from east to west across the sky each day because Earth
   a. rotates in a clockwise direction.
   b. rotates from east to west.
   c. rotates from west to east.
   d. two of the above
3. When does the winter solstice occur in the Northern Hemisphere?
   a. June 21
   b. March 21
   c. September 21
   d. December 21
4. Which statement about solar eclipses is false?
   a. They are rare.
   b. They last only a few minutes.
   c. They may be partial or total eclipses.
   d. They occur during the full moon phase.
5. Which statement about lunar eclipses is false?
   a. They can be seen from any place with a view of the moon.
   b. They cause the moon to disappear completely.
   c. They occur at least twice a year.
   d. They may last for hours.
6. When does the first quarter phase of the moon occur?
   a. one week after the full moon phase
   b. two weeks after the new moon phase
   c. three weeks after the new moon phase
   d. two weeks after the third quarter phase
7. How does the moon appear during the first quarter phase?


a.


b.


c.


d.

Lesson 24.4: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. event that occurs when the full moon moves through Earth's shadow

_____ 2. dark area shaped like an object that occurs where the object obstructs light

_____ 3. phase of the moon when the near side is more than half lit but not full

_____ 4. event that may occur when the new moon passes directly between Earth and the sun

_____ 5. outer part of Earth's shadow during a lunar eclipse where light is only partly blocked

_____ 6. phase of the moon when the near side is less than half lit but not new

_____ 7. inner part of Earth's shadow during a lunar eclipse where light is completely blocked

Terms

a. crescent

b. gibbous

c. lunar eclipse

d. penumbra

e. shadow

f. solar eclipse

g. umbra

Lesson 24.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. In the Northern Hemisphere, the sun is directly over the Tropic of Cancer on the day called the __________.
2. A(n) __________ solar eclipse occurs when the moon's shadow completely blocks the sun.
3. A(n) __________ lunar eclipse occurs when only part of the moon is within Earth's umbra.
4. The moon is in the __________ phase when Earth is between the moon and the sun.
5. The moon is in the __________ phase when the moon is between Earth and the sun.
6. A(n) __________ tide occurs when there is the greatest difference between high and low tides.
7. A(n) __________ tide occurs when there is the least difference between high and low tides.

Lesson 24.4: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast solar and lunar eclipses.

Chapter 25 HS The Solar System Worksheets

Chapter Outline

25.1 Introduction to the Solar System

Lesson 25.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. The ancient Greeks believed that Earth was at the center of the universe.

_____ 2. Ptolemy's geocentric model was rejected after about 100 years.

_____ 3. Copernicus thought that planets orbit the sun in ellipses.

_____ 4. Galileo was found guilty of heresy for supporting Copernicus' model.

_____ 5. Other stars besides our sun have planets revolving around them.

_____ 6. Thousands of extrasolar planets have been discovered.

_____ 7. The asteroid belt lies between Earth and Mars.

_____ 8. The length of a day on a planet can be determined from its orbital period.

_____ 9. One astronomical unit is equal to about 93 million kilometers.

_____ 10. The strength of gravity between two objects depends on their mass and distance apart.

Lesson 25.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Formation of the Solar System

All of the planets in our solar system lie in nearly the same plane. All of them also orbit the sun in the same direction. These two features provide important clues about how the solar system formed.

The most widely accepted explanation for the formation of the solar system is called the nebular hypothesis. According to this hypothesis, the sun and planets of our solar system formed about 4.6 billion years ago from the collapse of a giant cloud of gas and dust called a nebula. The nebula collapsed because it was drawn together by gravity. Gravity increased at the center of the collapsing nebula, and the cloud started to spin. As the nebula collapsed further, the spinning got faster. Much of the cloud's mass migrated to its center, but the rest of the material flattened out in an enormous disk.

As gravity pulled matter toward the center of the disk, the density and pressure at the center became intense. When the pressure at the center was high enough, nuclear fusion began. At this point, the sun came into existence. The outward force of nuclear energy from the sun countered the inward pull of gravity, and this stopped the disk from collapsing further.

Meanwhile, the outer parts of the disk were starting to cool. Matter condensed from the cloud, and small pieces of dust started clumping together. These clumps collided and combined with other clumps. Larger clumps, called planetesimals, attracted smaller clumps with their gravity. Eventually, the planetesimals formed protoplanets, which grew to become the planets and moons that exist in the solar system today. Gravity at the center of the disk attracted heavier particles, such as rock and metal, while lighter particles remained farther out toward the edge of the disk. Because of this gravitational sorting of material, the inner planets—Mercury, Venus, Earth, and Mars—formed from dense rock and metal, whereas the outer planets—Jupiter, Saturn, Uranus and Neptune—formed from lighter materials such as hydrogen, helium, water, ammonia, and methane.

