HOLT

Earth Science

Directed Reading Workbook

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Directed Reading Worksheets

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: What Is Earth Science?

1. For thousands of years, people have looked at the world and wondered what _____ shaped it.

2. How did cultures throughout history attempt to explain events such as volcano eruptions, earthquakes, and eclipses?

_____

_____

_____

3. How does modern science attempt to understand Earth and its changing landscape?

_____

_____

THE SCIENTIFIC STUDY OF EARTH

_____ **4.** Scientists in China began keeping records of earthquakes as early as
- **a.** 200 BCE.
- **b.** 480 BCE.
- **c.** 780 BCE.
- **d.** 1780 BCE.

_____ **5.** What kind of catalog did the ancient Greeks compile?
- **a.** a catalog of rocks and minerals
- **b.** a catalog of stars in the universe
- **c.** a catalog of gods and goddesses
- **d.** a catalog of fashion

_____ **6.** What did the Maya track in ancient times?
- **a.** the tides
- **b.** the movement of people and animals
- **c.** changes in rocks and minerals
- **d.** the movements of the sun, moon, and planets

_____ **7.** Based on their observations, the Maya created
- **a.** jewelry.
- **b.** calendars.
- **c.** books.
- **d.** pyramids.

_____ **8.** For a long time, scientific discoveries were limited to
- **a.** observations of phenomena that could be made with the help of scientific instruments.
- **b.** observations of phenomena that could not be seen, only imagined.
- **c.** myths and legends surrounding phenomena.
- **d.** observations of phenomena that could be seen with the unaided eye.

_____ **9.** What inventions in the 17th century made seeing previously hidden worlds possible?
- **a.** the astrolabe and the compass
- **b.** the microscope and the telescope
- **c.** the microscope and the corrective lens
- **d.** binoculars and magnifiers

_____ **10.** Earth science is the scientific study of
- **a.** astrology.
- **b.** supernatural phenomena.
- **c.** cosmetology.
- **d.** Earth and the universe around it.

_____ **11.** It is assumed in Earth science that causes of natural events, or phenomena,
- **a.** can be understood through careful observation and experimentation.
- **b.** can be understood through methods other than careful observation and experimentation.
- **c.** will not be understood until the next century.
- **d.** can never be fully understood.

BRANCHES OF EARTH SCIENCE

_____ **12.** What improves when technology, such as new processes or equipment, is developed?
- **a.** the ability to change human nature
- **b.** the ability to make observations
- **c.** the ability to prevent wars
- **d.** the ability to prevent natural disasters

_____ **13.** The four major areas of study in Earth science are
- **a.** volcanology, astronomy, geology, and meteorology.
- **b.** the solid Earth, the oceans, the atmosphere, and the universe beyond Earth.
- **c.** the Earth around us, the Earth we can see, the Earth we cannot see, and the universe.
- **d.** geography, agriculture, astronomy, and astrology.

_____ **14.** Geology is the scientific study of
- **a.** rocks, maps, processes, and technology of Earth.
- **b.** legends, observations, technology, and structure of the solid Earth.
- **c.** the origin and history of Mayan culture.
- **d.** the origin, history, structure of Earth, and the processes that shape Earth.

_____ **15.** Areas of study for geologists might include
- **a.** the atmosphere, climate, and weather patterns.
- **b.** Earth's crust, forces within Earth, and fossils.
- **c.** chemistry, physics, and math.
- **d.** diet, nutrition, and exercise.

16. What is the scientific study of the oceans called?

_____

17. Name four features of the ocean that oceanographers study.

_____

_____

_____

_____

18. A branch of science called _____ is the scientific study of Earth's atmosphere, especially in relation to weather and climate.

_____

19. Name two technologies that meteorologists use to study the atmospheric conditions that produce weather.

_____

_____

20. Name three weather factors that meteorologists measure.

_____

_____

_____

21. Define *climate*.

_____

_____

22. The scientific study of the universe, called _____, is one of the oldest branches of Earth science.

23. How long ago were the ancient Babylonians charting positions of the planets and stars?

_____

24. Modern astronomers use Earth- and space-based _____ to study the sun, the moon, the planets, and the universe.

25. What two technologies have provided astronomers with new information about the universe?

_____

_____

26. A new field of Earth science called _____ studies the ways in which humans interact with their environment.

27. Name four issues that environmental scientists study.

_____

_____

_____

_____

THE IMPORTANCE OF EARTH SCIENCE

_____ **28.** Natural forces that shape Earth
- **a.** have little or no effect on life on Earth.
- **b.** affect life on Earth.
- **c.** have not been studied.
- **d.** are hard to quantify so they cannot be measured.

_____ **29.** What natural event could bury a town under ash?
- **a.** lunar eclipse
- **b.** earthquake
- **c.** volcano
- **d.** flood

_____ **30.** What natural event could produce waves that destroy shorelines?
- **a.** earthquake
- **b.** forest fire
- **c.** volcano
- **d.** lunar eclipse

_____ **31.** By understanding how natural forces shape our environment, Earth scientists can
- **a.** design devices to prevent natural disasters.
- **b.** figure out how to increase workforce productivity.
- **c.** teach people how to lead healthier lives.
- **d.** predict potential disasters more accurately and help save lives and property.

_____ **32.** The work of Earth scientists can help us understand our place in
- **a.** the universe.
- **b.** the atmosphere.
- **c.** the food chain.
- **d.** our society.

_____ **33.** Which category of Earth scientists has come up with new ideas about the origins of our universe?
- **a.** meteorologists
- **b.** cosmetologists
- **c.** astronomers
- **d.** astrologists

_____ **34.** The resources that make life as we know it possible come from
- **a.** Earth.
- **b.** other galaxies.
- **c.** hard work.
- **d.** the government.

_____ **35.** Earth scientists strive to help people learn how to
- **a.** improve their diets.
- **b.** invest their money.
- **c.** read and write.
- **d.** use Earth's resources wisely.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Science as a Process

1. How does science differ from other kinds of human endeavors such as art, architecture, and philosophy?

_____

_____

2. What is the goal of science?

_____

_____

3. What do scientists do?

_____

_____

_____

BEHAVIOR OF NATURAL SYSTEMS

_____ **4.** Scientists begin with the assumption that nature
- **a.** is undeniable.
- **b.** is understandable.
- **c.** is nearly impossible to understand.
- **d.** cannot be understood.

_____ **5.** What do scientists expect?
- **a.** Different forces in different situations will cause similar results.
- **b.** Different forces in similar situations will cause similar results.
- **c.** Similar forces in different situations will cause similar results.
- **d.** Similar forces in similar situations will cause similar results.

_____ **6.** Scientists also expect that nature is
- **a.** predictable.
- **b.** practical.
- **c.** impractical.
- **d.** unpredictable.

7. What does studying ice cores in Antarctica help scientists understand?

_____

_____

8. How do scientists increase their understanding of complex natural systems?

_____

_____

SCIENTIFIC METHODS

_____ **9.** What are the organized and logical approaches to scientific research called?
- **a.** scientific community
- **b.** scientific development
- **c.** scientific understanding
- **d.** scientific methods

_____ **10.** Which of the following is true of scientific methods?
- **a.** They are guidelines to scientific problem solving.
- **b.** They are a set of sequential steps that must always be followed.
- **c.** They are not used for scientific problem solving.
- **d.** They are of little use to scientists.

_____ **11.** Scientific methods often begin with
- **a.** theories.
- **b.** conclusions.
- **c.** observations.
- **d.** experiments.

_____ **12.** In scientific methods, observation is the process of obtaining information by
- **a.** using one's imagination.
- **b.** using the senses.
- **c.** watching television.
- **d.** using insight.

_____ **13.** Observations can often lead to
- **a.** answers.
- **b.** misconceptions.
- **c.** problems.
- **d.** questions.

_____ **14.** What is a hypothesis?
- **a.** an idea or explanation that can never be proven
- **b.** an idea or explanation that cannot be tested
- **c.** an idea or explanation that is based on observations and can be tested
- **d.** an idea or explanation that is always proven to be correct

Directed Reading *continued*

15. How can hypotheses be developed, and on what are most hypotheses based?

16. After a hypothesis is proposed, how is it tested?

17. What is an experiment?

18. A factor in an experiment that can be changed is called a(n) _____.

19. The factor in an experiment that is deliberately manipulated is called a(n) _____.

20. The factor in an experiment that changes as a result of manipulation of the independent variable(s) is called a(n) _____.

21. What is the purpose of a control group?

22. Most scientific experiments are _____ experiments.

23. At what point are scientists able to reach conclusions about a hypothesis?

24. Under what condition might a hypothesis be accepted as true?

25. Under what condition might a hypothesis be changed or discarded?

26. What do expected and unexpected results lead to?

_____

27. What else might the results of scientific inquiry lead to?

_____

SCIENTIFIC MEASUREMENTS AND ANALYSIS

_____ **28.** An important method of gathering information is
- **a.** analysis.
- **b.** measurement.
- **c.** prediction.
- **d.** testing.

_____ **29.** Measurement is the comparison of
- **a.** a standard unit with other standard units.
- **b.** independent variables with dependent variables.
- **c.** some aspect of an object or event with a standard unit.
- **d.** some aspect of an object or event with a another object of the same type.

_____ **30.** What do scientists around the world use to compare and analyze each other's measurements?
- **a.** the Internet
- **b.** books and periodicals
- **c.** the International System of Units
- **d.** the Standard Measurement System

_____ **31.** The SI includes standard measurements for
- **a.** cups, pints, quarts, and gallons.
- **b.** length, mass, temperature, and volume.
- **c.** inches, pounds, degrees, and feet.
- **d.** circles, squares, rectangles, and triangles.

_____ **32.** What are all SI units based on?
- **a.** intervals of 15
- **b.** intervals of 100
- **c.** intervals of 10
- **d.** intervals of two

_____ **33.** To what does the word "accuracy" refer?
- **a.** how close a measurement is to the true value of the thing being measured
- **b.** how close a measurement is to an accepted standard
- **c.** how close a measurement is after making necessary adjustments
- **d.** the time of day a measurement is taken

_____ **34.** What is precision?
- **a.** how long it takes to record a measurement
- **b.** how close a measurement is to the true value of the thing being measured
- **c.** the exactness of a measurement
- **d.** the margin of error found in a measurement

_____ **35.** Which of the following measurements is more precise?
- **a.** distance in centimeters rather than millimeters
- **b.** distance in millimeters rather than centimeters
- **c.** weight in kilograms rather than grams
- **d.** weight in grams rather than milligrams

_____ **36.** An error is an expression of the amount of
- **a.** precision or variation in a set of measurements.
- **b.** accuracy or variation in a set of measurements.
- **c.** accuracy or variety in a set of measurements.
- **d.** imprecision or variation in a set of measurements.

_____ **37.** Error is commonly expressed as
- **a.** percentage error or a confidence interval.
- **b.** correct or incorrect.
- **c.** margin of precision.
- **d.** margin of accuracy.

38. What is percentage error?

39. What does a confidence interval describe?

40. What do Earth scientists do when it is impossible to set up a controlled experiment to test a hypothesis?

41. What do Earth scientist use models for?

42. What is a model?

43. What is a physical model?

44. What are two examples of graphical models?

45. What is a conceptual model?

46. What is a mathematical model?

47. What type of model have scientists developed recently to represent simple processes or complex systems?

48. What are scientists able to do with a good computer model?

ACCEPTANCE OF SCIENTIFIC IDEAS

_____ **49.** Once scientists reach a conclusion,
- **a.** they keep their findings secret.
- **b.** they sell their findings to the highest bidder.
- **c.** they introduce their findings to the scientific community.
- **d.** they discard their findings and start over.

_____ **50.** Before new ideas are accepted by the scientific community, the ideas
- **a.** must undergo review and testing by other scientists.
- **b.** are published in a scientific journal.
- **c.** do not have to undergo any further testing or review.
- **d.** must be proven to be true by at least 90% of all scientists in the world.

_____ **51.** Which of the following is NOT a way that scientists present their results to the scientific community?
- **a.** at professional meetings
- **b.** in television infomercials
- **c.** in printed scientific journals
- **d.** in online scientific journals

_____ **52.** Before new ideas are released to a wider audience, scientists submit their ideas to
- **a.** the National Science Foundation.
- **b.** the public for peer review.
- **c.** other scientists for peer review.
- **d.** newspaper reporters.

_____ **53.** What is peer review?
- **a.** when experts on a given topic review another expert's work before publication
- **b.** when experts introduce flaws into another expert's work before publication
- **c.** when experts reject another expert's work before publication
- **d.** when experts compliment another expert's work before publication

_____ **54.** What do the experts determine in a peer review?
- **a.** if the journal that publishes the results has a wide enough audience
- **b.** if the results and conclusions merit publication
- **c.** if enough reviewers have read the work
- **d.** if the scientist who presented the work should be promoted

_____ **55.** Scientists follow an ethical code that says
- **a.** all experimental results should receive equal consideration.
- **b.** unless experimental results are peer reviewed, they cannot be true and valid.
- **c.** any experimental results deserve to be published.
- **d.** only valid experimental results should be published.

56. What happens after results are published?

57. Define theory.

58. What is a scientific law?

59. What does the free exchange of ideas between scientific fields allow?

60. What sometimes results when new connections are found between more than one branch of science?

SCIENCE AND SOCIETY

_____ **61.** The theories of plate tectonics, quantum mechanics, and evolution are examples of what?

- **a.** theories that have since been disproved
- **b.** theories that are too complicated to explain
- **c.** advances in science that have long-lasting and far-reaching effects on science and society
- **d.** advances in science that have had no real impact on science or society

62. For what has technology that was designed for space exploration been used?

63. What obligation do scientists have when developing new technology?

64. What factors should be considered before decisions about technology are made?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Earth: A Unique Planet

1. List three reasons that Earth is unique.

_____

_____

_____

2. Why do scientists study the characteristics that make life on Earth possible?

_____

_____

_____

EARTH BASICS

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

rock	ellipse	oblate spheroid
global ocean	Earth	radius
points	diameter	mountains

3. The third planet from the sun in our solar system is _____.

4. Formed about 4.6 billion years ago, Earth is made mostly of _____.

5. About 70 percent of Earth's surface is covered with water, called the _____.

6. Earth appears to be a perfect circle, but it is actually a slightly flattened sphere called a(n) _____.

7. Earth's surface is relatively smooth; that is, the distance between Earth's high and low _____ are small relative to its size.

8. Earth's average _____ is 12,756 km.

EARTH'S INTERIOR

9. Define seismic waves.

10. What have scientists learned about Earth by studying seismic waves?

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **11.** crust

_____ **12.** oceanic crust

_____ **13.** continental crust

_____ **14.** Moho

_____ **15.** mantle

_____ **16.** core

_____ **17.** lithosphere

_____ **18.** asthenosphere

_____ **19.** plasticity

_____ **20.** mesosphere

_____ **21.** outer core

a. the solid, outer layer of Earth that consists of the crust and the rigid upper part of the mantle

b. the central part of Earth below the mantle

c. the strong, lower part of the mantle between the asthenosphere and the outer core

d. the thin, solid, outermost layer of Earth above the mantle

e. the crust beneath the oceans

f. the lower boundary of the crust

g. the layer of rock between Earth's crust and core

h. the crust that makes up the continents

i. the solid, plastic layer of the mantle beneath the lithosphere; made of mantle rock that flows very slowly, which allows tectonic plates to move on top of it

j. a dense liquid below the mantle

k. the ability of a solid to flow

EARTH AS A MAGNET

_____ **22.** The lines of force of Earth's magnetic field extend between
- **a.** the North Pole and the South Pole.
- **b.** the poles and the equator.
- **c.** the North geomagnetic pole and the South geomagnetic pole.
- **d.** the core and the crust.

_____ **23.** Earth's magnetic field extends beyond the atmosphere and affects a region of space called the
- **a.** mesosphere.
- **b.** atmosphere.
- **c.** electrosphere.
- **d.** magnetosphere.

_____ **24.** The source of Earth's magnetic field may be
- **a.** the liquid iron in Earth's outer core.
- **b.** the solid rock in the asthenosphere.
- **c.** Earth's dense, rigid inner core.
- **d.** The rocky mantle.

_____ **25.** Scientists have learned that, in addition to Earth, the sun and moon also have
- **a.** magnetic fields.
- **b.** liquid outer cores.
- **c.** large amounts of iron.
- **d.** a magnetosphere.

EARTH'S GRAVITY

26. Define gravity.

27. Explain Isaac Newton's law of gravitation.

28. What is weight, and what unit is used to measure it?

29. On Earth, how much does a kilogram of mass weigh?

30. Explain how the location of an object affects its mass and weight.

31. According to the law of gravitation, how does the force of gravity relate to an object's distance from Earth's center?

32. Explain why a single object would weigh more at the either the North or South Pole than it would at the equator.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Energy in the Earth System

1. Traditionally, how have different fields of earth science been studied?

_____

_____

2. How are scientists approaching the study of Earth today?

_____

_____

_____

EARTH-SYSTEM SCIENCE

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **3.** system

_____ **4.** matter

_____ **5.** energy

_____ **6.** closed system

_____ **7.** open system

a. the ability to do work

b. a set of particles or interacting components considered to be a distinct physical entity for the purpose of study

c. a system in which energy, but not matter, is exchanged with the surroundings

d. a system in which both energy and matter are exchanged with the surroundings

e. anything that has mass and takes up space

8. What is true of systems in terms of their size and boundaries?

_____

_____

_____

_____

9. How does a large, complex system like the Earth system operate?

_____

_____

_____

Directed Reading *continued*

10. In what four ways can energy be transferred?

11. How might a system be described in terms of matter and energy?

12. Give one example of a closed system and explain what makes it a closed system.

13. Give one example of an open system and explain what makes it an open system.

14. Why does the Earth system resemble a closed system, even though it is technically an open system?

EARTH'S FOUR SPHERES

15. Matter on Earth occurs in what three states?

_____

_____

_____

16. The Earth system is composed of four _____ that are storehouses of all of the planet's matter.

17. A mixture of gases that surrounds a planet or moon is called its _____.

18. The portion of Earth that is water is called the _____.

19. The mostly solid, rocky part of Earth that extends from the center of the core to the surface of the crust is called the _____.

20. The part of Earth where life exists and that includes all of the living organisms on Earth is called the _____.

21. What purpose does the atmosphere serve?

_____

_____

_____

22. Where can Earth's fresh water supply be found?

_____

_____

_____

23. What parts of Earth are included in the geosphere?

_____

_____

_____

24. What is the biosphere composed of?

EARTH'S ENERGY BUDGET

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **25.** first law of thermodynamics

_____ **26.** energy budget

_____ **27.** second law of thermodynamics

_____ **28.** convection

a. additions in energy as well as subtractions are balanced in the transfer of all energy among Earth's spheres

b. energy is transferred between systems, but it cannot be created or destroyed

c. material is heated, the material's density decreases, and the hot material rises and releases heat; cooler, denser material sinks and displaces the hot material

d. energy transfer takes place, and matter becomes less organized with time

29. Like energy, _____ can be transferred, but cannot be created or destroyed.

30. The overall effect of the second law of thermodynamics is that the universe's _____ is spread out more and more uniformly over time.

31. Earth's four main spheres are _____ that can be thought of as huge storehouses of matter and energy.

32. How are matter and energy exchanged between the spheres?

33. When Earth formed, its interior was heated by what two processes?

34. Because Earth's interior is warmer than its surface layers, hot materials move toward the surface in a process called _____.

35. Earth's most important external energy source is the _____.

36. The heat generated by solar radiation causes the movement of air masses, which in turn creates _____ and ocean currents.

37. What is another important source of external energy from the sun and moon?

_____

38. The pull of the sun and the moon, combined with Earth's rotation, generates _____ that cause currents and drive the mixing of ocean water.