Questions

1. List two features of the solar system that provide clues about its formation.
2. In the nebular hypothesis, why did the nebula start to collapse?
3. Describe how the sun formed, according to the nebular hypothesis.
4. How does the nebular hypothesis account for the formation of planets?
5. Based on the nebular hypothesis, why are the inner planets denser than the outer planets?

Lesson 25.1: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. A problem with the geocentric model is that some planets seem to move backwards. Ptolemy resolved this problem by introducing the idea of
   a. nebulas.
   b. epicycles.
   c. elliptical orbits.
   d. heliocentric orbits.
2. Copernicus' model of the solar system was an improvement on Ptolemy's model because it
   a. was less complicated.
   b. perfectly described planetary movements.
   c. included planetary motions called deferents.
   d. two of the above
3. Using his telescope, Galileo made observations that supported the heliocentric model. They included the observation(s) that
   a. Venus has phases like the moon.
   b. Jupiter has moons orbiting around it.
   c. planets have elliptical orbits called epicycles.
   d. two of the above
4. Our solar system includes
   a. more than 500 moons.
   b. four dwarf planets.
   c. nine planets.
   d. all of the above
5. Exoplanets are often detected indirectly from evidence such as periodic changes in a star's
   a. radial velocity.
   b. temperature.
   c. brightness.

   d. two of the above

6. Which of the following planets has the smallest mass?
   a. Venus
   b. Earth
   c. Mars
   d. Uranus
7. Which of the following planets has the longest day?
   a. Mercury
   b. Venus
   c. Earth
   d. Mars

Lesson 25.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. scientist who revised the geocentric model of the solar system to account for retrograde motions of some planets

_____ 2. shift from an Earth-centered to a sun-centered model of the solar system

_____ 3. model of the solar system that places the sun at the center

_____ 4. scientist who discovered that the orbits of planets are elliptical rather than circular

_____ 5. model of the solar system that places Earth at the center

_____ 6. most widely accepted explanation for how the solar system formed

_____ 7. scientist who provided evidence for the heliocentric model of the solar system

Terms

a. geocentric model

b. heliocentric model

c. Ptolemy

d. nebular hypothesis

e. Galileo

f. Kepler

g. Copernican revolution

Lesson 25.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. Planets orbiting stars other than our own sun are called __________.
2. Astronomers now know that the solar system contains a total of __________ planets.
3. The planet in the solar system with the greatest diameter and mass is __________.
4. When planets are farther from the sun, the distance between their orbits is __________.
5. The distance from Earth to the sun is equal to one __________.
6. A planet that has a greater distance from the sun has a(n) __________ year.
7. The giant cloud of gas and dust from which our solar system formed is called a(n) __________.

Lesson 25.1: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Summarize how our understanding of the solar system changed from the ancient Greeks through Galileo and Kepler.

25.2 Inner Planets

Lesson 25.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. Venus is the only inner planet that has been explored by rovers.

_____ 2. All of the inner planets have iron cores.

_____ 3. Mercury's surface is covered with volcanoes.

_____ 4. From Earth, Venus appears very bright because its surface is so hot that it glows.

_____ 5. Clouds on Venus contain carbon dioxide, sulfur dioxide, and sulfuric acid.

_____ 6. Venus has more volcanoes than any other planet in the solar system.

_____ 7. Volcanic activity on Venus is caused by plate tectonics.

_____ 8. Mars has been studied more thoroughly than any other planet except Earth.

_____ 9. Mars appears to be red in color because of iron oxide in its soil.

_____ 10. Water cannot stay in the liquid state on Mars because its temperature is too low.

Lesson 25.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Venus

Of all the planets in our solar system, Venus is most similar to Earth in size and density. Venus is also our nearest neighbor. In addition, Venus' interior structure is similar to Earth's, with a large iron core and a silicate mantle. But the resemblance between the two inner planets ends there.

One way that Venus differs from Earth—and from all of the other planets in the solar system—is its direction of rotation. Venus rotates in a direction opposite to the direction that it orbits the sun, whereas the rest of the planets rotate in the same direction that they orbit the sun. Venus' rotation is also extremely slow, with just one rotation every 243 days. This is longer than the 224 days it takes Venus to orbit the sun, so a day on Venus is longer than a year.

Like Earth, Venus has an atmosphere, but the atmosphere is very different from Earth's atmosphere. Venus' atmosphere consists mostly of carbon dioxide with some sulfur dioxide and sulfuric acid, which is highly corrosive. Because carbon dioxide is a greenhouse gas, Venus' atmosphere traps heat from the sun and creates a powerful greenhouse effect. Although Venus is farther from the sun than Mercury, the greenhouse effect makes Venus hotter than Mercury. In fact, Venus is the hottest planet in the solar system. Temperatures at the surface reach 465 degrees Celsius, which is hot enough to melt lead! The atmosphere of Venus is also extremely thick. Because of the thickness of the atmosphere, the atmospheric pressure on the planet's surface is 90 times greater than the atmospheric pressure on Earth's surface.

Like Earth, Venus has many volcanoes. In fact, the surface of the planet is covered by large areas of volcanoes surrounded by plains of lava, and some of the volcanoes may be active. On Earth, volcanoes erupt along tectonic plate boundaries. On Venus, which lacks tectonic plates, heat builds up inside the planet and has no way to escape. The heat keeps building up until it finally destroys the crust and allows magma to erupt onto the surface.

Questions

1. In what ways does Venus resemble Earth?
2. How is Venus' rotation unique among all the planets in the solar system?
3. Explain how Venus' atmosphere compares with that of Earth.
4. Describe volcanic activity on Venus.

Lesson 25.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. The terrestrial planets include
   a. Mars.
   b. Venus.
   c. Mercury.
   d. all of the above
2. All of the inner planets
   a. have one or more moons.
   b. are made of igneous rock.
   c. have been geologically active.
   d. two of the above
3. Compared with the outer planets, the inner planets have
   a. slower rotations.
   b. longer orbits.
   c. more rings.
   d. more moons.
4. Temperatures vary widely on Mercury because it has
   a. almost no atmosphere.
   b. water on the surface.
   c. rapid rotation.
   d. a thin crust.
5. Venus is very similar to Earth in terms of its
   a. size.
   b. density.
   c. atmospheric pressure.
   d. two of the above
6. On which planet is a year shorter than a day?

a. Mercury
b. Venus
c. Earth
d. Mars

7. Compared with Earth, Mars is

a. smaller.
b. colder.
c. drier.
d. all of the above

Lesson 25.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. any of the four planets closest to the sun

_____ 2. smallest planet in the solar system

_____ 3. feature shared by all of the inner planets

_____ 4. any planet farther from the sun than Mars

_____ 5. planet with the highest temperatures

_____ 6. feature found only on Earth and Mars

_____ 7. inner planet that has two moons

Terms

a. ice cap

b. Mars

c. Mercury

d. outer planet

e. iron core

f. Venus

g. inner planet

Lesson 25.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The inner planets are also called __________ planets because they are similar to Earth.
2. The only inner planet that has a large moon is __________.
3. About 42 percent of Mercury's volume consists of its __________.

4. The planet that is Earth's closest neighbor is __________.
5. The planet with the largest mountain in the solar system is __________.
6. The only planet that rotates in a direction opposite to the direction it revolves is __________.
7. The moons of Mars are thought be captured __________.

Lesson 25.2: Critical Writing

Name__________________ Class_____________ Date_______

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Of all the inner planets besides Earth, Mars is the most likely ever to have had life. Explain why.

25.3 Outer Planets

Lesson 25.3: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. All of the outer planets are much larger than the inner planets.

_____ 2. The gas giant Jupiter has a total of 27 known moons.

_____ 3. The upper layer of Jupiter's atmosphere contains clouds of ammonia.

_____ 4. Jupiter's moon Europa is heated by radiation from Jupiter.

_____ 5. Voyager series spacecraft visited Jupiter and its moons.

_____ 6. There are more storms on Saturn than any other outer planet.

_____ 7. Saturn's rings are firmly attached to the surface of the planet.

_____ 8. Saturn's largest moon Titan is bigger than the planet Mercury.

_____ 9. Scientists think that Uranus was knocked over by a collision with a planet-sized object.

_____ 10. Uranus was discovered by Galileo in the early 1600s.

Lesson 25.3: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Neptune

Neptune is the only planet that cannot be seen from Earth without a telescope. Scientists predicted the existence of Neptune before it was actually discovered. They noticed that Uranus was not always located exactly where it should be. They assumed that the gravitational pull of another planet beyond Uranus was affecting Uranus' orbit. Neptune was discovered in 1846, in the position that had been predicted. In many respects, Neptune is similar to Uranus, although Neptune has slightly more mass and a slightly smaller diameter. Neptune is also much farther from the sun, at nearly 4.5 billion kilometers. It takes Neptune 165 Earth years to complete one orbit.

Neptune's composition is similar to that of the other gas giants. It has an atmosphere composed of hydrogen, helium, and methane gas; a mantle of water, ammonia, and methane ice; and a core of rock and ice. Neptune's blue color is mostly due to its frozen methane. Neptune has a very turbulent atmosphere. The winds on Neptune are stronger than those on any other planet in the solar system, reaching speeds of 1100 kilometers per hour, which is close to the speed of sound. This extreme weather surprised astronomers, because the planet receives little energy from the sun to power weather systems. Neptune is also one of the coldest places in the solar system. Temperatures at the top of the clouds are about -218 degrees Celsius.