CYCLES IN THE EARTH SYSTEM

39. Define reservoir.

_____

_____

_____

40. Define cycle.

_____

_____

_____

41. What happens to nitrogen as it passes through the nitrogen cycle?

_____

_____

_____

_____

_____

Directed Reading *continued*

42. What happens to carbon in the short-term carbon cycle?

43. What happens to carbon in the long-term carbon cycle?

44. Through which spheres does phosphorus move during the phosphorus cycle?

45. Describe the sequence of the phosphorus cycle.

46. Describe the water cycle.

47. What is transpiration?

HUMANS AND THE EARTH SYSTEM

48. The carbon cycle is affected when humans use _____.

49. When humans burn fuels, _____ is rapidly returned to the atmospheric reservoir.

50. Both the nitrogen and phosphorus cycles are affected by _____.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ecology

1. Define ecology.

_____

_____

_____

2. What word also means "non-living?"

_____

_____

_____

ECOSYSTEMS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **3.** ecosystem

_____ **4.** producers

_____ **5.** consumers

_____ **6.** decomposers

a. organisms that get their energy from eating other organisms

b. a community of organisms and their abiotic environment

c. organisms that make their own food; a source of food for other organisms

d. organisms that get energy by breaking down dead organisms

BALANCING FORCES IN ECOSYSTEMS

7. What else becomes limited because amounts of matter and energy in an ecosystem are limited?

_____

8. The largest population that an environment can support at any given time is called the _____.

9. In general, ecosystems react to changes in ways that maintain or restore _____ in the ecosystem.

10. When might an ecosystem be unable to restore a community of organisms to its original state?

_____

_____

11. The ultimate source of energy for almost every ecosystem is

the _____.

12. Plants capture solar energy by a chemical process

called _____.

13. Chemical changes that take place as energy and matter are cycled through an ecosystem result in what?

_____

_____

14. On the energy pyramid, where is the least amount of energy available to organisms found?

_____

_____

15. The sequence in which organisms consume other organisms can be

represented by a(n) _____.

16. A diagram that shows the complex feeding relationships among organisms

in an ecosystem is a(n) _____.

HUMAN STEWARDSHIP OF THE ENVIRONMENT

17. What effect might changes in an ecosystem have on a human population?

_____

_____

_____

_____

_____

18. Identify three ways in which human activity can disrupt ecological balances.

19. Define pollution.

20. How can people help keep Earth's ecosystems in balance?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Finding Locations on Earth

1. What shape is Earth?

2. What can be used on Earth to establish reference points?

3. For what purpose are the points where Earth's axis of rotation intersects Earth's surface used?

4. What are the reference points where Earth's axis intersects Earth's surface?

5. What is the equator?

6. What is used to locate places on Earth's surface?

LATITUDE

_____ **7.** Parallels are a set of circles on the reference grid
- **a.** that describe positions north and south of the equator.
- **b.** that describe positions north and south of the Greenwich Meridian.
- **c.** that crisscross the Earth parallel to the poles and the equator.
- **d.** that describe positions east and west of the equator.

_____ **8.** How did parallels get their name?
- **a.** They run around the world east and west of the equator.
- **b.** They run around the world perpendicular to the equator.
- **c.** They run around the world parallel to the equator.
- **d.** They run around the world horizontal to the poles.

_____ **9.** What is latitude?
- **a.** the distance around Earth at the equator
- **b.** the distance between meridians
- **c.** the actual distance north and south of the equator
- **d.** the angular distance north and south of the equator

_____ **10.** How is latitude measured?
- **a.** in hours
- **b.** in degrees
- **c.** in kilometers
- **d.** in miles

_____ **11.** What is the latitude of the equator?
- **a.** 10° latitude
- **b.** 0° longitude
- **c.** 90° latitude
- **d.** 0° latitude

_____ **12.** What part of a circle is the distance from the equator to either pole?
- **a.** one-half
- **b.** one-eighth
- **c.** one-fourth
- **d.** a whole circle

_____ **13.** What is the latitude of both the North Pole and the South Pole?
- **a.** 25°
- **b.** 180°
- **c.** 360°
- **d.** 90°

_____ **14.** What is the actual distance in kilometers of 1° of latitude?
- **a.** 1 kilometer
- **b.** 11 kilometers
- **c.** 111 kilometers
- **d.** 1,111 kilometers

_____ **15.** How are parallels north and south of the equator labeled?
- **a.** E and W
- **b.** N and S
- **c.** degrees and minutes
- **d.** latitude and longitude

_____ **16.** What does each degree of latitude consist of?

a. 90 equal parts, called minutes
b. 30 equal parts, called minutes
c. 60 equal parts, called seconds
d. 60 equal parts, called minutes

17. Into how many portions is each minute of latitude divided?

_____

_____

18. What is the latitude of Washington, D.C., including minutes and seconds?

_____

LONGITUDE

_____ **19.** To determine the specific location of a place, you need to know

a. the latitude, and how far north or south that place is along its circle of latitude.
b. the latitude, and how far east or west that place is along its circle of latitude.
c. the longitude, and how far east or west that place is along its circle of longitude.
d. only the longitude.

_____ **20.** How are east-west locations established?

a. by using meridians
b. by using north-south locations
c. by counting degrees
d. by using a map

_____ **21.** What is a meridian?

a. a circle that runs around the globe through the poles
b. half of a semicircle that runs from the equator to a pole
c. a semicircle that runs from pole to pole
d. the same thing as latitude

_____ **22.** By international agreement, one meridian was selected to be

a. 360°.
b. the number one meridian.
c. 180°.
d. 0°.

_____ **23.** What is the 0° meridian, which passes through Greenwich, England, called?
- **a.** the number one meridian
- **b.** the prime meridian
- **c.** the 180° meridian
- **d.** the English meridian

_____ **24.** What is longitude?
- **a.** the angular distance, measured in degrees, east or west of the prime meridian
- **b.** the angular distance, measured in degrees, north or south of the prime meridian
- **c.** the angular distance, measured in minutes, east or west of the prime meridian
- **d.** the angular distance, measured in degrees, east or west of the equator

_____ **25.** Where is the meridian that is opposite the prime meridian located?
- **a.** all the way around the world
- **b.** 90°, or a quarter of the way, around the world
- **c.** 180°, or halfway, around the world
- **d.** at the equator

_____ **26.** All locations east of the prime meridian have
- **a.** longitudes between 0° and 180°W.
- **b.** longitudes between 0° and 180°E.
- **c.** latitudes between 0° and 180°E.
- **d.** latitudes between 0° and 180°W.

_____ **27.** All locations west of the prime meridian have
- **a.** latitudes between 0° and 180°W.
- **b.** longitudes between 0° and 180°E.
- **c.** latitudes between 0° and 180°E.
- **d.** longitudes between 0° and 180°W.

28. Like latitude, how can longitude be expressed more precisely?

_____

29. What is the precise location of Washington, D.C. in degrees, minutes, and seconds?

_____

30. What does the distance covered by a degree of longitude depend on?

_____

_____

31. What does a degree of longitude equal in kilometers at the equator?

_____

32. Where do all meridians meet?

_____

_____

33. What happens to a degree of longitude as you move from the equator toward the poles?

_____

_____

GREAT CIRCLES

_____ **34.** What is a great circle often used for?
- **a.** navigation, especially by ships at sea
- **b.** navigation, especially by long-distance aircraft
- **c.** navigation, especially by short-distance aircraft
- **d.** navigation, especially by ships on inland lakes

_____ **35.** What is a great circle?
- **a.** any circle that divides the globe into halves, or marks the diameter of the globe
- **b.** any circle that divides the globe into degrees, or marks the circumference of the globe
- **c.** any circle that divides the globe into halves, or marks the circumference of the globe
- **d.** any circle around the globe

_____ **36.** Any circle formed by two meridians of longitude directly across the globe from each other is
- **a.** a great circle.
- **b.** a minor circle.
- **c.** longitude.
- **d.** latitude.

_____ **37.** What is the only line of latitude that is a great circle?
- **a.** the prime meridian
- **b.** the North Pole
- **c.** the South Pole
- **d.** the equator

_____ **38.** Great circles can run
- **a.** only in a north-south direction around the globe.
- **b.** in any direction around the globe.
- **c.** only in a east-west direction around the globe.
- **d.** only around the equator.

_____ **39.** Why do air and sea routes often travel along great circles?
- **a.** because they are the longest distance between two points on Earth
- **b.** because they are the only safe routes between two points on Earth
- **c.** because they are the only routes that connect two points on Earth
- **d.** because they are the shortest distance between two points on Earth

FINDING DIRECTION

_____ **40.** A magnetic compass can indicate direction because Earth has magnetic properties
- **a.** as if a powerful bar-shaped magnet were buried at Earth's center.
- **b.** as if a powerful horseshoe magnet were buried at Earth's center.
- **c.** that apparently originate in outer space.
- **d.** as if it were a giant sphere-shaped magnet.

_____ **41.** Earth's magnetic poles are
- **a.** at an angle to the sun and the other planets.
- **b.** constantly reversing polarity.
- **c.** at an angle to the sun's axis of rotation.
- **d.** at an angle to Earth's axis of rotation.

_____ **42.** What are the geomagnetic poles?
- **a.** the areas on Earth's surface just above where the poles of the imaginary magnet would be
- **b.** the areas opposite where the poles of the imaginary magnet would be on the other side of Earth
- **c.** the areas on Earth's surface just below where the poles of the imaginary magnet would be
- **d.** the areas around the poles where large magnets are buried in Earth

_____ **43.** What is true of the geomagnetic poles and the geographic poles?
- **a.** They are both at areas where magnets are found in Earth.
- **b.** They are located in different places.
- **c.** They are the same thing but have different names.
- **d.** They are located in the same places.

_____ **44.** Where does the needle of a compass point to?
- **a.** the geographic North Pole
- **b.** the geomagnetic south pole
- **c.** the geomagnetic north pole
- **d.** the geographic South Pole

Directed Reading *continued*

45. What is magnetic declination?

46. How is magnetic declination measured in the Northern Hemisphere?

47. What will a compass needle align with at all locations along the line of 0° magnetic declination?

48. By using magnetic declination, what can a person use a compass to determine?

49. What is the global positioning system used for?

50. What is the global positioning system?

51. How does a GPS receiver work?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Mapping Earth's Surface

1. What is a globe?

2. What are the advantages of globes?

3. Why did people develop a variety of maps for studying and displaying information about Earth?

HOW SCIENTISTS MAKE MAPS

4. What is the science of making maps called?

5. What do cartographers use to make maps?

6. How do cartographers conduct field surveys?

7. What do cartographers do with the information they collect during a field survey?

8. What is remote sensing, and how do cartographers use it?

9. How are maps often made?

MAP PROJECTIONS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **10.** map projection

_____ **11.** cylindrical projection

_____ **12.** azimuthal projection

_____ **13.** conic projection

a. a projection made by placing a paper cone over a lighted globe so that the axis of the cone aligns with the axis of the globe.

b. a projection made by placing a sheet of paper over a globe such that the paper touches it at only one point

c. a flat map that represents the three-dimensional curved surface of a globe

d. a projection made by wrapping a paper cylinder around a lighted globe

14. What happens when a curved surface is transferred to a flat map?

15. In what ways may an area shown on a map be distorted?

16. How is the size of the area shown on a map related to the distortion? Give examples.

Directed Reading *continued*

17. How do meridians that appear on a cylindrical projection differ from meridians on a globe?

18. Describe the accuracy and distortion of a cylindrical projection.

19. What are two advantages of cylindrical projections?

20. Describe the accuracy and distortion of an azimuthal projection.

21. Why are azimuthal projections a great help to navigators plotting routes used in air travel?

22. Where does the cone touch the globe in a conic projection?

23. Where is there the least distortion in a conic projection?

24. What is a polyconic projection and why is it useful?

_____

_____

_____

READING A MAP

_____ **25.** What must you be able to do to read a map?
- **a.** understand the symbols, be able to find directions, and calculate distances
- **b.** know where to research the history of map making
- **c.** memorize the distances between key points and find directions
- **d.** know the compass points and understand the symbols

_____ **26.** What is the first step in correctly interpreting a map?
- **a.** align the map by wrapping it around a globe
- **b.** look up the symbols in a dictionary
- **c.** determine how the compass directions are displayed
- **d.** find your current location on the map

_____ **27.** How are maps commonly drawn?
- **a.** north at top, east at the right, west at the left, south at the bottom
- **b.** east at top, north at the right, west at the left, south at the bottom
- **c.** north at top, east at the left, west at the right, south at the bottom
- **d.** south at top, east at the right, west at the left, north at the bottom

_____ **28.** Where do parallels and meridians run on most maps?
- **a.** Meridians run from side to side, parallels from top to bottom.
- **b.** Parallels run from side to side, meridians from top to bottom.
- **c.** Parallels run from top to side, meridians from top to bottom.
- **d.** Parallels run from top to bottom, meridians from side to side.

_____ **29.** On maps drawn by the USGS, what features are marked by parallels?
- **a.** the eastern and the western boundary
- **b.** the western and the eastern boundary
- **c.** the southern and the western boundary
- **d.** the northern and the southern boundary

_____ **30.** How are eastern and western boundaries of USGS maps indicated?
- **a.** by parallels
- **b.** by meridians of longitude
- **c.** by framed edges
- **d.** by curved lines

_____ **31.** What is a compass rose?
- **a.** a symbol that indicates the latitude and longitude
- **b.** a symbol that indicates the directions for finding distance
- **c.** a symbol that indicates the cardinal directions
- **d.** a symbol that indicates the blue jay directions

_____ **32.** What are the cardinal directions?
- **a.** northeast and southwest
- **b.** all the points on the compass
- **c.** north and south
- **d.** north, east, south, and west

_____ **33.** The arrow that points north on some maps is
- **a.** generally labeled and may not point to the top of the map.
- **b.** generally unlabeled and may not point to the top of the map.
- **c.** generally labeled and always points to the top of the map.
- **d.** generally unlabeled and always points to the top of the map.

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

parallel	fractional scale	legend
graphic scale	symbol	verbal scale
longitude	scale	

34. A list of map symbols and their meaning is called a _____.

35. On a map, a _____ may resemble the feature it represents or it may be more abstract.

36. The relationship between the distance shown on a map and the actual distance is the _____.

37. A printed line with ruler-like markings that represents a unit of measurement, such as the kilometer or mile, is called a _____.

38. The ratio 1:25,000 printed on a map is an example of a _____.

39. The sentence "One centimeter is equal to one kilometer." is an example of a _____.

40. How do you find the actual distance between two points on Earth using a graphic scale?

_____

_____

Directed Reading *continued*

41. What does the fractional scale 1:10,000 on a map indicate?

42. What happens to a fractional scale when different systems of measurement are used? Give an example.

43. What is an isogram?

44. What are the meanings of *iso-* and *-gram*?

45. What are isobars?

46. What is true of isobars on a weather map?

47. Why will isobars never cross one another?

48. What do scientists commonly use isograms to show?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Types of Maps

_____ **1.** What are some of the characteristics of an area shown on maps used by Earth scientists?
- **a.** types of animals, types of plants, types of minerals
- **b.** types of rocks, differences in air pressure, varying depths of groundwater
- **c.** types of governments, differences in tire pressure, varying depths of focus
- **d.** types of countries, types of states, types of counties

TOPOGRAPHIC MAPS

_____ **2.** What do topographic maps show?
- **a.** surface features of Earth
- **b.** surfaces of highways
- **c.** cities and counties
- **d.** the tops of mountains

_____ **3.** What is topography?
- **a.** the study of mountains
- **b.** the study of weather and climates of Earth
- **c.** the size and shape of the land surface features of a region
- **d.** the features of Earth beneath the surface crust

_____ **4.** What do most topographic maps show besides natural features?
- **a.** types and properties of soils
- **b.** constructed features, such as buildings and roads
- **c.** weather features, such as temperature and precipitation
- **d.** types of rocks found in a given area

_____ **5.** How are topographic maps made?
- **a.** by putting available photographs together with old maps to make a new map
- **b.** by using land-level photographs and estimates of distance collected in the field
- **c.** by using subterranean photographs and survey points collected in the field
- **d.** by using aerial photographs and survey points collected in the field

_____ **6.** Topographic maps show the height of land above sea level, which is called
- **a.** irrigation.
- **b.** revelation.
- **c.** elevation.
- **d.** elevator.

_____ **7.** What is mean sea level, or the place from which elevation is measured?
- **a.** the point midway between the highest and next to highest tide levels of the ocean
- **b.** the point midway between the highest and lowest tide levels of the ocean
- **c.** the point midway between the lowest and next to lowest tide levels of the ocean
- **d.** the point closest to the lowest and next to highest tide levels of the ocean

_____ **8.** What is the elevation at mean sea level?
- **a.** -20
- **b.** 100
- **c.** 500
- **d.** 0

_____ **9.** What would be the advantage of a topographic map of an island over a typical map projection?
- **a.** It would show the island's plants, water, and resources.
- **b.** It would show the island's villages, roads, and ports.
- **c.** It would show the island's location, buildings, and farms.
- **d.** It would show the island's size, shape, and elevation.

_____ **10.** What are contour lines used to show on topographic maps?
- **a.** irrigation
- **b.** elevation
- **c.** escalation
- **d.** aeration

_____ **11.** What is a contour line?
- **a.** an isogram that connects points of equal elevation
- **b.** an anagram that connects points of equal elevation
- **c.** an isogram that connects points that have different elevations
- **d.** an epigram that connects points of equal elevation

_____ **12.** Because points at a given elevation are connected, the shape of
- **a.** the common lines reflects the shape of the land.
- **b.** the contour lines reflects the shape of the map.
- **c.** the contour lines reflects the shape of the land.
- **d.** the epigrams reflects the shape of the land.

Directed Reading *continued*

_____ **13.** What is the contour interval?

- **a.** the difference in contour between one elevation line and the next
- **b.** the difference in elevation between one elevation line and the next
- **c.** the difference in elevation between one contour line and the next
- **d.** the difference in contour between one contour line and the next

14. What is relief on a map?

15. What is the contour interval like on a map where the relief is high? Give an example.

16. What is the contour interval like on a map where the relief is low? Give an example

17. What is an index contour?

18. How are exact elevations marked?

19. What indicates the shapes of landforms on a topographic map?

Directed Reading *continued*

20. What do contour lines spaced widely apart indicate?

21. What do contour lines spaced closely together indicate?

22. Describe the contour line that indicates a valley.

23. Where will the V in the contour line point if a stream or river flows through the valley? Explain why.

24. How is the width of a valley represented on a contour map?

25. How are hilltops indicated on a topographical map?

26. What are depression contours?

27. What does the color of a symbol indicate on a topographic map?

In the space provided, write the letter of the color that is used to represent each feature on contour maps.

a. black
b. red
c. blue
d. green
e. brown or black
f. purple

_____ **28.** major highways

_____ **29.** bodies of water

_____ **30.** buildings, boundaries, roads, railroads

_____ **31.** contour lines

_____ **32.** areas not verified by field exploration

_____ **33.** forested areas

GEOLOGIC MAPS

_____ **34.** What are geologic maps designed to show?
- **a.** the distribution of topographic features
- **b.** the distribution of geologic features
- **c.** realistic geologic features
- **d.** the distribution of political boundaries

_____ **35.** What in particular do geologic maps show about a given area?
- **a.** types of rocks and locations of faults, folds, and other structures
- **b.** types of organisms and locations of habitats and ecosystems
- **c.** types of roads and locations of highways and rest stops
- **d.** types of contours and locations of roads, lakes, and buildings

_____ **36.** What type of maps are geologic maps created on top of?
- **a.** case maps
- **b.** topographic maps
- **c.** reference maps
- **d.** base maps

_____ **37.** What does the base map provide?
- **a.** underground features, such as faults or folds, to help identify the location of geographic units
- **b.** surface features, such as rocks, faults, or folds, to help identify the location of geologic units
- **c.** map features, such as bodies of water or roads, to help identify the location of geographic units
- **d.** surface features, such as topography or roads, to help identify the location of geologic units

_____ **38.** What is a geologic unit?
- **a.** a volume of rock of different age ranges and rock types
- **b.** a single rock of a given age range and rock type
- **c.** a volume of rock of a given age range and rock type
- **d.** a single rock of different age ranges and rock types

_____ **39.** What types of units are usually assigned colors in the same color family, such as different shades of blue?
- **a.** geologic units of similar ages
- **b.** geologic units of similar colors
- **c.** geologic units of similar types of rock
- **d.** geologic units of different ages

40. Describe the set of letters that geologists assign to each rock unit and what the letters symbolize.

41. What do contact lines indicate on geologic maps?

42. Describe the two main types of contacts.

43. What are strike and dip symbols?

SOIL MAPS

_____ **44.** Why do Earth scientists construct soil maps?
- **a.** to classify, map, and describe sediment
- **b.** to classify, map, and describe soils
- **c.** to survey, record, and spread soils
- **d.** to decide where to use more soil as land fill

_____ **45.** What are soil maps based on?
- **a.** surveys that reveal information about locations of soil
- **b.** surveys that record information about properties of soil
- **c.** surveys that record information about properties of vegetation
- **d.** surveys that record information about properties of minerals

_____ **46.** What is the government agency in charge of soil data?
- **a.** Natural Resources Conservation Service
- **b.** Natural Resources Conversation Service
- **c.** American Resources Conservation Service
- **d.** National Resources Conservation Service

_____ **47.** What department is the NRCS part of in the U.S. federal government?
- **a.** the Department of Forestry
- **b.** the Department of Horticulture
- **c.** the Department of Minerals
- **d.** the Department of Agriculture

48. What are the three main parts of a soil survey?

49. Describe the three parts of a soil survey.

50. How does knowing soil properties help farmers, agricultural engineers, and government agencies?

OTHER TYPES OF MAPS

_____ **51.** Earth scientists use maps to show the location and flow of water and air by plotting data from various points around a region and
- **a.** using isotopes to connect the points with different data.
- **b.** using isograms to connect the points with identical data.
- **c.** using isograms to connect the points with different data.
- **d.** using epigrams to connect the points with identical data.

_____ **52.** What do meteorologists use maps for?
- **a.** to record and predict meteorites
- **b.** to record and predict volcanic eruptions
- **c.** to record and predict the weather
- **d.** to record and predict earthquakes

_____ **53.** What types of things may be plotted on weather maps?
- **a.** precipitation, air pressure, weather fronts
- **b.** condensation, ice formation, climate
- **c.** volcanoes, earthquakes, tidal waves
- **d.** mountains, valleys, waterways

_____ **54.** What can be recorded about groundwater by using maps?
- **a.** mineral content and saline content
- **b.** location and direction of flow
- **c.** purity and taste
- **d.** amount and best way to drill wells

_____ **55.** What other things do Earth scientists use maps to study?
- **a.** changes in geography, state lines, and economic factors
- **b.** changes in the life cycles of organisms
- **c.** changes in topography, available resources, and factors that affect climate
- **d.** changes in global geopolitical boundaries

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Matter

1. What is matter?

_____

_____

2. What does mass mean?

_____

_____

PROPERTIES OF MATTER

_____ **3.** What are two types of properties of matter?
- **a.** physical and atomic
- **b.** chemical and magnetic
- **c.** physical and chemical
- **d.** chemical and mental

_____ **4.** What kind of properties can be observed without changing the composition of the substance?
- **a.** chemical
- **b.** physical
- **c.** magnetic
- **d.** atomic

_____ **5.** Which of the following are all physical properties of matter?
- **a.** density, color, hardness
- **b.** density, reactions, hardness
- **c.** chemistry, freezing point, color
- **d.** lightness, electrons, boiling point

_____ **6.** The properties that describe how a substance reacts with other substances to produce different substances are
- **a.** chemical properties.
- **b.** physical properties.
- **c.** magnetic properties.
- **d.** atomic properties.

_____ **7.** When iron reacts with oxygen to form rust, the reaction is an example of a
- **a.** physical property of oxygen.
- **b.** magnetic property of oxygen.
- **c.** chemical property of iron.
- **d.** physical property of iron.

_____ **8.** Which of the following is a chemical property of helium?
- **a.** Helium does not react with other substances but does form new substances.
- **b.** Helium reacts with other substances but does not form new substances.
- **c.** Helium reacts with other substances to form new substances.
- **d.** Helium does not react with other substances to form new substances.

_____ **9.** A substance that cannot be broken down into simpler, stable substances by chemical means is
- **a.** an element.
- **b.** an atom.
- **c.** matter.
- **d.** mass.

_____ **10.** What does each element have that can be used to identify it?
- **a.** a group of chemicals and atoms
- **b.** a group of compounds
- **c.** a characteristic set of physical and chemical properties
- **d.** a characteristic set of magnetic properties

_____ **11.** About how many elements occur naturally on Earth?
- **a.** more than 1,000
- **b.** more than 90
- **c.** more than 900
- **d.** more than 9,000

_____ **12.** About how many elements have been created in laboratories?
- **a.** about 36
- **b.** about 12
- **c.** about 60
- **d.** about 24

_____ **13.** How many elements make up 98% of Earth's crust?
- **a.** two
- **b.** four
- **c.** eight
- **d.** six

_____ **14.** What is an *atom*?
- **a.** the smallest unit of an element
- **b.** the smallest unit of oxygen
- **c.** the smallest unit of matter
- **d.** the smallest unit in the universe

_____ **15.** How many atoms lined up side by side would equal the thickness of a book page?
- **a.** about a hundred
- **b.** more than a million
- **c.** less than a hundred thousand
- **d.** less than a thousand

ATOMIC STRUCTURE

_____ **16.** Atoms are made up of smaller parts called
- **a.** elemental particles.
- **b.** subatomic particles.
- **c.** material particles.
- **d.** energy particles.

_____ **17.** What are the three major kinds of subatomic particles?
- **a.** matter, energy, elements
- **b.** atoms, elements, subtrons
- **c.** nucleus, positrons, magnitrons
- **d.** protons, electrons, neutrons

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **18.** protons

_____ **19.** electrons

_____ **20.** neutrons

- **a.** particles that have a negative charge
- **b.** particles that have no charge
- **c.** particles that have a positive charge

21. What is the nucleus of an atom?

22. Why does the nucleus of an atom have a positive charge?

23. How much of an atom's mass does the nucleus make up?

24. How much of an atom's volume does the nucleus make up?

25. What makes up most of the volume of an atom?

26. What is an electron cloud?

27. Why are electrons attracted to the nucleus of an atom?

28. What holds the electrons in an atom?

ATOMIC NUMBER

_____ **29.** What is the atomic number of an element?
- **a.** the number of neutrons in the nucleus of the atom
- **b.** the number of protons and neutrons in the nucleus of the atom
- **c.** the number of protons in the nucleus of the atom
- **d.** the number of electrons in the nucleus of an atom

_____ **30.** An uncharged atom has an equal number of
- **a.** neutrons and electrons.
- **b.** protons and electrons.
- **c.** protons and neutrons.
- **d.** protons, electrons, and neutrons.

_____ **31.** The atomic number of an uncharged atom is also equal to
- **a.** the number of its neutrons.
- **b.** the number of its subatomic particles.
- **c.** the number of its elements.
- **d.** the number of its electrons.

_____ **32.** Elements on the periodic table are ordered according to
- **a.** their weight.
- **b.** their atomic numbers.
- **c.** their mass.
- **d.** their number of neutrons.

_____ **33.** The periodic table is a system for
- **a.** classifying neutrons.
- **b.** classifying chemicals.
- **c.** classifying elements.
- **d.** classifying matter.

_____ **34.** Elements in the same column on the periodic table have similar arrangements of what?
- **a.** electrons in their atoms
- **b.** protons in their atoms
- **c.** neutrons in their atoms
- **d.** positrons in their atoms

_____ **35.** Elements that have similar arrangements of electrons also have
- **a.** similar numbers of neutrons.
- **b.** similar chemical properties.
- **c.** similar elemental properties.
- **d.** similar physical properties.

ATOMIC MASS

_____ **36.** What is the *mass number* of an atom?
- **a.** the sum of its protons and electrons
- **b.** the sum of its protons, electrons, and neutrons
- **c.** the sum of its neutrons and electrons
- **d.** the sum of its protons and neutrons

_____ **37.** Since the mass of a subatomic particle is too small to be expressed easily in grams, what special unit is used?
- **a.** atomic matter unit (amu)
- **b.** elemental mass unit (emu)
- **c.** atomic mass unit (amu)
- **d.** subatomic mass unit (smu)

_____ **38.** Which subatomic particles each have an atomic mass unit close to 1?
- **a.** electrons and neutrons
- **b.** protons and neutrons
- **c.** protons and electrons
- **d.** electrons and positrons

_____ **39.** The mass of one proton is equal to the combined mass of how many electrons?
- **a.** less than 1
- **b.** about 184
- **c.** about 1,840
- **d.** much more than 1,840

_____ **40.** When calculating an atom's approximate mass, how is the mass of electrons figured?
- **a.** It is ignored.
- **b.** It is figured at 1 over 1,840.
- **c.** It is figured at 1 for every proton.
- **d.** It is figured at 1,840 for every proton.

_____ **41.** Although all atoms of the same element contain the same number of protons, the number of its
- **a.** neutrons may differ.
- **b.** neutrons is always smaller.
- **c.** positrons may differ.
- **d.** electrons may differ.

_____ **42.** Which of the following is true of atoms of helium?
- **a.** All have two neutrons, but some have only one electron.
- **b.** Most have two neutrons, but some have only one neutron.
- **c.** Most have one proton, but some have only one neutron.
- **d.** All have one neutron, but some have only one proton.

_____ **43.** An atom with the same number of protons as other atoms
- **a.** has a different atomic number.
- **b.** has no mass.
- **c.** has no atomic number.
- **d.** has the same atomic number.

44. What is an isotope?

45. How does a helium atom that has two neutrons compare with a helium atom that has only one neutron?

46. Why do different isotopes of the same element have slightly different properties?

THE PERIODIC TABLE OF ELEMENTS

_____ **47.** What is the atomic number of hydrogen?
- **a.** 2
- **b.** 3
- **c.** 1
- **d.** 6

_____ **48.** What is the symbol of hydrogen?
- **a.** C
- **b.** H
- **c.** He
- **d.** 1

_____ **49.** What is the atomic number of sodium?
- **a.** 1
- **b.** 6
- **c.** 11
- **d.** 0

_____ **50.** What is the name of the element that has the symbol Ca?
- **a.** Cesium
- **b.** Californium
- **c.** Cobalt
- **d.** Calcium

_____ **51.** What is the symbol of iron?
- **a.** I
- **b.** Ir
- **c.** Fe
- **d.** F

_____ **52.** What is the atomic number of iron?
- **a.** 26
- **b.** 8
- **c.** 55
- **d.** 4

_____ **53.** What is the symbol of uranium?
- **a.** Ur
- **b.** U
- **c.** Fe
- **d.** Um

_____ **54.** What is the atomic number of uranium?
- **a.** 92
- **b.** 28
- **c.** 238
- **d.** 7

In the space provided, write the letter of the atomic number that matches the element on the periodic table.

_____ **55.** helium

_____ **56.** carbon

_____ **57.** nitrogen

_____ **58.** oxygen

_____ **59.** neon

_____ **60.** aluminum

_____ **61.** sulfur

_____ **62.** chlorine

- **a.** 8
- **b.** 10
- **c.** 6
- **d.** 16
- **e.** 13
- **f.** 2
- **g.** 17
- **h.** 7

63. Why does the periodic table use an average atomic mass for each element?

_____

_____

64. What does average atomic mass mean?

_____

_____

_____

65. How many naturally occurring isotopes of hydrogen are there?

_____

66. Why does each isotope of hydrogen have a mass number different from the others?

_____

_____

67. How can you determine the average atomic mass of hydrogen?

_____

_____

_____

68. What is the average atomic mass of hydrogen, as noted in the periodic table?

_____

VALENCE ELECTRONS AND PERIODIC PROPERTIES

_____ **69.** Elements are arranged in columns on the period table based on what?
- **a.** similarities in their physical properties
- **b.** similarities in their chemical properties
- **c.** differences in their physical properties
- **d.** differences in their chemical properties

_____ **70.** What are columns called on the periodic table?
- **a.** properties
- **b.** rows
- **c.** valences
- **d.** groups

_____ **71.** The number of outermost electrons in an atom's electron cloud largely determine an atom's
- **a.** chemical properties.
- **b.** physical properties.
- **c.** magnetic properties.
- **d.** atomic properties.

_____ **72.** What are the outermost electrons in an atom's electron cloud called?
- **a.** atomic electrons
- **b.** nuclear electrons
- **c.** valence electrons
- **d.** periodic electrons

_____ **73.** Within each group on the periodic table, the atoms of each element generally have
- **a.** the same physical properties.
- **b.** different chemical properties.
- **c.** the same number of valence atoms.
- **d.** the same atomic numbers.

_____ **74.** How many valence electrons do atoms of elements in Groups 3–12 have?
- **a.** 3 or more
- **b.** 2 or more
- **c.** only 1
- **d.** 1 or 2

75. In groups 13-18 on the periodic table, what is the number of valence electrons in each atom?

76. What is true of an atom that has 8 valence electrons?

77. What is true of elements whose atoms have 1, 2, or 3 valence electrons?

78. What is the main difference between *metals* and *nonmetals*?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Combinations of Atoms

_____ **1.** What is true of the elements found in Earth's crust?
- **a.** They usually occur in pure form.
- **b.** They generally occur in combination with other elements.
- **c.** They usually do not occur in combination with other elements.
- **d.** They generally occur in pure form, but in combination with other elements.

_____ **2.** What is a *compound*?
- **a.** a substance made of two or more elements joined by chemical bonds between the atoms of those elements
- **b.** a substance made of a single element joined by chemical bonds between the atoms of that element
- **c.** a substance made of thousands of elements joined by chemical bonds between the atoms of those elements
- **d.** a substance made of two or more subatomic particles joined by physical bonds

_____ **3.** The properties of a compound are
- **a.** the same as those of the elements that make up the compound.
- **b.** physically similar to the elements of the compound.
- **c.** chemically similar to the elements of the compound.
- **d.** different from those of the elements that make up the compound.

MOLECULES

_____ **4.** The smallest unit of matter that can exist by itself and retain all of a substance's chemical properties is a(n)
- **a.** mixture.
- **b.** atom.
- **c.** molecule.
- **d.** element.

_____ **5.** In a molecule of two or more atoms, how are the atoms connected?
- **a.** The atoms are chemically bonded together.
- **b.** Magnetism connects the atoms.
- **c.** The atoms are physically mixed.
- **d.** Electrostatic energy bonds the atoms together.

_____ **6.** Molecules that are made up of only two atoms are called
- **a.** subatomic particles.
- **b.** diatomic molecules.
- **c.** isotopes.
- **d.** chemical formulas.

_____ **7.** What does O_2 mean?
- **a.** It means a diatomic molecule with 2 parts.
- **b.** It means an oxygen compound with 2 parts.
- **c.** It means a mixture of 2 parts oxygen.
- **d.** O is the symbol for oxygen; the subscript 2 is the number of oxygen atoms bonded together.

CHEMICAL FORMULAS

_____ **8.** In any compound, the elements that make up the compound
- **a.** occur in different relative proportions.
- **b.** occur in the same relative proportions.
- **c.** do not occur in measurable proportions.
- **d.** do not occur in the same relative proportions.

_____ **9.** What is a *chemical formula*?
- **a.** a combination of letters and numbers that shows which elements make up a compound
- **b.** the numbers used to show how many chemical and physical bonds a molecule has
- **c.** a combination of subscripts and letters that shows which electrons make up a mixture
- **d.** the letters used to show how many chemical and physical bonds a molecule has

_____ **10.** What does the chemical formula H_2O mean?
- **a.** Each water molecule has one atom of hydrogen and one atom of oxygen.
- **b.** Each water molecule has one atom of hydrogen and two atoms of oxygen.
- **c.** Each water molecule has two atoms of hydrogen and two atoms of oxygen.
- **d.** Each water molecule has two atoms of hydrogen and one atom of oxygen.

_____ **11.** In a chemical formula, what does a subscript that follows the symbol for a element indicate?
- **a.** half the number of atoms of that element in the molecule
- **b.** the number of atoms of that element in the molecule
- **c.** double the number of atoms of that element in the molecule
- **d.** the number of molecules of that element in an atom

CHEMICAL EQUATIONS

_____ **12.** How do elements and compounds form new compounds?
- **a.** by being heated and melting together
- **b.** by combining through physical reactions
- **c.** by combining through chemical reactions
- **d.** by dividing through chemical reactions

_____ **13.** What is a *chemical equation*?
- **a.** a formula that describes the physical reaction of elements and compounds combining to form new compounds
- **b.** a formula that describes the chemical reaction of elements that do not combine to form new compounds
- **c.** a formula that describes the chemical reaction of elements and compounds combining to form new compounds
- **d.** a formula that describes the physical reaction of compounds that do not combine to form new compounds

_____ **14.** In a chemical equation, what is shown on the left-hand side of the arrow?
- **a.** the reactions
- **b.** the products
- **c.** the molecules
- **d.** the reactants

_____ **15.** In a chemical equation, what is shown on the right-hand side of the arrow?
- **a.** the reactions
- **b.** the products
- **c.** the molecules
- **d.** the reactants

_____ **16.** What does the arrow in a chemical reaction mean?
- **a.** "gives" or "yields"
- **b.** "gives" and "takes"
- **c.** "takes" or "yields"
- **d.** "takes" or "makes"

17. Explain the equation $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.

_____

_____

18. When is a chemical equation balanced?

_____

_____

19. Why can you not change chemical formulas to balance an equation?

20. What are coefficients?

21. In the equation $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$, what is the coefficient in $2H_2O$? How is the coefficient used?

22. In the equation $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$, how is the coefficient in $2O_2$ used?

CHEMICAL BONDS

_____ **23.** What are *chemical bonds*?

- **a.** the forces that hold the molecules in atoms together
- **b.** the forces that hold the subatomic particles within molecules together with other molecules
- **c.** the forces that hold the subatomic particles in atoms within molecules together
- **d.** the forces that hold the atoms within molecules together

_____ **24.** Chemical bonds form because of

- **a.** the transmutation of energy.
- **b.** the attraction between positive and negative charges.
- **c.** the change of matter into energy.
- **d.** positive and negative charges repelling each other.

_____ **25.** How do atoms form chemical bonds?
- **a.** by combining protons
- **b.** by either transferring or sharing neutrons
- **c.** by either transferring or sharing valence electrons
- **d.** by either combining or rearranging valence electrons

_____ **26.** What is the result of variations in the forces that hold molecules together?
- **a.** a wide range of physical and chemical properties
- **b.** a wide range of behavioral difficulties
- **c.** a narrow range of physical and chemical properties
- **d.** virtually nothing

_____ **27.** When scientists study the interactions of atoms, what can they predict?
- **a.** how long it takes for chemical bonds to form
- **b.** how subatomic particles will split apart to form other atoms
- **c.** which kinds of atoms will form chemical bonds together
- **d.** the weather

_____ **28.** How many valence electrons can a hydrogen atom have?
- **a.** 1
- **b.** 2
- **c.** 3
- **d.** 4

_____ **29.** How can hydrogen reach a more chemically unreactive state?
- **a.** by splitting
- **b.** by fusing
- **c.** by giving up or accepting another proton
- **d.** by giving up or accepting another electron

_____ **30.** What happens when an electron is transferred from one atom to another?
- **a.** Only the atom that accepts the electron becomes charged; the other becomes neutral.
- **b.** Only the atom that gave up the electron becomes charged; the other becomes neutral.
- **c.** Both atoms lose their charge.
- **d.** Both atoms become charged.

_____ **31.** What is an *ion*?
- **a.** an atom or molecule that has a neutral charge
- **b.** an atom or molecule that carries a negative or positive charge
- **c.** an atom that has at least one extra neutron
- **d.** an atom that has at least one extra proton

_____ **32.** How many electrons do neutral sodium atoms have?
- **a.** 1
- **b.** 11
- **c.** 8
- **d.** 2

_____ **33.** How many valance electrons does a sodium atom have?
- **a.** 8
- **b.** 11
- **c.** 1
- **d.** 2

_____ **34.** If a neutral sodium atom loses its outermost electron, how many electrons are now in its outermost electron cloud?
- **a.** 8
- **b.** 2
- **c.** 11
- **d.** 1

_____ **35.** When an atom gives up an electron and no longer has a balance between positive and negative charges, what does it become?
- **a.** a molecule
- **b.** an isotope
- **c.** neutral
- **d.** an ion

_____ **36.** When a sodium atom releases its valence electron, what does it become?
- **a.** a proton
- **b.** a sodium isotope
- **c.** a positive sodium ion
- **d.** a negative sodium ion

_____ **37.** If a neutral chlorine atom accepts an electron, what happens?
- **a.** It now has 8 valence electrons, and it becomes a chemically unstable, positively charged chloride ion.
- **b.** It now has 7 valence electrons, and it becomes a chemically unstable, negatively charged chloride ion.
- **c.** It now has 8 valence electrons, and it becomes a chemically stable, negatively charged chloride ion.
- **d.** It now has 7 valence electrons, and it becomes a chemically stable, positively charged chloride ion.

_____ **38.** What is an *ionic bond*?

a. the force between charged ions that results from neutron transfer between atoms
b. the opposing force between uncharged ions
c. the attractive force between ions with the same charge
d. the attractive force between oppositely charged ions

_____ **39.** An *ionic compound is* formed through the transfer of

a. electrons.
b. protons.
c. neutrons.
d. energy.