Like the other outer planets, Neptune has rings of ice and dust. However, the rings are faint and may change or disappear over fairly short periods of time. Neptune has 13 known moons. The only one that has enough mass to be pulled into a spherical shape by its own gravity is Triton. This moon orbits in the opposite direction to the orbit of Neptune. Scientists think that Triton did not form near Neptune but instead was captured by Neptune's gravity as it passed by.

Questions

1. How did scientists predict the existence of Neptune before it was discovered?
2. In what ways is Neptune similar to the other outer planets?
3. Describe Neptune's weather.
4. Why do scientists think that Triton did not form near Neptune?

Lesson 25.3: Multiple Choice

Name____________________ Class_______________ Date________

Circle the letter of the correct choice.

1. The outer planets include all of the following planets except
   a. Jupiter.
   b. Saturn.
   c. Uranus.
   d. Venus.
2. All of the outer planets have
   a. multiple moons.
   b. planetary rings.
   c. solid surfaces.
   d. two of the above
3. From Earth, Jupiter appears to be very bright in the night sky because it is
   a. very large and reflects a lot of sunlight.
   b. one of the hottest planets in the solar system.
   c. almost as close to Earth as Venus, the brightest planet.
   d. none of the above
4. The largest moon in the solar system is the moon named
   a. Titan.
   b. Triton.
   c. Oberon.
   d. Ganymede.
5. Besides Earth, which planet in the solar system has been observed to have thunderstorms?
   a. Jupiter
   b. Saturn
   c. Uranus
   d. Neptune
6. Why does Uranus appear blue?
   a. It is covered with a thick layer of bluish ice.
   b. Only blue light can travel that far from the sun.
   c. It has clouds of methane that filter out red light.

d. none of the above

7. How many moons does Uranus have?
   a. 13
   b. 27
   c. 63
   d. 67

Lesson 25.3: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. largest planet in the solar system

_____ 2. least dense of all the planets in the solar system

_____ 3. dust and other small particles that encircle an outer planet

_____ 4. planet with stronger winds than any other planet in the solar system

_____ 5. huge storm on the surface of Jupiter

_____ 6. gap in the methane clouds on Neptune

_____ 7. only planet in the solar system with an axis almost parallel to its orbit

Terms

a. Great Dark Spot

b. Jupiter

c. Saturn

d. planetary ring

e. Uranus

f. Great Red Spot

g. Neptune

Lesson 25.3: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. The outer planets are made largely of gases, so they are also called __________.
2. The outer planets consist mainly of the elements helium and __________.
3. The four moons of Jupiter named Io, Europa, Ganymede, and Callisto are called collectively __________-moons.
4. The only planet with rings that are easy to see from Earth is __________.
5. The only planet that cannot be seen from Earth without a telescope is __________.

6. The existence of __________ was predicted before it was discovered because of its influence on Uranus' orbit.
7. Most of the moons of __________ are named for characters in Shakespeare's plays.

Lesson 25.3: Critical Writing

Name___________________ **Class**______________ **Date**________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

The inner planets are also called the terrestrial planets. The outer planets could accurately be called the non-terrestrial planets. Explain why.

25.4 Other Objects in the Solar System

Lesson 25.4: True or False

Name____________________ Class_______________ Date_________

Write true if the statement is true or false if the statement is false.

_____ 1. Most asteroids are geologically active.

_____ 2. Asteroid impacts are linked to mass extinctions in Earth's past.

_____ 3. A total of about 5000 asteroids have been discovered.

_____ 4. Scientists think that the asteroid belt formed more recently than the rest of the solar system.

_____ 5. Meteors range from the size of boulders down to the size of grains of sand.

_____ 6. Most meteors burn up in the atmosphere.

_____ 7. The Kuiper belt contains comets, asteroids, and dwarf planets.

_____ 8. Ceres is a dwarf planet located in the Kuiper belt.

_____ 9. Eris was once considered to be the tenth planet in the solar system.

_____ 10. Astronomers think there may be many undiscovered dwarf planets in our solar system.

Lesson 25.4: Critical Reading

Name____________________ Class_______________ Date_________

Read this passage based on the text and answer the questions that follow.

Planet or Dwarf Planet?

From the time it was discovered in 1930 until 2006, Pluto was considered the ninth planet in our solar system. When astronomers first observed Pluto, telescopes were not as powerful as they are now, so Pluto and its moon Charon were thought to be one larger object. With stronger telescopes, astronomers realized that Pluto was much smaller than they had thought. Over time, astronomers learned more about Pluto and found that it differed from the other planets in additional ways. For example, unlike the outer planets, which are gas giants, Pluto is icy and rocky. Pluto's orbit is also tilted relative to the orbits of the other planets, and its orbit is longer and narrower. Scientists also discovered that Pluto's orbit is part of the Kuiper belt, a distant region of the solar system where more than 200 million small objects orbit the sun.