_____ **40.** When are most ionic compounds formed?

a. when electrons are transferred between atoms of metallic elements
b. when neutrons are transferred between atoms of metallic and nonmetallic elements
c. when electrons are transferred between atoms of metallic and nonmetallic elements
d. when electrons are transferred between atoms of nonmetallic elements

_____ **41.** Sodium chloride is composed of

a. negatively charged sodium ions and positively charged chloride ions.
b. positively charged sodium ions and negatively charged chloride ions.
c. positively charged sodium ions and chloride ions.
d. negatively charged sodium ions and chloride ions.

42. What is a covalent bond?

_____

_____

_____

43. If atoms are sharing electrons, what happens to the positive nucleus of each atom?

_____

_____

_____

44. What force keeps atoms that share electrons joined?

45. What is a covalent compound?

46. How do two atoms of hydrogen combine with one atom of oxygen to form a water molecule?

47. Why would atoms that are covalently bonded not share electrons equally?

48. What is a polar covalent bond?

49. Explain how water is an example of a molecule that forms because of polar covalent bonds.

50. What is caused by a water molecule's slightly negative charge at its oxygen end and the slightly positive charge at its hydrogen end?

_____

_____

_____

MIXTURES

_____ **51.** What is a mixture?
- **a.** a combination of five or more substances that are not chemically combined
- **b.** a combination of two or more substances that are chemically combined
- **c.** a combination of two or more substances that are not chemically combined
- **d.** a combination of 10 or more substances that are chemically combined

_____ **52.** The substances that make up a mixture
- **a.** keep their individual properties.
- **b.** lose their individual properties.
- **c.** combine chemically.
- **d.** lose their individual chemical properties.

_____ **53.** Unlike a compound, a mixture
- **a.** can be separated into its parts by chemical means.
- **b.** cannot be separated into its parts by physical means.
- **c.** cannot be separated into its parts by chemical means.
- **d.** can be separated into its parts by physical means.

_____ **54.** To separate a mixture of powdered sulfur, S, and iron, Fe, filings, you can
- **a.** use chemical means.
- **b.** use a magnet to attract the iron.
- **c.** add more chemicals.
- **d.** pick out the sulfur by hand.

_____ **55.** What are heterogeneous mixtures?
- **a.** three or more substances that are uniformly distributed
- **b.** two or more substances that are not uniformly distributed
- **c.** three or more substances that cannot be separated by physical means
- **d.** two or more substances that can be separated by physical means

_____ **56.** What rock is an example of a heterogeneous mixture of minerals?

a. limestone
b. feldspar
c. quartz
d. granite

57. What is a homogeneous mixture?

58. What is a homogeneous mixture of two or more substances uniformly dispersed throughout the mixture?

59. What is dissolved in the solution known as sea water?

60. What is happening in sea water on a molecular level, in terms of positive and negative charges?

61. What is an alloy?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: What Is a Mineral?

1. What do a ruby, a gold nugget, and a grain of salt have in common?

_____

_____

_____

2. What substances are the basic materials of Earth's crust?

_____

_____

3. What is a *mineral*?

_____

_____

CHARACTERISTICS OF MINERALS

_____ **4.** To determine if a substance is a mineral or a nonmineral, scientists
- **a.** run a lot of tests.
- **b.** ask three basic questions.
- **c.** ask five basic questions.
- **d.** ask four basic questions.

_____ **5.** Scientists determine that a substance is a mineral when the answer to
- **a.** half the questions is yes.
- **b.** half the questions is no.
- **c.** all four questions is yes.
- **d.** all four questions is no.

_____ **6.** What is an inorganic substance?
- **a.** one that is hard, dense, and lifeless
- **b.** one that is made up of living things or the remains of living things
- **c.** one that is not made up of living things or the remains of living things
- **d.** something made up of the remains of ancient plants

_____ **7.** Which of the following is a question scientists ask to determine if a substance is a mineral?
- **a.** Does the substance occur naturally?
- **b.** Will the substance sink to the bottom of a tank?
- **c.** Is the substance shiny and heavy?
- **d.** Is the substance manufactured?

_____ **8.** Why is obsidian not a mineral?
- **a.** It does not sink to the bottom of a water tank.
- **b.** The atoms are not arranged in a regularly repeating crystalline structure.
- **c.** The atoms are arranged in a regularly repeating crystalline structure.
- **d.** It does not conduct electricity.

_____ **9.** What is the fourth question scientists ask to determine if a substance is a mineral?
- **a.** Does it weigh more than most other substances of its density?
- **b.** Does it float or sink?
- **c.** Does it have a consistent chemical composition?
- **d.** Does it have an inconsistent chemical composition?

KINDS OF MINERALS

_____ **10.** How many different kinds of minerals have scientists identified?
- **a.** fewer than 3,000
- **b.** more than 3,000
- **c.** fewer than 200
- **d.** more than 30,000

_____ **11.** How many minerals are common?
- **a.** fewer than 20
- **b.** about a dozen
- **c.** more than 20
- **d.** more than 3,000

_____ **12.** The common minerals are called
- **a.** sand.
- **b.** dirt-forming minerals.
- **c.** rock-forming minerals.
- **d.** common form minerals.

_____ **13.** Which of the following are among the 10 most common minerals?
- **a.** quartz, sand, uranium, rock salt
- **b.** diamonds, rock candy, salt
- **c.** ice, sediment, sugar
- **d.** quartz, gypsum, halite

_____ **14.** What are the two main groups of minerals?
- **a.** reflective and nonreflective
- **b.** silicate and nonsilicate
- **c.** nutritional and non-nutritional
- **d.** animal and vegetable

Directed Reading *continued*

15. What is the basis for classifying minerals into two main groups?

16. Describe a *silicate* mineral.

17. What two atoms are found in the mineral quartz?

18. What are the most common silicate minerals?

19. What determines what type of feldspar will form?

20. In addition to quartz and feldspars, what is another type of silicate mineral?

21. Ferromagnesian minerals are rich in what metals?

22. 96% of Earth's crust is made up of what?

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **23.** carbonates

_____ **24.** halides

_____ **25.** native elements

_____ **26.** oxides

_____ **27.** sulfates

_____ **28.** sulfides

a. elements uncombined with other elements

b. compounds that contain a sulfate group (SO_4)

c. compounds that contain a carbonate group (CO_3)

d. compounds that consist of one or more elements combined with sulfur

e. compounds that contain oxygen and an element other than silicon

f. compounds that consist of chlorine or fluorine combined with sodium, potassium, or calcium

29. What are *nonsilicate* minerals?

_____

_____

30. What are the six major groups of nonsilicate minerals?

_____

_____

_____

_____

_____

_____

CRYSTALLINE STRUCTURE

_____ **31.** What do all minerals in Earth's crust have?

a. a silicon atom and an oxygen atom

b. a crystalline structure

c. the same number of elements and compounds

d. the same number of protons and electrons

_____ **32.** What characterizes each type of mineral crystal?

a. a silicon atom and an oxygen atom

b. the unique number of elements and compounds

c. shared geometric shapes

d. a specific geometric arrangement of atoms

Directed Reading *continued*

33. What is a *crystal*?

34. Each type of mineral crystal is characterized by what?

35. What hinders the growth of single, large crystals?

36. As a result of the conditions under which minerals form, minerals are commonly made up of what?

37. If a crystal forms where the surrounding material is not restrictive, how will the mineral develop?

38. Why is knowing crystal shapes helpful?

39. How do scientists use X rays to study the structure of crystals?

CRYSTALLINE STRUCTURE OF SILICATE MINERALS

_____ **40.** The crystalline structure of silicate minerals is
- **a.** made up of different basic building blocks.
- **b.** made up of the same basic building blocks.
- **c.** inconsistent from mineral to mineral.
- **d.** unique, unlike any other crystal.

_____ **41.** What does each building block of the crystalline structure of silicate minerals have?
- **a.** four oxygen atoms arranged in a pyramid with one silicon atom in the center
- **b.** one oxygen atom with four silicon atoms in the center
- **c.** three oxygen atoms arranged in a pyramid with two silicon atoms in the center
- **d.** four oxygen atoms arranged in a pyramid with four silicon atoms in the center

_____ **42.** How many sides does the basic building block of the crystalline structure of silicate minerals have?
- **a.** 1
- **b.** 2
- **c.** 3
- **d.** 4

_____ **43.** What is the basic building block of the crystalline structure of silicate minerals called?
- **a.** silicon tetrahedron
- **b.** silicon-oxygen octagon
- **c.** oxygen tetrahedron
- **d.** silicon-oxygen tetrahedron

_____ **44.** What is true of silicon-oxygen tetrahedra?
- **a.** They combine in the same arrangements to form different silicates.
- **b.** They combine in different arrangements to form different silicates.
- **c.** They combine in the same arrangements to form the same silicates.
- **d.** They combine in different arrangements to form nonsilicates.

_____ **45.** The various arrangements of the silicon-oxygen tetrahedra are a result of
- **a.** the kinds of bonds that form between the silicon atoms of the tetrahedra and other tetrahedra.
- **b.** the kinds of bonds that form between the oxygen atoms of the tetrahedra and the silicon atoms of the tetrahedra.
- **c.** the kinds of bonds that form between the oxygen atoms of the tetrahedra and other atoms.
- **d.** the kinds of bonds that form between the silicon atoms of the tetrahedra and other atoms.

_____ **46.** The oxygen and silicon atoms of the tetrahedra may bond with
- **a.** silicon atoms of other tetrahedra only.
- **b.** atoms of neighboring tetrahedra, and bonds may form between the silicon atoms and other elements outside the tetrahedra.
- **c.** atoms of other elements only.
- **d.** atoms of neighboring tetrahedra, and bonds may form between the oxygen atoms and other elements outside the tetrahedra.

THE CRYSTALLINE STRUCTURE OF NONSILICATE MINERALS

_____ **47.** Why do nonsilicate minerals show a variety of crystalline structures?
- **a.** because nonsilicate minerals are similar to silicate minerals
- **b.** because nonsilicate minerals have similar chemical compositions
- **c.** because nonsilicate minerals have diverse chemical compositions
- **d.** because silicate minerals have diverse chemical compositions

_____ **48.** What are common crystal structures for nonsilicate minerals?
- **a.** cubes, spheres, triangles
- **b.** cubes, hexagonal prisms, irregular messes
- **c.** prisms, polyspheres, tetragons
- **d.** cubes, hexagonal prisms, irregular masses

_____ **49.** Nonsilicates may form
- **a.** tetrahedra that are similar to those in silicates.
- **b.** tetrahedra that are similar to those in nonsilicates.
- **c.** tetrahedra that are exactly the same as those in silicates.
- **d.** other crystalline structures that are exactly like silicates.

_____ **50.** What is true of the ions in the center of nonsilicate tetrahedra?
- **a.** They are oxygen.
- **b.** They are not silicon.
- **c.** They are silicon.
- **d.** They are not ions.

51. How can classes of nonsilicate minerals be divided into smaller groups?

52. What determines a nonsilicate's characteristics?

53. Why do the native elements have very high densities?

54. What is *closest packing*?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Identifying Minerals

_____ **1.** Mineralogists are scientists who
- **a.** study the weather.
- **b.** examine, analyze, and classify the weather.
- **c.** examine, analyze, and classify minerals.
- **d.** examine, analyze, and classify animals.

_____ **2.** Mineralogists identify minerals by
- **a.** using special equipment.
- **b.** finding similar minerals in books.
- **c.** studying properties of the weather.
- **d.** studying the properties of minerals.

PHYSICAL PROPERTIES OF MINERALS

_____ **3.** Each mineral has specific properties that are a result of
- **a.** scientific theory.
- **b.** crystals in its chemicals.
- **c.** chemical composition and crystalline structure.
- **d.** specialized equipment.

_____ **4.** What is one property of a mineral that is easy to observe?
- **a.** magnetism
- **b.** size
- **c.** weight
- **d.** color

_____ **5.** Color alone is generally
- **a.** a reliable clue for identifying a mineral sample.
- **b.** not a reliable clue for identifying a mineral sample.
- **c.** the best way of identifying a mineral sample.
- **d.** not a clue for identifying a mineral sample.

_____ **6.** What is true of mineral color?
- **a.** It takes large amounts of certain elements to affect color.
- **b.** Very small amounts of certain elements may greatly affect color.
- **c.** Many minerals are dissimilar in color.
- **d.** All minerals are similar in color.

_____ **7.** What is corundum?
- **a.** yellow pyrite with traces of fool's gold
- **b.** a bluish mineral composed of aluminum and carbon atoms
- **c.** a colorless mineral composed of aluminum and oxygen atoms
- **d.** amethyst with traces of chromium

_____ **8.** What is corundum with traces of chromium, Cr?
- **a.** a red gem called diamond
- **b.** a red gem called sapphire
- **c.** a red gem called ruby
- **d.** a red gem called garnet

_____ **9.** What causes the purple color of amethyst?
- **a.** carbon, C; and iron, Fe
- **b.** manganese, Mn; and corundum
- **c.** quartz and crystal
- **d.** manganese, Mn; and iron, Fe

_____ **10.** What is another reason that color is unreliable in identifying minerals?
- **a.** Color is not a significant property of minerals.
- **b.** Most minerals are basically the same color.
- **c.** Weathered surfaces may hide the color of minerals.
- **d.** Minerals and elements are basically the same color.

_____ **11.** What is streak?
- **a.** the shape of the mineral crystal when frozen
- **b.** the color of the mineral in powdered form
- **c.** the surface color observed when the mineral is cleaved
- **d.** the color of the mineral in large crystals

_____ **12.** The easiest way to observe the streak of a mineral is to
- **a.** rub some of the mineral against a streak plate.
- **b.** rub two pieces of the mineral together.
- **c.** rub the mineral on paper.
- **d.** use rubbing compound to make it shine.

_____ **13.** What is true of the streak's color?
- **a.** It is almost always the same as the mineral in solid form.
- **b.** It may differ from the color of the mineral in solid form.
- **c.** It may differ from the color of the mineral in liquid form.
- **d.** It is never accurate, but scientists still use it.

_____ **14.** What kind of streak do metallic minerals generally have?
- **a.** silver
- **b.** neutral or no streak
- **c.** dark
- **d.** very light

15. Describe the streak of most nonmetallic minerals.

16. What is *luster*?

17. What is *metallic luster*?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **18.** glassy luster

_____ **19.** waxy luster

_____ **20.** pearly luster

_____ **21.** brilliant luster

_____ **22.** dull or earthy luster

a. diamond, for example

b. mineral that lacks any shiny appearance

c. transparent quartz and other minerals that look like glass

d. minerals such as mica

e. minerals that have the appearance of candle wax

23. What is *cleavage* in geology?

24. Where does a mineral break when it has cleavage?

25. What is *fracture* in minerals?

26. How do mineralogists describe a fracture?

Directed Reading *continued*

27. What is *hardness* in mineralogy?

28. Describe an example of how hardness does NOT mean "resistance to cleavage or fracture."

29. What is the *Mohs hardness scale*?

30. How do mineralogists test the hardness of an unknown mineral?

31. What are the softest and hardest minerals on the Mohs hardness scale?

32. How would you use the Mohs hardness scale to test an unknown mineral?

33. What does a diamond's hardness result from?

34. Why does a mineral always have the same general shape?

35. What is the basic crystal system where three axes of equal length intersect at 90° angles?

36. What is a tetragonal crystal system?

37. What is the basic crystal system where two of the three axes of unequal length intersect at 90° angles, and the third axis is oblique to the others?

38. What is an orthorhombic crystal system?

39. What is the basic crystal system where three horizontal axes of the same length intersect at 120° angles, and the vertical axis is longer or shorter than the horizontal axes?

40. What is a triclinic crystal system?

41. What can cause the six basic crystal shapes to become more complex?

42. How would a piece of galena feel compared with a piece of quartz of the same size?

43. What is *density*?

44. On what does the density of a mineral depend?

_____

_____

45. What are the densities of most of the common minerals in Earth's crust?

_____

_____

SPECIAL PROPERTIES OF MINERALS

_____ **46.** What color is calcite in ordinary light?
- **a.** white
- **b.** red
- **c.** blue
- **d.** violet

_____ **47.** What color does calcite appear to be in ultraviolet light?
- **a.** white
- **b.** red
- **c.** blue
- **d.** violet

_____ **48.** Minerals with the property of fluorescence
- **a.** absorb ultraviolet light and then produce invisible light of a single color.
- **b.** reflect ultraviolet light and then produce visible light of various colors.
- **c.** reflect ultraviolet light and then produce invisible light of various colors.
- **d.** absorb ultraviolet light and then produce visible light of various colors.

_____ **49.** Phosphorescence is the property that causes a mineral to
- **a.** turn colors after ultraviolet light is turned on.
- **b.** bubble when it is converted to liquid form.
- **c.** grow after ultraviolet light is turned on.
- **d.** glow after ultraviolet light is turned off.

_____ **50.** Phosphorescence is useful in mining
- **a.** lithium, an ore of eucryptite.
- **b.** eucryptite, an ore of lithium.
- **c.** eucharite, an ore of mythium.
- **d.** kryptonite, an ore of lithium.

_____ **51.** What is a chatoyancy?
- **a.** a silky appearance some minerals display in ultraviolet light
- **b.** a silky appearance some minerals display in reflected light
- **c.** a soft appearance some minerals display in phosphorescent light
- **d.** a foggy appearance some minerals display in deflected light

_____ **52.** What it chatoyancy also called?
- **a.** cat-and-mouse effect
- **b.** catnip effect
- **c.** cat's-cradle effect
- **d.** cat's-eye effect

_____ **53.** What causes chatoyancy?
- **a.** loosely packed perpendicular fibers within a mineral
- **b.** closely packed perpendicular fibers within a mineral
- **c.** loosely packed parallel fibers within a mineral
- **d.** closely packed parallel fibers within a mineral

_____ **54.** What is asterism?
- **a.** a phenomenon in which a six-sided star shape appears when a mineral reflects light
- **b.** a phenomenon in which a five-sided star shape appears when a mineral absorbs light
- **c.** a phenomenon in which a four-sided shape appears when a mineral reflects light
- **d.** a phenomenon in which a square appears in a mineral

_____ **55.** What happens to light rays as they pass through transparent minerals?
- **a.** They straighten out.
- **b.** They bend.
- **c.** They are absorbed.
- **d.** They are reflected.

_____ **56.** What is refraction?
- **a.** the absorption of light rays as they pass from a substance, such as air, to another substance, such as a mineral
- **b.** the disappearance of light rays as they pass from a substance, such as air, to another substance, such as a mineral
- **c.** the bending of light rays as they pass from a substance, such as air, to another substance, such as a mineral
- **d.** the ending of light rays as they pass from a substance, such as rock, to another substance, such as a soil

57. Describe the property called *double refraction*.

Directed Reading *continued*

58. What causes double refraction to occur?

59. Magnets may attract small particles of some minerals that contain what element?

60. What do bar magnets and some pieces of lodestone both have?

61. From what conditions does *radioactivity* result?

62. What are two examples of radioactive elements?

63. What is the most common mineral that contains uranium?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Rocks and the Rock Cycle

_____ **1.** The solid part of Earth is made up of material called
- **a.** glacial ice.
- **b.** lava.
- **c.** rock.
- **d.** wood.

_____ **2.** Rock can be a collection of one or more minerals, or it might be made of
- **a.** inorganic matter.
- **b.** solid organic matter.
- **c.** liquid organic matter.
- **d.** chemicals.

_____ **3.** Which of the following can rock sometimes be made of?
- **a.** brick
- **b.** mineral matter that is not crystalline
- **c.** inorganic matter
- **d.** plastic

_____ **4.** Scientists who study the processes that form and change rock are called
- **a.** geologists.
- **b.** paleontologists.
- **c.** botanists.
- **d.** zoologists.

THREE MAJOR TYPES OF ROCKS

_____ **5.** The word igneous comes from a Latin term that means
- **a.** “from fire.”
- **b.** “from wind.”
- **c.** “from rock.”
- **d.** “from fossils.”

_____ **6.** How do rocks get broken down into small fragments?
- **a.** by freezing
- **b.** by erosion
- **c.** by deposition
- **d.** by crystallization

_____ **7.** Which of the following does NOT change the form of existing rock?
- **a.** extreme pressure
- **b.** extreme heat
- **c.** a chemical process
- **d.** light

_____ **8.** The word metamorphic means
- **a.** "changed from."
- **b.** "to become."
- **c.** "changed form."
- **d.** "to form."

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **9.** igneous rock

_____ **10.** sedimentary rock

_____ **11.** lava

_____ **12.** metamorphic rock

_____ **13.** magma

_____ **14.** sediment

- **a.** rock that forms when existing rock is altered
- **b.** molten rock
- **c.** rock that forms when molten rock cools and hardens
- **d.** rock that forms when rock fragments are compressed and cemented together
- **e.** molten rock that is exposed at Earth's surface
- **f.** rocks, mineral crystals, and organic matter that have been broken into fragments

THE ROCK CYCLE

15. Define *rock cycle.*

_____

_____

_____

16. When a body of _____ rock is exposed at Earth's surface, a number of processes break the rock down into sediment.

17. When bits and pieces of rock are compacted or cemented, the bits and pieces become _____ rocks.

18. If sedimentary rocks are subjected to changes in temperature and pressure, the rocks may become _____ rocks.

19. Under certain temperature and pressure conditions, metamorphic rock will melt and form _____.

20. If magma cools, it turns into new _____ rock.

21. A particular body of rock does not always pass through each stage of the _____.

PROPERTIES OF ROCKS

22. How are the physical and chemical properties of rock determined?

23. What do the physical characteristics of a rock reflect?

24. What does the chemical stability of the minerals in the rock determine?

25. The way that minerals and rocks form is related to the _____ of the rock.

26. What did N.L. Bowen learn when he first began studying how minerals crystallize from magma?

27. Define *Bowen's reaction series*.

Directed Reading *continued*

28. According to Bowen's hypothesis, what are the two ways that minerals form?

_____

_____

_____

29. The rate at which a mineral chemically breaks down is dependent on the _____ of the mineral.

30. The chemical stability of minerals is dependent on the strength of the _____ between atoms in the mineral.

31. What two factors determine rocks' natural zones of weakness?

_____

_____

32. Both sedimentary and metamorphic rocks tend to break in _____.

33. When rock formed under intense _____ is uplifted to Earth's surface, decreased pressure allows the joints and fractures to open.

34. Once weaknesses are exposed to air, the processes of physical and chemical _____ begin.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Igneous Rock

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

crystalline igneous rock chemical composition

1. When magma cools and hardens, it forms _____.
2. Most igneous rock can be identified as _____ because the minerals in the rock crystallize as igneous rock forms from magma.
3. The _____ of minerals in the rock and its texture determine the identity of the igneous rock.

THE FORMATION OF MAGMA

In the space provided, write the letter of the answer choice that best completes each statement or best answers each question.

_____ **4.** Magma forms when rock
- **a.** cools.
- **b.** solidifies.
- **c.** weathers.
- **d.** melts.

_____ **5.** Three factors that affect whether rock melts include temperature, pressure, and
- **a.** the presence of fluids in the rock.
- **b.** the chemical composition of the rock.
- **c.** the composition of the fluid in the rock.
- **d.** the chemical/fluid ratio of the rock.

_____ **6.** Rock melts when
- **a.** its temperature drops below the melting point of minerals in the rock.
- **b.** its temperature rises above the melting point of minerals in the rock.
- **c.** the air temperature reaches 38°C.
- **d.** it breaks into fragments.

_____ **7.** Adding fluids to hot rock generally
- **a.** increases the melting point of certain minerals in the rock.
- **b.** has no effect on the melting point of certain minerals in the rock.
- **c.** decreases the melting point of certain minerals in the rock.
- **d.** causes the rock to crystallize.

_____ **8.** The first minerals to melt have the
- **a.** highest melting point.
- **b.** lowest melting point.
- **c.** darkest color.
- **d.** lightest color.

_____ **9.** The process by which different minerals in rock melt at different temperatures is called
- **a.** meltdown.
- **b.** partial melting.
- **c.** total melting.
- **d.** decomposition.

_____ **10.** How does the cooling process of magma compare with the melting process?
- **a.** The cooling process is the same as the process of partial melting.
- **b.** The cooling process is the reverse of the process of partial melting.
- **c.** The cooling process is faster than the process of partial melting.
- **d.** The cooling process is slower than the process of partial melting.

_____ **11.** As temperature drops, the first minerals to crystallize from magma have
- **a.** the lowest freezing point.
- **b.** the highest freezing point.
- **c.** no freezing point.
- **d.** the same freezing points.

_____ **12.** The crystallization and removal of different minerals from the cooling magma is called
- **a.** partial cooling.
- **b.** total freezing.
- **c.** crystallization.
- **d.** fractional crystallization.

_____ **13.** Crystals that form during fractional crystallization
- **a.** settle in the middle of the magma chamber.
- **b.** settle at the bottom or stick to the walls and ceiling of the magma chamber.
- **c.** leave the magma chamber.
- **d.** dissolve in the magma chamber.

_____ **14.** In some crystals, why is the chemical composition of the inner part different from that of the outer part?

a. The crystallization took place very quickly.
b. The crystallization happened over a long period.
c. The temperature of the magma changed during crystallization.
d. The composition of the magma changed while the crystal was growing.

TEXTURES OF IGNEOUS ROCKS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **15.** intrusive igneous rock

_____ **16.** extrusive igneous rock

_____ **17.** coarse-grained texture

_____ **18.** fine-grained texture

_____ **19.** porphyritic texture

_____ **20.** glassy texture

_____ **21.** vesicular texture

a. the texture of quickly cooled magma that has a mixture of large and small crystals
b. the texture of quickly cooled magma that contains dissolved gasses that become trapped as bubbles
c. the texture of igneous rock that is composed of small crystals
d. rock formed from the cooling and solidification of lava at Earth's surface
e. the texture of quickly cooled magma that contains a small percentage of dissolved gasses
f. rock formed from the cooling and solidification of magma beneath Earth's surface
g. the texture of igneous rock that is composed of large mineral grains

22. How do intrusive and extrusive igneous rocks differ from each other?

_____

_____

_____

23. What determines the texture of igneous rock?

_____

24. What determines the size of crystals in igneous rock?

_____

25. Large mineral crystals are commonly found in _____.

26. An example of igneous rock with a coarse-grained texture is

_____.

27. Two examples of igneous rock with a fine-grained texture are

_____ and _____.

28. A rock that has a glassy texture is called _____.

_____.

29. Holes in a rock that result from rapid cooling are called

_____.

30. An example of igneous rock that has a vesicular texture is

_____.

COMPOSITION OF IGNEOUS ROCKS

31. What determines the mineral composition of an igneous rock?

32. Define *felsic*.

33. List five mineral components of felsic rock.

34. Name four examples of felsic rock.

35. Define *mafic*.

36. List the main mineral components of mafic rock.

37. What two components are responsible for the dark color of mafic rock?

38. Name two examples of mafic rock.

39. What four minerals make up rocks in the intermediate family?

40. How does the silica content of an intermediate rock compare with that of a felsic or mafic rock?

41. Name two rocks from the intermediate family.

INTRUSIVE IGNEOUS ROCK STRUCTURES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **42.** intrusion

_____ **43.** batholith

_____ **44.** stock

_____ **45.** laccolith

_____ **46.** sill

_____ **47.** dike

a. the largest of all intrusions; spreads at least 100 km^2 when exposed on Earth's surface

b. a dome that forms when magma flows between rock layers and spreads

c. an igneous rock mass that forms underground

d. a mass that forms when magma flows between rock layers and hardens; lies parallel to the rock layers that surround it

e. an intrusion similar to a batholith; covers less than 100 km^2 of Earth's surface

f. a mass that forms when magma flows and hardens across layers of rock rather than parallel to them

EXTRUSIVE IGNEOUS ROCK STRUCTURES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **50.** extrusion

_____ **51.** volcano

_____ **52.** volcanic neck

_____ **53.** lava flow

_____ **54.** lava plateau

_____ **55.** tuff

a. an extrusion that takes the form of a flat mass of rock

b. volcanic ash deposits that form during an eruption

c. an igneous rock mass that forms on Earth's surface

d. a series of lava flows that cover a vast area with thick rock

e. the solidified central vent that remains after the soft parts of a volcano are eroded by wind and water

f. a vent through which magma, gases, or volcanic ash is expelled

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Sedimentary Rock

1. Define *sediment*.

2. What three factors determine the characteristics of sedimentary rock?

FORMATION OF SEDIMENTARY ROCKS

3. How are newly formed sediments transported to new locations?

4. What determines the composition of sediment?

5. What happens to sediment as it is moved from one place to another?

6. What are the two main processes that convert loose sediment to sedimentary rock?

7. The process in which the volume and porosity of a sediment is reduced by the weight and pressure of overlying sediments is called

_____.

8. The process in which minerals precipitate into pore spaces between sediment grains and bind sediments together to form rock is called

_____.

CHEMICAL SEDIMENTARY ROCK

_____ **9.** Sedimentary rock that forms when minerals precipitate from a solution or settle from a suspension is called
- **a.** organic sedimentary rock.
- **b.** chemical sedimentary rock.
- **c.** clastic sedimentary rock.
- **d.** elastic sedimentary rock.

_____ **10.** One reason that minerals precipitate is because of
- **a.** evaporation.
- **b.** compaction.
- **c.** cementation.
- **d.** condensation.

_____ **11.** When water evaporates, it leaves behind minerals called
- **a.** metamorphites.
- **b.** magma.
- **c.** crystals.
- **d.** evaporites.

_____ **12.** Two examples of evaporites are
- **a.** coal and granite.
- **b.** gypsum and halite.
- **c.** chalk and limestone.
- **d.** sandstone and shale.

_____ **13.** The Bonneville Salt Flats near the Great Salt Lake in Utah are a good example of
- **a.** evaporite deposits.
- **b.** coal deposits.
- **c.** limestone deposits.
- **d.** shale deposits.

ORGANIC SEDIMENTARY ROCKS

Use the terms from the following list to complete the sentences below. Each term may be used only once. Some terms will not be used.

chalk, coral, carbon, calcite, coal, limestone, organic sedimentary rock

14. Sedimentary rock that forms from the remains of plants or animals is called _____.

15. Some limestones and _____ are examples of organic sedimentary rocks.

16. Coal forms from plant remains that are buried before they decay and are then compacted into matter that is composed mainly of _____.

17. Organic limestone forms when marine organisms such as coral, clams, oysters, and plankton remove chemical components of the minerals _____ and aragonite from sea water.

18. When marine organisms die, their shells eventually become _____.

19. An example of limestone made up of the shells of tiny, one-celled marine organisms that settle to the ocean floor is _____.

CLASTIC SEDIMENTARY ROCK

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **20.** clastic sedimentary rock

_____ **21.** conglomerate

_____ **22.** breccia

_____ **23.** sandstone

_____ **24.** shale

_____ **25.** quartz

a. mineral that is a major component of most sandstones

b. rock composed of angular fragments with sharp corners that range in size from fine mud to boulders

c. sedimentary rock that forms when fragments of preexisting rocks are compacted or cemented together

d. rock made up of sand-sized grains cemented together

e. rock that consists of clay-sized particles that are cemented and compacted

f. rock composed of rounded fragments sized from fine mud to boulders

CHARACTERISTICS OF CLASTIC SEDIMENTS

26. What two factors determine the physical characteristics of sediments?

27. Name the four agents that transport sediments.

28. How does the speed with which the agent of erosion moves the sediment affect that sediment?

29. Define *sorting*.

30. How do poorly sorted and well-sorted sediments differ?

31. What causes sediment to change in size and shape as it is transported from its source to where it is deposited?

32. In general, how do sediment particles that travel long distances differ from those that have traveled short distances?

SEDIMENTARY ROCK FEATURES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **33.** depositional environment

_____ **34.** stratification

_____ **35.** bed

_____ **36.** massive bed

_____ **37.** cross-bed

_____ **38.** graded bedding

_____ **39.** reverse grading

a. a stratified layer

b. a bed characterized by slanting layers

c. a type of stratification in which various sizes and kinds of materials are deposited in one layer

d. a bed with no internal structure

e. a type of stratification in which the smallest grains are on the bottom and larger grains are on top

f. the layering of sedimentary rock, which occurs when the conditions of deposition change

g. the setting in which sediment is deposited

40. A sedimentary rock feature caused by the action of wind or water on sand is called a(n) _____.

41. A sedimentary rock feature that forms when a muddy deposit dries and shrinks is called a(n) _____.

42. How are fossils formed?

_____

_____

43. How are concretions formed?

_____

_____

44. How are geodes formed?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Metamorphic Rock

1. Define *metamorphism*.

_____

_____

2. Where does most metamorphic rock form?

_____

_____

3. Metamorphic rock forms from which three types of rock?

_____

_____

_____

FORMATION OF METAMORPHIC ROCKS

Use the terms from the following list to complete the sentences below. Each term may be used only once.

parallel bands	composition	magma
pressure	tectonic plates	metamorphism

4. Hot fluids, heat, and _____ cause some minerals to change into other minerals.

5. Minerals might change in size or shape, or they sometimes separate into _____ that give rocks a layered appearance.

6. Hot fluids from magma can circulate through the rock and change the mineral _____ by dissolving some minerals and adding others.

7. The type of rock that forms because of _____ can indicate the conditions that were in place when the original rock changed.

8. One type of metamorphism occurs when small volumes of rock come in contact with _____.

9. The second type of metamorphism occurs when large areas of Earth's crust are affected by the heat and pressure caused by the movement and collisions of _____.

10. Define *contact metamorphism*.

11. Describe the area of rock that is affected by contact metamorphism.

12. In addition to changes caused by heat from magma, what other occurrence can cause changes in the surrounding rock during contact metamorphism?

13. Define *regional metamorphism*.

14. Explain how metamorphic rock forms during regional metamorphism.

15. Which type of metamorphism causes most metamorphic rock to form?

16. Explain why rocks that are formed as a result of contact metamorphism are often found near those formed by regional metamorphism.

CLASSIFICATION OF METAMORPHIC ROCKS

17. In what two ways are metamorphic rocks classified?

_____

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **18.** foliation

_____ **19.** slate

_____ **20.** schist

_____ **21.** gneiss

_____ **22.** nonfoliated

_____ **23.** quartzite

_____ **24.** marble

a. a coarse-grained rock that forms when large amounts of heat and pressure are exerted on slate

b. the metamorphic rock texture in which mineral grains are arranged in planes or bands

c. a nonfoliated rock that forms when quartz sandstone is metamorphosed

d. the metamorphic rock texture in which mineral grains are not arranged in planes or bands

e. a foliated rock that forms when pressure is exerted on the sedimentary rock shale

f. a metamorphic rock that forms from the compression of limestone

g. a metamorphic rock that forms when intense heat and pressure underground cause the minerals in schist to separate into bands as the minerals recrystallize

25. Explain the two ways in which foliated metamorphic rock might form.

_____

_____

_____

_____

26. Describe two characteristics of nonfoliated metamorphic rock.

_____

_____

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Mineral Resources

1. How many different minerals have been identified in Earth's crust?

_____

2. What are three examples of metals?

_____

_____

_____

3. What are two examples of nonmetals?

_____

_____

4. List three characteristics of metals.

_____

_____

_____

5. List two characteristics of nonmetals.

_____

_____

ORES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **6.** cinnabar

_____ **7.** native element

_____ **8.** bauxite

_____ **9.** ore

_____ **10.** magnatite

_____ **11.** compound

a. metallic mineral that can exist in Earth's crust as a nugget of pure metal

b. mineral consisting of two or more elements

c. mineral deposit from which mineral resources can be removed profitably

d. ore from which mercury can be removed

e. ore from which aluminum can be removed

f. ore from which iron can be removed

Directed Reading *continued*

12. Name three ores that form within cooling magma.

_____

_____

_____

13. What happens to dense metallic minerals as magma cools?

_____

14. The process that occurs when magma comes into contact with existing rock is _____.

15. Heat and chemical reactions with hot fluids from magma sometimes change the surrounding rock and form _____.

16. Hot fluids that can move through small cracks in rock are _____.

17. Narrow zones of rock formed when minerals precipitate from the hydrothermal solution are called _____.

18. An ore deposit that forms from many thick mineral veins in a small region is called a(n) _____.

19. List four valuable heavy minerals that commonly make up veins.

_____

_____

_____

_____

20. What happens first when movement of water helps form ore deposits?

_____

_____

21. What happens when currents become too weak to carry the dense metals?

_____

_____

22. Because of the mechanical action of the stream, fragments become concentrated at the bottom of stream beds in _____.

USES OF MINERAL RESOURCES

_____ **23.** An example of a metal valued for its beauty is
- **a.** gypsum.
- **b.** calcite.
- **c.** platinum.
- **d.** sulfur.

_____ **24.** Sources of valuable minerals and elements such as gold are
- **a.** nonmetallic minerals.
- **b.** gemstones.
- **c.** metallic ores.
- **d.** calcite and gypsum.

_____ **25.** Gemstones are
- **a.** valuable metallic ores.
- **b.** rare nonmetallic minerals.
- **c.** metals such as gold and platinum.
- **d.** common nonmetallic ores.

_____ **26.** A mineral often used as a building material is
- **a.** quartz.
- **b.** graphite.
- **c.** platinum.
- **d.** gypsum.

MINERAL EXPLORATION AND MINING

_____ **27.** In order to be considered for mining, the area must have
- **a.** a much higher concentration of minerals than is found elsewhere.
- **b.** large gold and silver deposits.
- **c.** gemstones.
- **d.** radioactivity.

_____ **28.** During mineral exploration, people search for mineral deposits by
- **a.** tracking weather patterns.
- **b.** studying local geology.
- **c.** avoiding earthquake zones.
- **d.** searching only for metallic ores.

_____ **29.** Special equipment is used to measure and identify patterns in
- **a.** organic materials, rock samples, and economic recovery.
- **b.** placer deposits, streambeds, and veins**.**
- **c.** native elements, compounds, and ore deposits.
- **d.** magnetism, gravity, radioactivity, and rock color.

_____ **30.** Subsurface mining techniques are used for mineral deposits
- **a.** close to Earth's surface.
- **b.** in the oceans.
- **c.** in stream beds.
- **d.** below Earth's surface.

_____ **31.** When overlying rock material is stripped away to reveal mineral deposits, the process is called
- **a.** subsurface mining.
- **b.** nodule mining.
- **c.** surface mining.
- **d.** placer mining.

_____ **32.** Minerals in placer deposits are mined
- **a.** in open pits.
- **b.** by dredging.
- **c.** on the deep-ocean floor.
- **d.** deep underground.

_____ **33.** A nodule would be found
- **a.** in a subsurface mine.
- **b.** on the ocean floor.
- **c.** in a river or stream.
- **d.** in an open-pit mine.

_____ **34.** Undersea mining is not practical because
- **a.** there are no valuable minerals in the ocean.
- **b.** nodules cannot be recovered.
- **c.** minerals cannot be removed from nodules.
- **d.** it is difficult and expensive.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Nonrenewable Energy

1. Name two things energy is used for.

_____

_____

2. Energy resources that exist in limited amounts and cannot be replaced quickly are called _____.

FOSSIL FUELS

_____ **3.** Nonrenewable natural resources formed from the remains of living things are called
- **a.** fossil fuels.
- **b.** prehistoric rock.
- **c.** magma.
- **d.** plants and animals.

_____ **4.** Examples of fossil fuels are
- **a.** gold, peat moss, and minerals.
- **b.** solar energy and light.
- **c.** coal, petroleum, and natural gas.
- **d.** wind energy and heat.

_____ **5.** Fossil fuels that consist of compounds containing stored energy used by plants and animals millions of years ago are called
- **a.** renewable resources.
- **b.** nuclear fuels.
- **c.** undersea nodules.
- **d.** hydrocarbons.

_____ **6.** What happens when hydrocarbons are burned?
- **a.** The forming of chemical bonds produces radioactive energy.
- **b.** The breaking of chemical bonds reduces heat and light energy.
- **c.** The forming of chemical bonds releases energy as heat and light.
- **d.** The breaking of chemical bonds releases energy as heat and light.

_____ **7.** Coal deposits are the remains of plants that have undergone a complex chemical process called
- **a.** energization.
- **b.** carbonization.
- **c.** burning.
- **d.** fossilization.

_____ **8.** Carbonization occurs when partially decomposed plant material
- **a.** is buried in swamp mud and becomes peat.
- **b.** becomes river sediment.
- **c.** develops into a renewable resource.
- **d.** releases propane and carbon dioxide.