Astronomers began to debate whether Pluto and other newly discovered, similar objects should be classified as planets. They decided that they needed to refine their definition of planet. According to the new definition, a planet must:

- orbit a star rather than another planet so it is not a moon.
- be small enough that it isn't a star.
- have enough mass that its gravity pulls it into a spherical shape.

- have enough gravity to have cleared its orbit of smaller objects.

Pluto does not fit the revised definition of a planet. It meets the first three criteria in the list above, but as part of the Kuiper belt, it does not meet the fourth criterion. To classify Pluto and similar orbiting objects, astronomers came up with a new category, the dwarf planet. A dwarf planet is an object that meets all the criteria of a planet except for clearing its orbit of other objects. In addition to Pluto, there are currently three other known dwarf planets in the solar system: Eris, Ceres, and Makemake.

Questions

1. How does Pluto differ from the planets in our solar system?
2. What is the new (post-2006) definition of a planet?
3. What is a dwarf planet? Why is Pluto classified as a dwarf planet?

Lesson 25.4: Multiple Choice

Name___________________ **Class**______________ **Date**________

Circle the letter of the correct choice.

1. An asteroid lacks all of the following except
   a. a spherical shape.
   b. an atmosphere.
   c. internal heat.
   d. gravity.
2. Possible origins of meteoroids include
   a. asteroids.
   b. comet tails.
   c. the planet Mars.
   d. all of the above
3. Water may have been brought to early Earth when it collided with
   a. comets.
   b. asteroids.
   c. meteoroids.
   d. other planets.
4. Why does the tail of a comet always point away from the sun?
   a. The tail is pulled by planetary gravity.
   b. The tail is pushed by particles from the sun.
   c. The tail has a hooked shape because of the comet's spin.
   d. none of the above
5. Comets with periods of thousands or millions of years originate in a region of the solar system called the
   a. asteroid belt.
   b. Kuiper belt.
   c. Oort cloud.
   d. outer belt.
6. Which of the following is classified as a dwarf planet?
   a. Hydra

b. Charon
c. Dysnomia
d. Makemake

7. Which of the following statements describes a planet but not a dwarf planet?
   a. It has enough mass to form a spherical shape.
   b. It has cleared its orbit of smaller objects.
   c. It is not a moon of a larger planet.
   d. It orbits around a star.

Lesson 25.4: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. what a meteor is called after it lands on Earth

_____ 2. small, icy object with a very elliptical orbit around the sun

_____ 3. very small, rocky body that orbits the sun

_____ 4. one of Pluto's moons

_____ 5. what a meteor is called before it enters Earth's atmosphere

_____ 6. one of the solar system's dwarf planets

_____ 7. small piece of rock burning up as it passes through Earth's atmosphere

Terms

a. asteroid

b. Hydra

c. meteorite

d. Ceres

e. meteor

f. comet

g. meteoroid

Lesson 25.4: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Most of the asteroids in the solar system are found between Mars and Jupiter in a band called the __________.
2. Earth's moon is thought to have originated from Earth when the planet was struck by a large __________.
3. Asteroids with orbits that cross Earth's orbit are called __________ asteroids.
4. A(n) __________ occurs when Earth passes through a cluster of meteoroids.

5. The time between one appearance of a comet and the next is called the comet's __________.
6. Comets that reappear every 200 years or less originate in a region of the solar system called the __________.
7. The largest known dwarf planet in the solar system is named __________.

Lesson 25.4: Critical Writing

Name__________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Scientists are very interested in studying asteroids. Explain why.

CHAPTER 26 HS Stars, Galaxies, and the Universe Worksheets

Chapter Outline

26.1 Stars

Lesson 26.1: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. A given constellation is always in the same place in the sky.

_____ 2. All the stars in a constellation are actually very close together.

_____ 3. Many stars produce much more energy than our sun.

_____ 4. Gravity prevents nuclear fusion from causing a star to collapse.

_____ 5. All the energy from stars is in the form of visible or ultraviolet light.

_____ 6. An orange star is hotter than a yellow star.

_____ 7. For main sequence stars, temperature is directly related to brightness.

_____ 8. Larger stars spend more time as main sequence stars than smaller stars do.

_____ 9. A star that is a red giant will next become a white dwarf.

_____ 10. All elements with an atomic number greater than lithium formed in stars by nuclear fusion.

Lesson 26.1: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

How Stars Are Classified

The color of a star reflects its surface temperature. The temperature of a star, in turn, is influenced by the star's size. Smaller stars produce less energy, so they generally have cooler surface temperatures than larger stars. Relatively cool stars are red, warmer stars are orange or yellow, and extremely hot stars are blue or blue-white. Color is the most common way to classify stars. The **Table** 26.1 shows the classification system. The class of a star is given by a letter, and each letter corresponds to a color and range of temperatures.