_____ **9.** The complex chemical and physical processes would produce coal only if what is NOT present in a swamp?
- **a.** carbon dioxide
- **b.** methane
- **c.** oxygen
- **d.** bacteria

_____ **10.** As peat is covered by layers of sediments, the weight squeezes out water and gases, forming a denser material called
- **a.** anthracite.
- **b.** lignite.
- **c.** oxygen.
- **d.** bituminous coal.

_____ **11.** Bituminous coal is formed when
- **a.** increased temperature and pressure of more sediments compacts lignite.
- **b.** decreased temperature and pressure of more sediments compacts lignite.
- **c.** Earth's crust folds, producing higher temperatures and pressure.
- **d.** Earth's crust folds, producing lower temperatures and pressure.

_____ **12.** Where Earth's crust folds, producing high temperatures and pressure, bituminous coal changes into
- **a.** lignite.
- **b.** bacteria.
- **c.** anthracite.
- **d.** peat.

13. Carbon is what percent of bituminous coal?

_____

14. What happened when prehistoric plants and microorganisms died in shallow prehistoric oceans and lakes?

_____

15. As buried sediment accumulated on ocean floors and lake bottoms, what happened to the sediment?

_____

_____

16. What is another name for petroleum?

_____

17. In what form is petroleum?

_____

18. In what form is natural gas?

_____

19. Why are petroleum and natural gas deposits highly sought after?

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **20.** cap rock

_____ **21.** permeable rock

_____ **22.** impermeable rock

a. rock through which liquids cannot flow

b. the impermeable layer of rock above an oil reservoir

c. rock with spaces through which liquids can flow

23. Why does petroleum rise above trapped water beneath the cap rock?

_____

24. Why does natural gas rise above petroleum beneath the cap rock?

_____

25. What often happens when a well is drilled into an oil reservoir?

_____

FOSSIL-FUEL SUPPLIES

26. One of the main sources of energy around the world is _____.

27. Unrefined petroleum is called _____.

28. The most abundant fossil fuel in the world is _____.

29. A material that contains hard-to-mine petroleum is _____.

30. One fossil fuel with undiscovered reserves is _____.

31. Name five items for which crude oil is used besides fuel.

_____

_____

_____

_____

_____

32. In what three countries is almost two-thirds of the world's coal found?

_____

_____

_____

NUCLEAR ENERGY

_____ **33.** The basis of nuclear technology is
- **a.** making weapons.
- **b.** striking atomic nuclei with high-energy particles.
- **c.** creating atoms in a laboratory.
- **d.** joining the neutrons of several atoms.

_____ **34.** Energy produced by nuclear technologies is called
- **a.** nuclear fission.
- **b.** a nuclear reaction.
- **c.** nuclear energy.
- **d.** nuclear waste.

_____ **35.** Splitting the nucleus of a large atom into two or more smaller nuclei is called
- **a.** nuclear energy.
- **b.** nuclear splitting.
- **c.** nuclear fusion.
- **d.** nuclear fission.

_____ **36.** Splitting an atom creates a powerful reaction because
- **a.** atoms contain no smaller parts.
- **b.** the forces holding the nucleus together are extremely strong.
- **c.** the chemical bonds between atoms are unbreakable.
- **d.** the nucleus of an atom is weak.

_____ **37.** What happens when the nucleus of an atom splits?
- **a.** It releases additional neutrons as well as energy.
- **b.** It releases additional electrons as well as energy.
- **c.** It combines with nearby atoms.
- **d.** Nothing happens.

_____ **38.** What occurs as newly released neutrons from an atomic reaction strike other nearby nuclei?
- **a.** splitting of a neutron
- **b.** a chain reaction
- **c.** joining of two nuclei
- **d.** nuclear fusion

_____ **39.** An uncontrolled fission reaction may result in
- **a.** the splitting of a neutron.
- **b.** an electrical storm.
- **c.** the joining of two nuclei.
- **d.** an explosion.

_____ **40.** What kind of nuclear reaction must occur in order to produce heat that can be used to generate electricity?
- **a.** controlled fission
- **b.** controlled fusion
- **c.** uncontrolled fission
- **d.** uncontrolled fusion

41. The equipment in which controlled nuclear fission is carried out is a(n) _____.

42. The process of nuclear fission releases a tremendous amount of _____.

43. The element currently used for nuclear fission is _____.

44. After uranium-235 is processed into fuel pellets, the fuel pellets are said to be what?

_____

45. Enriched fuel pellets are used to make _____.

46. What happens when bundles of fuel rods are bombarded by neutrons?

_____

_____

47. What happens to fuel rods that are used to create nuclear fission?

48. Describe how heat from fuel rods provides power for electric generators.

49. What happens to excess heat?

50. What are two advantages of nuclear power plants?

51. What is a disadvantage of nuclear fission?

52. Why must wastes from nuclear fission be stored safely?

53. Where are nuclear wastes from nuclear power plants currently stored?

54. Where are other wastes from nuclear power plants currently stored?

55. The process in which nuclei of hydrogen atoms combine to form larger nuclei of helium is called _____.

56. The process of nuclear fusion releases _____.

57. What temperatures are needed for fusion reactions to occur?

_____

_____

_____

58. If a commercial fusion reactor could be built, what might be used as fuel?

_____

_____

_____

59. What is an advantage of using ocean water as fuel for nuclear fusion?

_____

_____

_____

60. What other advantages would energy from nuclear fusion have?

_____

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Renewable Energy

1. If worldwide energy consumption increases as predicted, in how many years will the world's supply of fossil fuels be used up?

_____

2. Why is nuclear energy not considered the best replacement for fossil fuels?

_____

_____

_____

3. What is the name of resources that can be replaced as they are used or within a human life span?

_____

GEOTHERMAL ENERGY

_____ **4.** What flows far beneath Earth's surface?
- **a.** nuclear energy
- **b.** fossil fuels
- **c.** water
- **d.** natural gas

_____ **5.** How does water beneath the surface become heated?
- **a.** by the atmosphere
- **b.** by heat absorbed by Earth's surface
- **c.** by steam produced by the sun
- **d.** by rocks heated by magma

_____ **6.** Geothermal energy comes from
- **a.** deep within the Earth.
- **b.** Earth's surface.
- **c.** right below Earth's surface.
- **d.** the atmosphere.

_____ **7.** Which is NOT a way that geothermal energy has been harnessed?
- **a.** using geothermal steam to drive turbines
- **b.** mining ores
- **c.** pumping water into hot rocks
- **d.** drilling wells to reach hot water

_____ **8.** Which place obtains 85% of its home heating from geothermal power?
- **a.** San Francisco
- **b.** Japan
- **c.** France
- **d.** Iceland

SOLAR ENERGY

9. How long does it take the sun to provide enough energy to meet Earth's energy needs for one year?

_____

10. What is solar energy?

_____

_____

_____

11. What is the chief challenge scientists face with regard to solar energy?

_____

_____

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **12.** solar collector

_____ **13.** active system

_____ **14.** photovoltaic cell

_____ **15.** passive system

- **a.** a system that converts solar energy directly into electricity for small objects
- **b.** a system that converts sunshine into heat energy without moving parts
- **c.** a device such as a box with a glass top that converts sunshine into energy
- **d.** a system for using solar energy that uses solar collectors

16. Describe how a solar collector might work.

17. What is a disadvantage of solar collectors?

ENERGY FROM MOVING WATER

18. What are two sources of energy from moving water?

19. What is energy produced by running water called?

20. How much of the United States' electricity comes from hydroelectric power plants?

21. Why is a dam necessary for a hydroelectric plant?

22. What happens inside a hydroelectric plant?

23. How have people made use of tides as a source of energy?

ENERGY FROM BIOMASS

_____ **24.** Which is NOT an example of biomass?
- **a.** paper waste
- **b.** manure
- **c.** coal
- **d.** wood

_____ **25.** Where is biomass a major source of energy?
- **a.** in many developing countries
- **b.** in the United States
- **c.** in Europe
- **d.** in many industrial countries

_____ **26.** What percentage of trees that are cut down are used as an energy source?
- **a.** 100%
- **b.** 25%
- **c.** less than 50%
- **d.** more than 50%

_____ **27.** The action of bacteria on biomass can produce
- **a.** natural gas and petroleum.
- **b.** gases and liquids that can be burned as fuel.
- **c.** fire and water.
- **d.** electricity and nuclear fission.

ENERGY FROM WIND

28. What causes wind?

_____

29. What devices convert wind energy into mechanical energy?

_____

30. In what kinds of places is wind energy currently producing electricity?

_____

31. What is the name for a group of hundreds of giant wind turbines?

_____

32. How much energy might such large groups of wind turbines produce?

_____

33. What is the main disadvantage of wind energy?

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Resources and Conservation

_____ **1.** According to predictions, worldwide coal reserves will last
- **a.** about 20 years.
- **b.** about 100 years.
- **c.** about 200 years.
- **d.** indefinitely.

_____ **2.** According to predictions, humans will have used half of Earth's oil supply within
- **a.** 20 years.
- **b.** 100 years.
- **c.** 200 years.
- **d.** 1,000 years.

_____ **3.** What are people doing about the limited supply of traditional energy resources?
- **a.** stopping the use of fossil fuels
- **b.** researching new energy sources
- **c.** giving up coal mining
- **d.** using only renewable resources

4. In general, how can mining damage the environment?

_____

_____

5. How can fossil fuels and nuclear power generation damage the environment?

_____

_____

6. How have governments helped reduce the impact of energy use on the environment?

_____

_____

ENVIRONMENTAL IMPACTS OF MINING

7. Name two kinds of pollution caused by mining.

_____

_____

Directed Reading *continued*

8. How does mining affect water resources?

9. Describe a mining practice that harms wildlife habitats.

10. What may happen to land above a mine as a result of removing materials below the surface?

11. Why are fires in coal mines a problem?

12. What is the purpose of laws in the United States that regulate mines?

13. Name three laws that regulate mining operations.

14. What law protects threatened or endangered species from mining?

15. What is reclamation?

16. What is the effect of reclamation?

17. How do some mining operations work to reduce environmental damage?

FOSSIL FUELS AND THE ENVIRONMENT

_____ **18.** What is a likely feature of land where strip mining has been performed?
- **a.** green forests
- **b.** deep holes
- **c.** rolling hills
- **d.** clear water

_____ **19.** What can happen to land whose plants and topsoil are removed by strip mining?
- **a.** It can provide new habitats for wildlife.
- **b.** It can be turned into fertile farm land.
- **c.** It often erodes quickly.
- **d.** Nothing happens to it.

_____ **20.** When rocks exposed by mining weather to form acids, what may be a harmful effect?
- **a.** Runoff can carry the acids into rivers and harm aquatic life.
- **b.** The rocks can wear away and form poisoned soil.
- **c.** Acid runoff can form gullies and ravines.
- **d.** The mines can no longer produce high-quality coal.

_____ **21.** When coal with a high sulfur content is burned, what is released into the atmosphere in large amounts?
- **a.** carbon dioxide
- **b.** carbon monoxide
- **c.** hydrogen
- **d.** sulfur dioxide

_____ **22.** Under what conditions does acid precipitation form?
- **a.** when SO_2 combines with water in the air
- **b.** when CO_2 combines with water in the air
- **c.** when water breaks up into hydrogen and oxygen
- **d.** when hydrogen combines with CO

_____ **23.** A major cause of acid rain is
- **a.** burning coal.
- **b.** burning gasoline.
- **c.** catalytic converters.
- **d.** combining petroleum and natural gas.

_____ **24.** Which is NOT an effective way to reduce pollutants emitted by cars?
- **a.** careful maintenance
- **b.** catalytic converters
- **c.** coal use regulations
- **d.** emissions testing

CONSERVATION

_____ **25.** The preservation and wise use of natural resources is called
- **a.** environmental science.
- **b.** recycling.
- **c.** conservation.
- **d.** reclamation.

26. Name three ways conservation can help the environment.

27. Why are people in developing countries using more mineral resources?

28. Name two ways minerals can be conserved.

29. Define *recycling*.

30. Name three metals that are often recycled.

31. Compared with the energy used by mining and manufacturing, how much energy does recycling require?

32. How does insulation in a home help conserve energy?

Directed Reading *continued*

33. How do energy-efficient appliances help conserve energy?

34. Describe two additional ways to conserve energy in your home.

35. How much carbon dioxide does an average car produce for each 3.8 L of gasoline burned?

36. Describe three ways to conserve gasoline.

37. What do scientists predict about freshwater resources in the not too distant future?

38. Describe four ways to help conserve water.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Determining Relative Age

1. How old is Earth estimated to be?

2. Who originated the idea that Earth is billions of years old?

3. On what did the 18th-century Scottish physician and farmer base his conclusions?

UNIFORMITARIANISM

4. What did James Hutton theorize?

5. What is the principle of uniformitarianism?

6. In what way is the principle of uniformitarianism important to the science of geology?

7. How did later geologists refine Hutton's ideas?

8. Before Hutton, what two things did people believe about the age and geology of Earth?

9. What question did Hutton's principle of uniformitarianism raise?

10. What did Hutton observe about the forces that shaped the land on his farm?

11. How did Hutton's observations and conclusions influence other scientists?

12. What is one way to learn about Earth's past?

RELATIVE AGE

_____ **13.** Layers of rock are called
- **a.** strata.
- **b.** data.
- **c.** errata.
- **d.** pages.

_____ **14.** The order of rock layers reveals
- **a.** the type of rock in the layers.
- **b.** the relative age of the layers.
- **c.** the exact years in which each layer formed.
- **d.** periods of volcanic activity.

_____ **15.** Relative age indicates
- **a.** the true age of the rock layers.
- **b.** that all rock was formed at the same time.
- **c.** the amount of erosion in a rock layer.
- **d.** that one rock layer is older than another layer.

_____ **16.** Although various types of rock form layers, what type of rock is commonly used by scientists to determine the relative age of rocks?
- **a.** igneous rock
- **b.** metamorphic rock
- **c.** sedimentary rock
- **d.** superheated rock

LAW OF SUPERPOSITION

_____ **17.** Sedimentary rocks form when
- **a.** lava flows from volcanoes at different periods of volcanic activity.
- **b.** new layers of sediment are deposited on top of old layers of sediment.
- **c.** magma is injected into older rock from Earth's core and then cools.
- **d.** rivers erode igneous rocks and wind forms the edges into layered shapes.

_____ **18.** Layers of compressed and hardened sediments are called
- **a.** beds.
- **b.** leaves.
- **c.** shelves.
- **d.** sheets.

_____ **19.** What is a bedding plane?
- **a.** a single sediment bed
- **b.** a dark-colored layer of sediment
- **c.** a light-colored layer of sediment
- **d.** a boundary between rock beds

_____ **20.** The law of superposition helps scientists determine the
- **a.** relative age of a layer of sedimentary rock.
- **b.** true age of a layer of sedimentary rock.
- **c.** composition of a layer of sedimentary rock.
- **d.** rate at which a layer of sedimentary rock will erode.

PRINCIPLE OF ORIGINAL HORIZONTALITY

_____ **21.** In what kinds of layers does sedimentary rock generally form?
- **a.** vertical
- **b.** horizontal
- **c.** circular pools
- **d.** rippled curves

_____ **22.** What can scientists assume when sedimentary rock layers are not horizontal?
- **a.** The rock has been tilted or deformed.
- **b.** The rock is not actually sedimentary.
- **c.** The rock has been eroded.
- **d.** The law of superposition is wrong.

_____ **23.** What causes sedimentary rock layers to be tilted or deformed?
- **a.** erosion by water
- **b.** lava flows from volcanoes
- **c.** movements of Earth's crust
- **d.** the weight of new layers of sediment

_____ **24.** When sedimentary rock is tilted or deformed, scientists know that crustal movements occurred
- **a.** while lava was flowing.
- **b.** before the rock was formed.
- **c.** while the rock was forming.
- **d.** after the rock was formed.

25. In what cases is it difficult to apply the law of superposition?

26. When sedimentary rock layers have been tilted or deformed, what must scientists do before they can apply the law of superposition?

27. What is graded bedding?

28. What can scientists assume if large particles are in the top of a layer of sedimentary rock?

29. When sandy sediments form curved beds at an angle to the bedding plane, what are the sedimentary layers called?

30. Why do the layers in cross-beds appear to be curved at the bottom and cut off at the top?

31. Why do scientists study the shapes of cross-beds?

32. What are ripple marks, and how are they formed?

33. What can scientists assume if ripple marks in sedimentary rock point up?

34. How do scientists use ripple marks to determine the relative ages of rocks?

UNCONFORMITIES

_____ **35.** How are buried rock layers exposed to erosion?

- **a.** They are lifted up by changes in weather.
- **b.** They expand when Earth's climate warms.
- **c.** They are lifted up by movements of Earth's crust.
- **d.** Buried layers are never exposed to erosion.

_____ **36.** An unconformity shows that

- **a.** erosion occurs all the time.
- **b.** deposition stopped for a period of time.
- **c.** an area was underwater.
- **d.** volcanic action increased at one time.

_____ **37.** According to the law of superposition, what is the age relationship of rocks on either side of an unconformity?

- **a.** All the rocks beneath an unconformity are younger than the rocks above it.
- **b.** All the rocks at the boundary of an unconformity are the same age.
- **c.** All the rocks beneath an unconformity are older than the rocks above it.
- **d.** The age relationship between rocks at an unconformity cannot be determined.

_____ **38.** Which of the following is NOT a type of unconformity?
- **a.** two
- **b.** three
- **c.** four
- **d.** five

_____ **39.** Which of the following is NOT a type of unconformity?
- **a.** discontinuity
- **b.** disconformity
- **c.** nonconformity
- **d.** angular unconformity

_____ **40.** How does a nonconformity form?
- **a.** Unstratified igneous or metamorphic rock is folded and tilted and then eroded.
- **b.** Unstratified igneous or metamorphic rock is uplifted, erodes, and then covered by new igneous or metamorphic rock.
- **c.** Stratified rock is buried beneath unstratified igneous or metamorphic rock when a volcano erupts.
- **d.** Unstratified igneous or metamorphic rock us uplifted, erodes, and then sediments are deposited on the eroded surface.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **41.** unconformity

_____ **42.** deposition

_____ **43.** angular unconformity

_____ **44.** erosion

_____ **45.** nonconformity

_____ **46.** disconformity

- **a.** accumulation of sediments
- **b.** the boundary between older layers of sedimentary rock and overlying younger layers
- **c.** break in the geologic record showing that deposition stopped for a period of time
- **d.** natural force that can cause breaks in the geologic record
- **e.** boundary between stratified rock on top of unstratified rock
- **f.** the boundary between a set of tilted layers and a set of horizontal layers

Directed Reading *continued*

47. What can happen when rock layers have been disturbed by faults or intrusions?

48. What is a fault?

49. Explain how an intrusion forms.

50. What law do scientists apply to determine relative ages of rock when they find faults or intrusions?

51. Explain the law of crosscutting relationships.

52. What is the relative age of a fault or igneous intrusion that cuts through an unconformity?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Determining Absolute Age

1. What does *relative age* indicate?

_____

_____

2. Besides relative age, what else do scientists need to know in order to learn more about Earth's history?

_____

3. What is absolute age?

_____

_____

ABSOLUTE DATING METHODS

_____ **4.** A method scientists use to determine absolute age is
- **a.** observing and calculating climate changes that may or may not have occurred over time.
- **b.** using geologic processes that can be observed and measured over time.
- **c.** using geologic processes that have been observed during earthquakes and volcanic eruptions.
- **d.** studying the interaction of plants and animals and making guesses about the past.

_____ **5.** Another method of determining absolute age is
- **a.** measuring the chemical composition of certain materials in rock.
- **b.** measuring the sediment contained in several layers of rock.
- **c.** recording which layer of rock is on top of other layers.
- **d.** analyzing the chemical composition of soils on top of rock.

_____ **6.** The age of a stream can be measured using rates of erosion
- **a.** by measuring the amount of sediment in the stream.
- **b.** by measuring the rate at which the stream erodes its bed.
- **c.** by measuring the rate at which water flows through the stream during a flood.
- **d.** by measuring the number of streams that join the stream along its full length.

_____ **7.** Over what time period can rates of erosion help scientists determine absolute age?
- **a.** more than 2,000,000 years
- **b.** from 1,000,000 to 2,000,000 years
- **c.** from 100,000 to 200,000 years
- **d.** from 10,000 to 20,000 years

_____ **8.** Which geologic feature can be given an absolute age using rates of erosion?
- **a.** Mt. Saint Helens
- **b.** the Grand Canyon
- **c.** Niagara Falls
- **d.** Lake Superior

_____ **9.** Rate of erosion is not a dependable way of determining the absolute age of the Grand Canyon because
- **a.** the Grand Canyon formed during a huge flood, and little evidence remains.
- **b.** the Grand Canyon formed over millions of years, and rates of erosion may have varied greatly.
- **c.** the Grand Canyon has been surrounded by deserts, where rates of erosion are very slow.
- **d.** the Grand Canyon is too large for rates of erosion to be measured.

10. In what way can the rate of deposition be used to estimate absolute age?

11. In general, at about what rate is sedimentary rock such as limestone, shale, or sandstone deposited?

12. What are two reasons a sedimentary layer might not be deposited at the average rate?

13. How are varves similar to the rings of a tree?

14. What do varves look like?

15. Where and how do varves generally form?

16. How many layers make up a single varve?

17. How are varves useful to geologists?

RADIOMETRIC DATING

_____ **18.** Small amounts of what type of materials in rocks can act as natural clocks?
- **a.** sedimentary materials
- **b.** intrusive materials
- **c.** radioactive materials
- **d.** igneous materials

_____ **19.** Atoms of the same element that have different numbers of neutrons are called
- **a.** varves.
- **b.** isotopes.
- **c.** radioactive particles.
- **d.** alpha particles.

_____ **20.** Radioactive isotopes emit particles and energy
- **a.** at a constant rate regardless of surrounding conditions.
- **b.** at differing rates regardless of surrounding conditions.
- **c.** at differing rates depending on surrounding conditions.
- **d.** at a constant rate if conditions remain the same.

_____ **21.** When radioactive isotopes decay,
- **a.** particles are emitted, but no energy is released.
- **b.** particles are emitted, and rocks become smaller.
- **c.** particles are emitted, and small amounts of energy are released.
- **d.** particles are emitted, and large amounts of energy are released.

_____ **22.** In what way is the natural breakdown of radioactive elements most useful to scientists?
- **a.** It can provide an estimate of the absolute age of rocks.
- **b.** It can accurately measure the absolute age of rocks.
- **c.** It can provide an estimate of the relative age of rocks.
- **d.** It can accurately measure the relative age of rocks.

_____ **23.** The method of using radioactive decay to measure the absolute age of rocks is called
- **a.** blind dating.
- **b.** radioactive dating.
- **c.** radiometric dating.
- **d.** decay dating.

_____ **24.** What happens when an atom emits particles and energy?
- **a.** The atom always remains unchanged.
- **b.** The atom always changes into a different isotope of the same element.
- **c.** The atom always changes into a different isotope of the same element.
- **d.** The atom changes into a different isotope of the same element or into an isotope of a different element.

_____ **25.** The original radioactive isotope in a rock is called
- **a.** the parent isotope.
- **b.** the daughter isotope.
- **c.** the breakdown isotope.
- **d.** the clock isotope.

26. What do scientists measure when using radiometric dating?

27. What are daughter isotopes?

Directed Reading *continued*

28. How do scientists determine the absolute age of a rock using radiometric dating?

29. What changes the rate of radioactive decay?

30. What have scientists determined about the time that is required for half of any amount of a radioactive isotope to decay?

31. What is a half-life?

32. If you began with 10 g of a parent isotope, how much of that isotope would be left after one half-life?

33. How much of an original isotope remains at the end of a second half-life?

34. How can scientists determine the age of a rock sample using the half-life of a parent isotope?

35. What does a higher percentage of daughter isotopes in a rock mean?

36. How could a parent or daughter isotope be gained or lost?

37. What determines which radioactive element will give a more accurate measurement of a rock's age?

38. How long is the half-life of uranium-238?

39. For dating what kinds of geologic samples containing uranium is ^{238}U most useful? Why?

40. What is the half-life of potassium-40?

41. In what kinds of rock does potassium-40 occur?

42. What ages of rock are dated by potassium-40?

43. What is the half-life of rubidium-87, and how is it related to and used in conjunction with ^{40}K?

CARBON DATING

_____ **44.** The method used to determine the age of organic remains included in rock layers is called
- **a.** argon-argon dating, or argon-2 dating.
- **b.** carboniferous dating, or wet-carbon dating.
- **c.** carbon-carbon dating, or carbon-2 dating.
- **d.** carbon-14 dating, or radiocarbon dating.

_____ **45.** What carbon isotope combines with oxygen to form radioactive carbon dioxide, CO_2?
- **a.** carbon-12
- **b.** carbon-13
- **c.** carbon-14
- **d.** carbon-15

_____ **46.** What does most CO_2 in the atmosphere contain?
- **a.** about equal amounts of nonradioactive carbon-12 and the radioactive isotope carbon-14
- **b.** small amounts of nonradioactive carbon-12 and large amounts of the radioactive isotope carbon-14
- **c.** nonradioactive carbon-12 and no radioactive isotope carbon-14
- **d.** large amounts of nonradioactive carbon-12 and small amounts of the radioactive isotope carbon-14

47. Describe how all living organisms end up containing both ^{12}C and ^{14}C.

48. What is the first step in finding the age of a small amount of organic material?

49. What is the second step in finding the age of a small amount of organic material?

50. What is the half life of carbon-14?

51. Why does radioactive carbon-14 begin to decay after a plant or animal dies?

52. What happens to the carbon-14 in the tissues of a plant or animal that has died?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Fossil Record

_____ **1.** For what geological information are fossils an important source?
- **a.** learning whether rock is sedimentary, igneous, or metamorphic
- **b.** finding the absolute and relative ages of rocks
- **c.** seeing the erosion patterns on ancient rocks
- **d.** learning whether rocks have intrusions or faults

_____ **2.** Fossils provide clues to
- **a.** past geologic events, climates, and evolution of living things.
- **b.** past weather, cloud cover, and changes in seasons.
- **c.** recent events in human history.
- **d.** the earliest development of the Solar System.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **3.** fossil

_____ **4.** paleontology

_____ **5.** sedimentary rock

_____ **6.** igneous or metamorphic rock

- **a.** the type of rock in which almost all fossils are discovered
- **b.** the study of fossils
- **c.** the remains of an animal or plant that lived in a previous geologic time
- **d.** rock in which fossils are rarely discovered

7. Why are most fossils found in sedimentary rock?

_____

_____

_____

8. Why are fossils so rarely found in igneous or metamorphic rock?

_____

_____

_____

_____

_____

INTERPRETING THE FOSSIL RECORD

9. What type of information does the fossil record provide?

_____

_____

10. How do fossils provide important clues to environmental changes that occurred in Earth's past?

_____

_____

_____

11. What is one way scientists can tell if an area of land was once covered by an ocean?

_____

_____

12. What is one way scientists can use information from fossils?

_____

_____

FOSSILIZATION

_____ **13.** What usually happens to dead plants or animals?

a. They become fossils.
b. They just stay where they are.
c. They are eaten or decomposed by bacteria.
d. Nothing happens to them.

_____ **14.** Which type of organisms usually become fossils?

a. organisms that were buried quickly or protected from decay
b. organisms that were ignored by passing animals.
c. organisms that lived in water.
d. organisms that had hard outer shells.

_____ **15.** In general, what parts of organisms become fossils?

a. all parts are equally likely to be fossilized
b. hard parts, such as wood, bones, shells, or teeth
c. soft parts, such as skin and organs
d. only very hard woods

_____ **16.** Why are mummified remains found in very dry places?
- **a.** Most bacteria thrive in dry environments.
- **b.** Bacteria do not cause decay in dry environments.
- **c.** Fewer animals live in dry environments.
- **d.** Most bacteria cannot survive in dry environments.

_____ **17.** Which method of fossilization was also used by ancient civilizations?
- **a.** petrification
- **b.** excretion
- **c.** mummification
- **d.** deposition

_____ **18.** How are insects preserved in amber?
- **a.** They eat tree sap, which preserves their bodies.
- **b.** They become trapped in tree sap, which hardens.
- **c.** They lay eggs in sap, which hatch before the sap hardens.
- **d.** Tree sap is very dry, and few bacteria live in it.

_____ **19.** What material has been recovered from amber in rare cases?
- **a.** DNA
- **b.** RNA
- **c.** living insects
- **d.** antennae

_____ **20.** Tar seeps are formed by thick deposits of
- **a.** clay.
- **b.** amber.
- **c.** petroleum.
- **d.** silica

_____ **21.** What about tar seeps led fossilized animals to become trapped in the sticky tar?
- **a.** Tar smells good to animals.
- **b.** Tar seeps are commonly covered by water.
- **c.** Tar seeps are often found in steep holes.
- **d.** Tar seeps are surrounded by food.

_____ **22.** Which is a common petrifying mineral?
- **a.** talc
- **b.** molybdenum
- **c.** silica
- **d.** gypsum

TYPES OF FOSSILS

_____ **23.** An imprint displays
- **a.** an exact, complete form of an organism.
- **b.** internal details of an organism.
- **c.** the hard portions of an organism.
- **d.** the surface features of an organism.

_____ **24.** Which type of fossil is formed when mud fills a mold and hardens?
- **a.** an imprint
- **b.** a mold
- **c.** a cast
- **d.** a coprolite

_____ **25.** What does a cast show about an animal?
- **a.** It shows how an animal reproduced.
- **b.** It provides an exact replica of the animal.
- **c.** It shows what the animal's natural enemies were.
- **d.** It provides a general idea of the animal's size.

_____ **26.** What type of fossil gives scientists clues about what ancient animals ate?
- **a.** an imprint
- **b.** a cast
- **c.** a coprolite
- **d.** a mold

_____ **27.** Gastroliths are commonly found
- **a.** in layers of clay.
- **b.** close to dinosaur remains.
- **c.** at the bottoms of tar seeps.
- **d.** in empty pockets within shale.

_____ **28.** A trace fossil is
- **a.** fossilized dung or waste materials from ancient animals, such as dinosaurs.
- **b.** fossilized evidence of past animal movement such as a track, footprint, boring, or burrow.
- **c.** the carbonized outline of a leaf, stem, flower, or fish that was made in soft mud or clay.
- **d.** the complete fossilized body of an ancient animal.

_____ **29.** Scientists study trace fossils to find
- **a.** exactly what an animal looked like.
- **b.** precisely what an animal weighed.
- **c.** clues to an animal's appearance and activities.
- **d.** clues to what an animal ate.

_____ **30.** Which of the following is an example of a trace fossil?
- **a.** an intact dinosaur tooth
- **b.** a bird's footprint
- **c.** an imprint of a leaf
- **d.** a spider in amber

31. From what kinds of animals have scientists found trace fossils of footprints?

_____

_____

_____

_____

INDEX FOSSILS

_____ **32.** Fossils that are found only in the rock layers of a particular geologic period are called
- **a.** trace fossils.
- **b.** imprints.
- **c.** index fossils.
- **d.** complete fossils.

_____ **33.** Index fossils are found
- **a.** in a very small geographic area.
- **b.** in igneous rocks.
- **c.** widely scattered in rocks over a large region.
- **d.** widely scattered through many layers of rocks.

_____ **34.** What is most important about the features of an index fossil?
- **a.** Its features must be recognized as coming from other organisms that became fossils.
- **b.** Its features must be equally clear in each of the different fossils found.
- **c.** Its features must differ according to the location on Earth in which it is found.
- **d.** Its features must clearly distinguish it from other fossils.

_____ **35.** The organisms that form index fossils lived
- **a.** during a short span of geologic time.
- **b.** during a long span of geologic time.
- **c.** for about 2 million years
- **d.** over any span of geologic time, long or short.

_____ **36.** How commonly distributed must the fossil of an organism be in order to be considered an index fossil?
- **a.** The fossil must be rare and unique.
- **b.** The fossil must occur in fairly large numbers within the rock layers.
- **c.** The fossil may exist in any numbers, but it must be found within many different layers of rock.
- **d.** The fossil must occur in small numbers in a very specific location.

INDEX FOSSILS AND ABSOLUTE AGE

_____ **37.** Scientists use index fossils to
- **a.** determine the relative ages of different rock layers.
- **b.** find dividing points in the fossil record.
- **c.** determine branches in the development of species.
- **d.** determine the absolute ages of specific rock layers.

_____ **38.** Rock layers in which index fossils have been found can be dated accurately because the organisms that formed the index fossils lived
- **a.** for a long span of geologic time.
- **b.** for a short span of geologic time.
- **c.** all over Earth.
- **d.** in a small part of Earth.

_____ **39.** How old are the rock layers in which ammonite fossils are found?
- **a.** 100 and 200 million years
- **b.** 180 to 206 million years
- **c.** 206 to 220 million years
- **d.** 220 to 300 million years

40. How can scientists use index fossils to determine the absolute age of rock layers in different parts of the world?

41. What else do geologists use index fossils to find?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Geologic Time

1. Where can we find evidence of changes in conditions on Earth's surface?

_____

2. What do scientists use to describe the sequence and length of changes in Earth's crust?

_____

3. What is the purpose of the geologic time scale?

_____

THE GEOLOGIC COLUMN

4. What two things did 19th century scientists do to determine the relative ages of sedimentary rock all over the world?

_____

_____

5. Why did scientists combine their observations of rocks all over the world?

_____

_____

6. The ordered arrangement of rock layers is called

a(n) _____.

7. In a geologic column, the oldest rocks are located at the

_____ of the column.

8. What two things distinguish a rock layer in a geologic column?

_____

_____

9. How do the fossils in the upper layers of a geologic column differ from those in the lower, older layers?

_____

_____

_____

10. Many of the fossils that have been discovered in the oldest layers of rock have been _____ for millions of years.

11. When the first geologic columns were developed, what factors did scientists use to estimate the ages of rock layers?

_____

_____

12. What method has enabled scientists to determine the ages of rock layers more accurately?

_____

13. Suppose a scientist wants to determine the age of a rock layer with a geologic column. With what does the scientist compare the rock layer?

_____

_____

14. Suppose a layer of rock matches a layer on the geologic column. What does this tell a scientist?

_____

DIVISIONS OF GEOLOGIC TIME

15. What three indicators do geologists use to divide the geologic time scale into smaller units?

_____

16. How are rocks grouped within each unit of geologic time similar?

_____

17. A unit of geologic time is usually characterized by _____ of a dominant life-form.

18. What does the abbreviation *Ma* stand for?

_____

19. When did Precambrian time begin?

_____

20. What species were common during the Cambrian Period?

_____

_____

21. What happened to the atmosphere during the Ordovician Period?

22. When did the Silurian Period begin?

23. During which period did the age of fishes begin?

24. In what era was the Carboniferous Period?

25. In North America, into what two periods is the Carboniferous Period divided?

26. What was the dominant life-form of the Jurassic Period?

27. What marked the end of the Mesozoic Era?

28. In which epoch did the age of mammals begin?

29. When did the Eocene Epoch begin?

30. In what epoch did large carnivores appear?

31. In what period was the Pleistocene Epoch?

32. In what epoch did complex human societies develop?

33. The largest unit of geologic time is called a(n) _____.

34. Name the four eons into which geologic time is divided.

35. The Hadean eon, the Archean eon, and the Proterozoic eon make up an interval called _____.

Directed Reading *continued*

36. Why is it difficult to divide Precambrian time into smaller time units?

_____

37. An eon is divided into smaller units of geologic time called _____.

38. The first era of the Phanerozoic eon was the _____.

39. The Paleozoic Era lasted about _____.

40. What kinds of fossils are found in rocks from the Paleozoic Era?

_____

41. The era after the Paleozoic Era was the _____.

42. What kinds of fossils are found in rocks from the Mesozoic Era?

_____

43. The present geologic era is called the _____.

44. When did the present geologic era begin?

_____

45. What kinds of fossils are common in Cenozoic rocks?

_____

46. An era is divided into shorter time units called _____.

47. How do geologic periods get their names?

_____

48. A period may be divided into smaller units called _____.

49. Why can scientists not always divide a period into epochs?

_____

_____

50. An epoch may be divided into shorter units called _____.

51. How is an age defined?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Precambrian Time and the Paleozoic Era

1. Where is the geologic history of Earth recorded?

_____

2. What kind of information can scientists get from the types of rock and the fossils in a rock layer?

_____

EVOLUTION

3. The gradual development of new organisms from other organisms since the beginning of life is called _____.

4. In what year was the theory of evolution by natural selection proposed, and by whom?

_____

5. Climatic and geologic changes could affect an organism's ability to _____.

6. What do scientists study to learn why some organisms survived over long periods and others became extinct?

_____

_____

PRECAMBRIAN TIME

_____ **7.** What is a nebula?
- **a.** the newly formed sun
- **b.** a large cloud
- **c.** a star
- **d.** a planet

_____ **8.** When did the Earth form?
- **a.** about 540 million years ago
- **b.** about 4.6 billion years ago
- **c.** after Precambrian time
- **d.** before Precambrian time

_____ **9.** The time interval that began with the formation of Earth is called
- **a.** the Cenozoic Era.
- **b.** the Mesozoic Era.
- **c.** the Paleozoic Era.
- **d.** Precambrian time.

_____ **10.** When did Precambrian time begin?
- **a.** about 4.6 billion years ago
- **b.** about 540 million years ago
- **c.** about 10 billion years ago
- **d.** about 88 million years ago

_____ **11.** Approximately when did Precambrian time end?
- **a.** 3 million years ago
- **b.** 540 million years ago
- **c.** 1 million years ago
- **d.** 10,000 years ago

_____ **12.** About how much of Earth's history occurred during Precambrian time?
- **a.** 20%
- **b.** 40%
- **c.** 50%
- **d.** 88%

_____ **13.** We know little about Precambrian time because
- **a.** no rocks exist from that time.
- **b.** Earth did not exist.
- **c.** no organisms existed so there are no fossils.
- **d.** Precambrian rocks were damaged and therefore could not be identified.

14. A large area of exposed Precambrian rocks is called a

_____.

15. Name four things that cause the formation of shields.

_____

_____

_____

_____

16. How much of the world's minerals occur in the rocks of Precambrian shields?

_____

_____

17. What valuable minerals are found in the rocks of Precambrian shields?

_____

18. Name three possible reasons why fossils are rare in Precambrian rocks.

_____

_____

_____

19. Precambrian fossils consisting of reeflike deposits formed by blue-green algae are called _____.

20. Where do stromatolites form today?

_____

21. What does the presence of stromatolite fossils in Precambrian rocks indicate?

_____

THE PALEOZOIC ERA

_____ **22.** When did the Paleozoic Era occur?
- **a.** before Precambrian time
- **b.** after Precambrian time
- **c.** before Earth was formed
- **d.** after the Mesozoic Era

_____ **23.** Approximately when did the Paleozoic Era begin?
- **a.** 540 thousand years ago
- **b.** 248 million years ago
- **c.** 540 million years ago
- **d.** 3.9 billion years ago

_____ **24.** Approximately when did the Paleozoic Era end?
- **a.** 540 thousand years ago
- **b.** 5,000 years ago
- **c.** 5 million years ago
- **d.** 248 million years ago

_____ **25.** When the Paleozoic Era began, Earth's landmasses were
- **a.** arranged much as they are today.
- **b.** located in a single region of the world.
- **c.** unstable due to tectonic activity.
- **d.** scattered around the world.

_____ **26.** By the end of the Paleozoic Era, Earth's landmasses had
- **a.** collapsed and dropped below sea level.
- **b.** collided to form a supercontinent called Pangaea.
- **c.** disappeared as a result of tectonic activity.
- **d.** lost all of their mineral deposits.

_____ **27.** How do Paleozoic rocks differ from Precambrian rocks?
- **a.** Paleozoic rocks contain many fossils.
- **b.** Paleozoic rocks are much older.
- **c.** Paleozoic rocks were formed by tectonic activity.
- **d.** Paleozoic rocks are found only in North America.