TABLE 26.1: Classification of Stars By Color and Temperature

Class	Color	Temperature Range	Sample Star
O	Blue	30,000 K or more	Zeta Ophiuchi
B	Blue-white	10,000–30,000 K	Rigel
A	White	7,500–10,000 K	Altair
F	Yellowish-white	6,000–7,500 K	Procyon A
G	Yellow	5,500–6,000 K	Sun
K	Orange	3,500–5,000 K	Epsilon Indi

TABLE 26.1: (continued)

Class	Color	Temperature Range	Sample Star
M	Red	2,000–3,500 K	Betelgeuse, Proxima Centauri

Questions

1. Relate the color of a star to its surface temperature.
2. Explain how a star's size influences its temperature.
3. About how much hotter is a class G star such as our sun than a class M class star such as Betelgeuse? Which class has stars about twice as hot as the sun? Give an example of a star in this class.

Lesson 26.1: Multiple Choice

Name____________________ **Class**_______________ **Date**________

Circle the letter of the correct choice.

1. Main sequence stars may differ in all of the following ways except
   a. age.
   b. size.
   c. temperature.
   d. composition.
2. What may change about a constellation?
   a. its location in the sky
   b. the stars it contains
   c. the relative positions of its stars
   d. none of the above
3. In main sequence stars, nuclear fusion results in the formation of
   a. hydrogen.
   b. helium.
   c. carbon.
   d. all of the above
4. Which color indicates a star with the highest temperature?
   a. red
   b. orange
   c. yellow
   d. blue
5. For main sequence stars, a Hertzsprung-Russell diagram shows the stars' temperature and
   a. color.
   b. brightness.
   c. mass.
   d. size.
6. In which stage do stars spend most of their life?
   a. red giant

b. blue giant
c. white dwarf
d. main sequence

7. After a supernova explosion, the core of a star may become a(n)

a. red supergiant.
b. neutron star.
c. black hole.
d. b or c above

Lesson 26.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions

_____ 1. stage in which a star's force of nuclear fusion balances its force of gravity

_____ 2. violent explosion of a red supergiant

_____ 3. stage in which a star consists almost entirely of neutral particles

_____ 4. stage in which a star's outer layers have started to cool and grow outward

_____ 5. stage in which a typical star has completely stopped fusion

_____ 6. cluster of stars that appear close together in the sky

_____ 7. collapsed core of a star that is too dense for light to escape its gravity

Terms

a. asterism

b. main sequence

c. neutron star

d. red giant

e. white dwarf

f. supernova

g. black hole

Lesson 26.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. A giant ball of glowing gas at a very high temperature is a(n) __________.
2. __________ is an apparent shift in position that is used to measure a star's distance.
3. All stars get their energy from a type of reaction called __________.
4. The color of a star is an indication of the star's __________.

5. A bigger star tends to have a(n) __________ temperature than a smaller star.
6. What happens to a red giant after it burns up all of its helium depends on its __________.
7. When our own sun completely stops fusion, it will become a(n) __________.

Lesson 26.1: Critical Writing

Name__________________ Class_____________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how parallax is used to measure the distance of stars.

26.2 Galaxies

Lesson 26.2: True or False

Name___________________ Class______________ Date________

Write true if the statement is true or false if the statement is false.

_____ 1. There are a total of about 5 million galaxies in the universe.

_____ 2. Star clusters contain greater numbers of stars than galaxies do.

_____ 3. The Pleiades, or Seven Sisters, is an example of a star cluster.

_____ 4. Globular clusters have a lot of dust in addition to stars.

_____ 5. The Andromeda Galaxy is an example of an irregular galaxy.

_____ 6. The reason we can't see many dwarf galaxies is that they are so distant.

_____ 7. The Milky Way Galaxy has a disk and central bulge.

_____ 8. Our solar system is at the outermost edge of our galaxy.

_____ 9. Constellations are binary or multiple star systems.

_____ 10. More than half of the bright stars we see in our galaxy are actually star systems.

Lesson 26.2: Critical Reading

Name___________________ Class______________ Date________

Read this passage based on the text and answer the questions that follow.

Types of Galaxies

Galaxies are the biggest groups of stars in the universe. They can contain anywhere from a few million to many billions of stars. Galaxies are divided into three types according to shape: spiral, elliptical, and irregular galaxies.

- Spiral galaxies spin and appear as a rotating disk of stars and dust, with a bulge in the middle. Several spiral arms reach outward from the central bulge like the arms of a pinwheel. Spiral galaxies have lots of gas and dust. Most of their stars are young and blue in color.
- Elliptical galaxies are more-or-less egg shaped. The smallest elliptical galaxies are as small as some globular clusters. The largest elliptical galaxies can contain over a trillion stars. Most stars in elliptical galaxies are reddish to yellowish in color because they are old stars. Most elliptical galaxies contain very little gas and dust because these particles have already formed into stars.
- Irregular galaxies are neither elliptical nor spiral in shape. Most irregular galaxies were once spiral or elliptical galaxies that were then deformed. This may have happened by gravitational attraction to a larger galaxy or by collision with another galaxy.

Dwarf galaxies are small galaxies containing only a few million or billion stars. Dwarf galaxies are the most common type of galaxies in the universe. However, because they are small, they are also dim, so we don't see very many dwarf galaxies from Earth. Most dwarf galaxies are irregular in shape. However, there are also dwarf elliptical galaxies and dwarf spiral galaxies. Dwarf galaxies are often found near larger galaxies. They sometimes collide and merge with their larger neighbors.

Questions

1. What are galaxies?
2. Compare and contrast spiral, elliptical, and irregular galaxies.
3. Describe dwarf galaxies.

Lesson 26.2: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Stars in an open cluster are generally
   a. red.
   b. old.
   c. from the same nebula.
   d. two of the above
2. Groups of stars that contain the greatest numbers of stars are
   a. globular clusters.
   b. open clusters.
   c. star systems.
   d. galaxies.
3. Types of galaxies by shape include
   a. dwarf galaxies.
   b. elliptical galaxies.
   c. regular galaxies.
   d. all of the above
4. Dwarf galaxies are
   a. relatively rare.
   b. not very bright.
   c. mostly spiral shaped.
   d. two of the above
5. The Milky Way Galaxy
   a. is a dwarf galaxy.
   b. is an elliptical galaxy.
   c. has spiral arms.
   d. has 1 to 2 million stars.
6. Which statement(s) about irregular galaxies is (are) true?
   a. Most were once spiral or elliptical galaxies.
   b. They became irregular when they were deformed.
   c. They were changed by gravity or a collision.
   d. all of the above
7. Globular clusters

a. are spherical in shape.
b. contain mostly blue stars.
c. have widely spaced stars.
d. contain billions of stars.

Lesson 26.2: Matching

Name___________________ **Class**______________ **Date**________

Match each definition with the correct term.

Definitions

_____ 1. group of up to a few thousand stars held loosely together by gravity

_____ 2. type of galaxy that forms a rotating disk

_____ 3. group of many thousand stars held tightly together by gravity

_____ 4. type of galaxy that is shaped like an egg

_____ 5. type of galaxy that is most common in the universe

_____ 6. any group of millions, billions, or even trillions of stars

_____ 7. type of galaxy that has no definite shape

Terms

a. dwarf galaxy

b. elliptical galaxy

c. globular cluster

d. irregular galaxy

e. open cluster

f. spiral galaxy

g. galaxy

Lesson 26.2: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. Our solar system is located in the __________ Galaxy.
2. A set of stars that are grouped closely together is called a star __________.
3. Hundreds or thousands of stars that are grouped closely together make up a star __________.
4. A system of two stars orbiting each other is called a(n) __________.
5. A spiral galaxy has projections called __________.
6. Based on its shape, the Milky Way Galaxy is classified as a(n) __________ galaxy.
7. At the center of most galaxies is a supermassive __________.

Lesson 26.2: Critical Writing

Name____________________ Class_______________ Date_________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how scientists determined the shape of the Milky Way Galaxy, including the types of evidence they used.

26.3 The Universe

Lesson 26.3: True or False

Name___________________ **Class**______________ **Date**________

Write true if the statement is true or false if the statement is false.

_____ 1. Hubble was the first scientist to discover that the universe is much larger than our own galaxy.

_____ 2. Today we know that there are as many galaxies in the universe as there are stars in our galaxy.

_____ 3. The existence of redshift demonstrates that other stars in the Milky Way Galaxy are moving away from our solar system.

_____ 4. Evidence has proven conclusively that the Big Bang theory is correct.

_____ 5. Scientists think that light-emitting objects now make up most of the matter in the universe.

_____ 6. Dark matter has no mass so it has no gravity.

_____ 7. Most astronomers think that the universe will expand more slowly in the future than it is expanding now.

_____ 8. Some scientists estimate that there is currently more dark energy than ordinary energy in the universe.

_____ 9. Gravitational lensing provides evidence for the existence of dark matter.

_____ 10. A similar principle explains both redshift and the Doppler effect.

Lesson 26.3: Critical Reading

Name___________________ **Class**______________ **Date**________

Read this passage based on the text and answer the questions that follow.

Formation of the Universe

The Big Bang theory is the most widely accepted cosmological explanation for how the universe formed. According to the Big Bang theory, the universe began about 13.7 billion years ago, before which everything in the universe was squeezed into a very small volume. This means that at the beginning, the entire known universe was a single, hot, chaotic mass. Then, an enormous explosion—a big bang—caused the universe to start expanding rapidly. According to the Big Bang theory, all of the matter and energy in the universe, and even space itself, came out of this explosion.

In the first few moments after the Big Bang, the universe was unimaginably hot and dense. As the universe expanded, it became less dense and began to cool. After only a few seconds, protons, neutrons, and electrons began to form. After a few minutes, protons and neutrons came together to create hydrogen nuclei. Energy in the universe was great enough to initiate nuclear fusion, and hydrogen nuclei fused together to become helium nuclei. However, the first neutral atoms (atoms that included electrons) did not form until about 380,000 years later. Scientists think that matter in the early universe was not evenly distributed across space. Instead, there existed dense clumps of matter held together by gravity. Eventually, these clumps became the countless trillions of stars, billions of galaxies, and other structures we now know to make up the visible mass of the universe.

When it was first proposed, the Big Bang theory was just a hypothesis. Many astronomers did not accept it and thought that the universe was static. However, nearly all astronomers came to accept the hypothesis when an important line of evidence for the Big Bang was discovered in 1964. After that, the Big Bang hypothesis achieved the status of a scientific theory. Two researchers at Bell Laboratories, using a microwave receiver, learned that the background radiation of the universe gave space a temperature of 3 Kelvin, not 0 Kelvin, which would be expected in a static universe. Although this is a small amount of heat, it was enough for most scientists to agree that it must be left over from the Big Bang.

Questions

1. What is the Big Bang theory?
2. Outline the events that occurred after the initial big bang.
3. What evidence convinced most astronomers that the Big Bang hypothesis should be considered a scientific theory?

Lesson 26.3: Multiple Choice

Name___________________ Class______________ Date________

Circle the letter of the correct choice.

1. Dark bands in the spectrum of light from a star show where elements in the star
   a. absorb light.
   b. reflect light.
   c. refract light.
   d. shift light.
2. What occurs as the universe expands?
   a. Solar systems get larger.
   b. Galaxies increase in size.
   c. The space between galaxies increases.
   d. all of the above
3. Prior to their acceptance of the Big Bang theory, most astronomers thought that the universe was
   a. unchanging.
   b. growing bigger.
   c. shrinking in size.
   d. alternately contracting and expanding.
4. After the Big Bang occurred, scientists think that the universe
   a. started to expand.
   b. grew less dense.
   c. began to cool.
   d. all of the above
5. How do scientists know that dark matter exists?
   a. Its heat raises the temperature of space.
   b. Its gravity affects objects around it.
   c. It gives off electromagnetic waves.
   d. all of the above
6. Astronomers have discovered recently that the rate at which the universe is expanding is

a. increasing.
b. decreasing.
c. staying the same.
d. impossible to determine.

7. Massive astrophysical compact halo objects (MACHOS) include objects in

a. black holes.
b. neutron stars.
c. white dwarfs.
d. two of the above

Lesson 26.3: Matching

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

Definitions

_____ 1. all the matter, energy, space, and time that ever existed and will ever exist

_____ 2. observation that more distant galaxies are moving away from us more quickly than closer galaxies

_____ 3. change in the color of light absorbed by an object as it moves away from an observer

_____ 4. proposed form of energy that we currently are unable to detect

_____ 5. most widely accepted explanation for how the universe formed

_____ 6. matter in the universe that does not give off electromagnetic radiation

_____ 7. shift in the pitch of sound as the sound source moves away from the listener

Terms

a. Hubble's law

b. Big Bang theory

c. dark energy

d. Doppler effect

e. universe

f. dark matter

g. redshift

Lesson 26.3: Fill in the Blank

Name___________________ **Class**______________ **Date**________

Fill in the blank with the appropriate term.

1. The study of the universe is called __________.
2. The scientist who discovered that there are galaxies beyond the Milky Way Galaxy was __________.
3. The element helium was first discovered in the __________.

4. Based on Hubble's law, scientists concluded that the universe is __________.
5. According to the Big Bang theory, the universe began about __________ years ago.
6. Scientists think that about 80 percent of matter in the universe is __________ matter.
7. __________ occurs when light from a very distant source bends around a super-massive object.

Lesson 26.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

An inflating balloon is sometimes used as an analogy for an expanding universe. Critique this analogy.

CONCEPT 27 CK-12 Earth Science For High School Workbook Answers