_____ **28.** How many periods is the Paleozoic Era divided into?
- **a.** four
- **b.** six
- **c.** seven
- **d.** three

_____ **29.** What is the first period of the Paleozoic Era called?
- **a.** Permian Period
- **b.** Cambrian Period
- **c.** Silurian Period
- **d.** Carboniferous Period

_____ **30.** Which of the following organisms appeared during the Cambrian Period?
- **a.** primitive organisms
- **b.** mammals
- **c.** marine life-forms
- **d.** marine vertebrates

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **31.** brachiopod

_____ **32.** invertebrate

_____ **33.** index fossil

_____ **34.** trilobite

- **a.** a fossil that scientists use to date rocks
- **b.** the most common Cambrian invertebrate
- **c.** a shelled animal common during the Cambrian Period
- **d.** an animal that does not have a backbone

35. Evidence of what type of organism has NOT been found in Cambrian rocks?

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **36.** vertebrate

_____ **37.** cephalopod mollusk

_____ **38.** graptolite

a. one of the dominant invertebrate life-forms during the Ordovician Period

b. an animal that has a backbone

c. a tiny invertebrate that lived in the ocean during the Ordovician Period

39. How did Ordovician fish differ from modern fish?

_____

40. A scorpion-like sea creature that lived during the Silurian Period was the _____.

41. In what period did the first land plants and land animals evolve?

_____

42. Another name for the Devonian Period is the _____.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **43.** rhipidistian

_____ **44.** Ichthyostega

_____ **45.** lungfish

a. the first amphibians

b. an air-breathing fish with strong fins that could crawl to land

c. a fish with the ability to breathe air

46. Name three types of plants that began to develop during the Devonian Period.

_____

_____

_____

47. Briefly describe the climate during the Carboniferous Period.

_____

_____

48. Briefly describe the landscape during the Carboniferous Period.

49. What does the word *carboniferous* mean?

50. Into what periods is the Carboniferous Period divided in North America?

51. What organism from the Carboniferous Period is thought to be the modern ancestor of the sea star?

52. What did the vertebrates that appeared at the end of the Pennsylvanian Period look like?

53. Which period marks the end of the Paleozoic Era?

54. What event occurred at the end of the Permian Period that affected a large number of Paleozoic life-forms?

55. What had happened to the continents by the end of the Permian Period?

56. What environmental changes had occurred by the end of the Permian Period?

57. Name two marine invertebrates that became extinct as a result of the environmental changes at the end of the Permian Period.

58. What animals survived the environmental changes at the end of the Permian Period?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Mesozoic and Cenozoic Eras

_____ **1.** How many marine organisms died at the end of the Permian Period?
- **a.** 50%
- **b.** 78%
- **c.** 90%
- **d.** 100%

_____ **2.** How many land organisms died at the end of the Permian Period?
- **a.** 50%
- **b.** 78%
- **c.** 90%
- **d.** 100%

_____ **3.** What occurs during a mass extinction?
- **a.** All species die off.
- **b.** Large numbers of species die off.
- **c.** Organisms adapt to environmental change.
- **d.** Most life-forms survive.

4. Why did an abundance of new life-forms appear after the mass extinction of the Permian Period?

_____

_____

THE MESOZOIC ERA

5. When did the Mesozoic Era begin?

_____

6. When did the Mesozoic Era end?

_____

7. What happened to Pangaea during the Mesozoic Era?

_____

8. What caused mountain ranges to form during the Mesozoic Era?

_____

9. Describe the landscape and climate during the Mesozoic Era.

_____

_____

10. Name five kinds of animals that flourished during the Mesozoic Era.

_____

_____

_____

_____

11. What is another name for the Mesozoic Era?

_____

12. How many periods is the Mesozoic Era divided into?

_____

13. Triassic Period plants that resembled today's palm trees are called

_____.

14. Reptiles that lived in the oceans during the Triassic Period were called

_____.

15. A type of shellfish that serves as a Mesozoic index fossil is called a(n)

_____.

16. What was the dominant life-form during the Jurassic Period?

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **17.** ornithischian

_____ **18.** Apatosaurus

_____ **19.** saurischian

_____ **20.** pterosaur

_____ **21.** Stegosaurus

a. a "bird-hipped" dinosaur

b. a flying reptile with skin-covered wings

c. a saurischian weighing up to 50 tons

d. a "lizard-hipped" dinosaur

e. one of the best-known ornithischians

22. A dinosaur that was nearly 6 m tall and had teeth up to 15 cm long was called the _____.

23. A dinosaur with armor was called the _____.

24. A dinosaur with a horn was called the _____.

25. A dinosaur with a bill like a duck was called the _____.

26. The earliest flowering plant, which appeared during the Cretaceous Period, was called a(n) _____.

27. Why have no dinosaur fossils been found in rocks formed after the Cretaceous Period?

_____

_____

28. What are two theories about the cause of the mass extinction at the end of the Cretaceous Period?

_____

_____

29. The theory that a giant meteorite crash caused the extinction of dinosaurs is called the _____.

_____

30. A substance from meteorites that would have spread over Earth after a large meteorite crash is called _____.

THE CENOZOIC ERA

31. The geologic era that includes the present period is called the _____.

32. When did the Cenozoic Era begin?

_____

33. What happened to Earth's continents during the Cenozoic Era?

_____

34. What changes have occurred in Earth's climate during the Cenozoic Era?

_____

35. Why is the Cenozoic Era called the Age of Mammals?

_____

36. The period of the Cenozoic Era that includes the time before the last ice age is called the _____.

37. The period of the Cenozoic Era that began with the last ice age and includes the present is called the _____.

38. Name the epochs of the Tertiary Period.

39. Name the epochs of the Quaternary Period.

40. When did the first primates evolve?

41. What happened to world temperatures at the end of the Eocene Epoch?

42. What caused the uplifting of the Himalayas?

43. Why did many grasses, cone-bearing trees, and hardwood trees grow during the Oligocene Epoch?

44. What climatic changes affected Antarctica during the Miocene Epoch?

45. When did the largest known land mammals live?

46. Name three examples of predators that evolved during the Pliocene Epoch.

Directed Reading *continued*

47. Why did the sea level fall toward the end of the Pliocene Epoch?

_____

_____

48. When did the Pleistocene Epoch begin?

_____

49. In what epoch did animals have fur that helped them endure the cold?

_____

_____

50. When did the Holocene Epoch begin?

_____

_____

51. If the entire history of Earth is pictured as occurring in one year, on what date would dinosaurs have disappeared?

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Continental Drift

1. Who obtained new information about the continents and their coastlines 400 years ago?

_____

2. What did people notice when they studied new world maps 400 years ago?

_____

_____

WEGENER'S HYPOTHESIS

_____ **3.** The German scientist Alfred Wegener proposed a hypothesis now called
- **a.** paleomagnetism.
- **b.** continental drift.
- **c.** floating continents.
- **d.** sea-floor spreading.

_____ **4.** Wegener hypothesized that the continents formed part of a single land mass, or
- **a.** mid-ocean ridge.
- **b.** monocontinent.
- **c.** supercontinent.
- **d.** world land.

_____ **5.** When did Wegener think that small continents began forming?
- **a.** more than 25 million years ago.
- **b.** more than 2.5 billion years ago.
- **c.** less than 250 million years ago.
- **d.** less than 2.5 million years ago.

_____ **6.** Wegener speculated that over millions of years these small continents
- **a.** moved closer together.
- **b.** did not move.
- **c.** drifted to the southern hemisphere.
- **d.** drifted to their present locations.

_____ **7.** What did Wegener hypothesize about mountain ranges such as the Andes?

a. that the crumpling of the crust in places produced them
b. that volcanic eruptions created them
c. that they always existed
d. that the pressure of the oceans produced them

8. Why was Wegener interested in finding fossils of the same plants and animals on two different continents?

9. Where were the fossils from the extinct land reptile called *Mesosaurus* found?

10. Why did Wegener believe that the fossils found in South America and western Africa proved that South America and Africa had once been joined?

11. How did the ages and types of rocks found in some coastal areas of Africa and South America support Wegener's hypothesis?

12. How did the locations of mountain chains support Wegener's hypothesis?

13. Give an example of a mountain chain that seems to continue from one continent to other continents across the ocean.

14. What do layers of debris from ancient glaciers in southern Africa and South America indicate to geologists?

15. What evidence shows that tropical or subtropical swamps used to cover areas that now have colder climates?

16. How did Wegener account for differences in climate between the past and today?

17. According to Wegener, how did the continents move?

18. Why did scientists disagree with Wegener's theory of how the continents moved?

19. Why was Wegener's theory not proven in his lifetime?

MID-OCEAN RIDGES

_____ **20.** Undersea mountain ranges with steep, narrow valleys in the center are called
- **a.** black smokers.
- **b.** the Mid-Atlantic Ridge.
- **c.** mid-ocean ridges.
- **d.** sea floor ridges.

_____ **21.** Compared to sediment found farther from a ridge, sea-floor sediment closer to a ridge is
- **a.** thicker.
- **b.** thinner.
- **c.** older.
- **d.** larger.

_____ **22.** Compared to rocks farther from a ridge, rocks closer to a ridge are
- **a.** larger.
- **b.** smaller.
- **c.** older.
- **d.** younger.

_____ **23.** The oldest ocean rocks are
- **a.** 3.8 billion years old.
- **b.** less than 200 million years old.
- **c.** more than 175 million years old.
- **d.** older than rocks on land.

SEA-FLOOR SPREADING

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **24.** magma

_____ **25.** paleomagnetism

_____ **26.** rift

_____ **27.** sea-floor spreading

- **a.** the mechanism that causes the continents to move
- **b.** molten rock
- **c.** a crack in Earth's crust
- **d.** the study of the magnetic properties of rocks

28. Describe the process of sea-floor spreading.

PALEOMAGNETISM

29. In what way is Earth like a giant magnet?

30. How does a compass determine direction?

Directed Reading *continued*

31. Explain how solidified magma comes to be magnetic.

32. Why do scientists think that Earth's magnetic field has not always pointed north?

33. Rocks with magnetic fields that point north have _____.

34. Rocks with magnetic fields that point south have _____.

35. What pattern did scientists discover when they placed rocks into chronological periods of normal and reverse polarity?

36. The pattern of normal and reverse polarity in rocks enabled scientists to create the _____.

37. Describe the puzzling magnetic patterns scientists found on the ocean floor.

38. On a map of the ocean floor, what do the magnetic patterns show?

39. What did scientists think happened to cause the magnetic patterns they found?

40. What did scientists do in order to assign ages to sea-floor rocks?

41. Where were the youngest rocks on the sea floor?

_____

42. Where were the older rocks on the sea floor?

_____

43. Where does new rock form on the sea floor?

_____

44. What do sea-floor rock patterns indicate about how rock forms?

_____

_____

45. What supports Hess's theory of sea-floor spreading?

_____

_____

WEGENER REDEEMED

_____ **46.** Scientists have found evidence of reversal patterns in
- **a.** rocks only on the ocean floor.
- **b.** rocks only on land.
- **c.** rocks on the ocean floor and on land.
- **d.** rocks from the moon.

_____ **47.** Continents move over Earth's surface
- **a.** by plowing through the sea floor.
- **b.** on ice sheets on the sea floor.
- **c.** by rolling on Earth's molten core.
- **d.** by the widening sea floor, which acts as a conveyor belt.

_____ **48.** The mechanism that verifies Wegener's hypothesis of continental drift is
- **a.** geomagnetic reversal.
- **b.** magnetic symmetry.
- **c.** sea-floor contracting.
- **d.** sea-floor spreading.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Theory of Plate Tectonics

1. The theory that explains why and how continents move is called

_____.

2. By what time period was evidence supporting continental drift, which led to the development of plate tectonics, developed?

_____

HOW CONTINENTS MOVE

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **3.** oceanic crust

_____ **4.** continental crust

_____ **5.** tectonic plates

_____ **6.** lithosphere

_____ **7.** asthenosphere

a. the solid outer layer of Earth, that consists of the crust and the rigid upper part of the mantle

b. dense crust made of rock that is rich in iron and magnesium

c. blocks of Earth's shell that ride on a deformable layer of the mantle

d. solid, plastic layer of the mantle beneath the lithosphere

e. low-density crust made of rock that is rich in silica

8. What is "plastic" rock and how does it move?

_____

_____

9. Describe how continents and oceans are carried on tectonic plates.

_____

TECTONIC PLATES

10. How many major tectonic plates have scientists identified?

_____

11. Why are the boundaries of the tectonic plates not always easy to identify?

_____

_____

12. How do scientists identify plate boundaries?

_____

13. A sudden movement along the boundary of a tectonic plate is a(n)

_____.

14. Frequent earthquakes in a given zone are evidence that

_____

15. How do volcanoes help identify the locations of plates boundaries?

_____

_____

16. A zone of active volcanoes that encircles the Pacific Ocean is known as the

_____.

17. In addition to volcanoes, what also occurs frequently in the Pacific Ring of Fire?

_____

18. What do the characteristics of the Pacific Ring of Fire indicate?

_____

TYPES OF PLATE BOUNDARIES

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **19.** divergent

_____ **20.** convergent

_____ **21.** transform

_____ **22.** mid-ocean ridge

_____ **23.** subduction zone

_____ **24.** fracture zone

a. boundary between tectonic plates that are sliding past each other horizontally

b. region where one plate moves under another

c. boundary between tectonic plates that are moving away from each other

d. undersea mountain range

e. short segments of a mid-ocean ridge that are connected by transform boundaries

f. the boundary between tectonic plates that are colliding

25. Name three areas where plate boundaries may be located.

26. What happens to magma at divergent boundaries?

27. Describe the rock that forms when magma cools to form new oceanic lithosphere.

28. A narrow area that forms where the plates at a divergent boundary separate is called a _____.

29. Where are most divergent boundaries located?

30. Describe an example of a rift valley.

31. When oceanic lithosphere collides with continental lithosphere, the oceanic lithosphere is less dense than the continental lithosphere, so it sinks, or _____.

32. What deep-ocean feature forms at subduction zones?

33. As the oceanic plate subducts, it releases fluids into the mantle, causing magma to form and rise to the surface, forming _____.

34. What happens when two plates made of continental lithosphere collide?

35. What is an example of a large mountain range formed when two plates made of continental lithosphere collided?

36. What happens when two plates made of oceanic lithosphere collide?

37. What is produced from magma formed from melted mantle rock?

38. An example of a feature that formed when two plates made of oceanic lithosphere collided is _____.

39. What causes earthquakes at transform boundaries?

40. How are transform boundaries different from other types of boundaries?

41. An example of a transform boundary is the _____.

42. The San Andreas Fault is located between what two plates?

43. Transform boundaries that connect short segments of a mid-ocean ridge are called _____.

44. What is an example of a convergent boundary?

45. What is an example of a divergent boundary in the mid-Atlantic?

CAUSES OF PLATE MOTION

_____ **46.** The movement of heated material due to differences in density is called
- **a.** convection.
- **b.** a convection cell.
- **c.** radioactivity.
- **d.** plate motion.

_____ **47.** The cycle in which the cooler, denser water sinks and the warmer water rises to the surface to create a cycle is called
- **a.** convection.
- **b.** plate tectonics.
- **c.** a convection cell.
- **d.** boiling water.

_____ **48.** Earth's mantle is heated by
- **a.** tectonic plates.
- **b.** core energy and radioactivity.
- **c.** boiling water.
- **d.** cool, dense mantle material.

_____ **49.** What causes tectonic plate movement?
- **a.** Hot material in the mantle sinks.
- **b.** Lack of a convection cell causes plates to rise.
- **c.** The mantle drags overlying tectonic plates along.
- **d.** Divergent boundaries come together.

_____ **50.** What happens to newer, warmer rock at a mid-ocean ridge as it cools?
- **a.** It is elevated above nearby rock.
- **b.** It slopes downward away from the ridge.
- **c.** It sinks into the mantle and pulls away from the ridge.
- **d.** It exerts force on the plate.

51. The force on the rest of the plate from the asthenosphere below cooling, sinking rock is called _____.

52. What happens as a result of ridge push?

_____

_____

_____

_____

53. Is ridge push the main driving force of plate motion? Along with ridge push, what did scientists study for clues to forces that drive plate motion?

54. What happens to magma in places where plates pull away from each other at mid-ocean ridges?

55. The force exerted by a sinking plate caused by the subduction of lithosphere into the asthenosphere is called _____.

56. Compared to speed of plates that are not subducting, plates that are subducting move _____.

57. What three forces work together to cause plate motions?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Changing Continents

1. What is the result of slow movements of tectonic plates?

_____

_____

RESHAPING EARTH'S CRUST

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **2.** shield

_____ **3.** rifting

_____ **4.** cratons

a. rocks that have been exposed at Earth's surface

b. large areas of stable rock older than 540 million years

c. the process by which a continent breaks apart

5. Describe continental crust.

_____

6. What probably causes continental lithosphere to become thinner and weaken?

_____

7. What happens when the lithosphere weakens?

_____

_____

8. What are two ways by which continents can change?

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **9.** terrane

_____ **10.** accretion

_____ **11.** seamount

_____ **12.** atoll

a. a small volcanic island or underwater mountain

b. the process by which a terrane becomes part of a continent

c. a piece of lithosphere that has a unique geologic history

d. a small coral island

13. Describe the rocks and fossils of a terrane.

14. What is found at the boundaries of a terrane?

15. Describe the magnetic properties of a terrane.

16. What happens when a tectonic plate carrying a terrane subducts under a plate made of continental crust?

17. What two forms might terranes take when they become part of a continent?

18. Name three kinds of materials that can form terranes.

19. What often happens when large terranes and continents collide?

20. What is an example of a mountain chain that formed when a large terrane and a continent collided?

EFFECTS OF CONTINENTAL CHANGE

21. Name three factors that affect a continent's climate.

22. How have movements of tectonic plates affected modern climates?

23. Most of Earth's continental surfaces were once covered

by _____.

24. Ice covered most of Earth when all the continents were located near _____.

25. What caused Earth's temperatures to change and its ice sheet to melt?

_____

26. What happens to populations of organisms as continents rift or as mountains form?

_____

27. What is an example of a unique species that evolved on Madagascar?

_____

28. Why did unique species of plants and animals evolve on Madagascar?

_____

_____

THE SUPERCONTINENT CYCLE

_____ **29.** A picture of continental change throughout time has been constructed by
- **a.** paleontologists.
- **b.** geologists.
- **c.** geographers.
- **d.** scientists from many fields.

_____ **30.** Supercontinents are
- **a.** large landmasses formed in the past from smaller continents.
- **b.** the large continents that exist today.
- **c.** pieces of large landmasses that broke apart.
- **d.** large oceans that covered Earth in the past.

_____ **31.** According to the theory of the supercontinent cycle, what will probably occur in the future?
- **a.** No new supercontinents will form.
- **b.** Old supercontinents will reappear.
- **c.** Continents will stay as they are.
- **d.** A new supercontinent will form.

_____ **32.** Supercontinents form when
- **a.** rifts form in the lithosphere.
- **b.** new convergent boundaries form after continents collide.
- **c.** heat builds up in Earth's interior.
- **d.** continental lithosphere subducts.

_____ **33.** What causes a supercontinent to break apart?
- **a.** Heat inside Earth causes rifts to form in the supercontinent.
- **b.** The convergent boundary between two continents becomes inactive.
- **c.** A new convergent boundary forms.
- **d.** The supercontinent cycle stops.

_____ **34.** The supercontinent that formed about 300 million years ago is called
- **a.** Laurasia.
- **b.** Gondwanaland.
- **c.** Africa.
- **d.** Pangaea.

_____ **35.** The body of water on the eastern edge of Pangaea was
- **a.** the Ural Sea.
- **b.** the Tethys Sea.
- **c.** the Panthalassa Ocean.
- **d.** the Russian Sea.

_____ **36.** Pangaea was surrounded by
- **a.** mountains.
- **b.** seas.
- **c.** an ocean.
- **d.** other supercontinents.

_____ **37.** One mountain range that formed when Pangaea was created was
- **a.** the Rocky Mountains.
- **b.** the Alps.
- **c.** the Himalayas.
- **d.** the Appalachians.

_____ **38.** How were Laurasia and Gondwanaland created?
- **a.** Pangaea collided with another supercontinent.
- **b.** North America collided with Eurasia.
- **c.** Pangaea split from north to south.
- **d.** A rift split Pangaea from east to west.

_____ **39.** The Tethys Sea eventually became
- **a.** the North Atlantic Ocean.
- **b.** Gondwanaland.
- **c.** the Mediterranean Sea.
- **d.** Laurasia.

40. How were South America and Africa formed?

Directed Reading *continued*

41. How was the South Atlantic Ocean formed?

42. How were India, Australia, and Antarctica formed?

43. How were the Himalaya Mountains formed?

44. When did the Himalaya Mountains begin to form?

45. How did the Rocky Mountains, the Andes, and the Alps form?

46. How did tectonic plate motion affect the oceans?

47. What will happen to Africa and the Mediterranean Sea in 150 million years if plate movements continue at current rates?

48. Describe how east Africa will change if plate movements continue at current rates.

49. What will cause the Atlantic Ocean to widen over the next 150 million years?

50. What will happen to Australia if plate movements continue?

51. What will happen to the region west of the San Andreas Fault in 150 million years?

52. According to scientists' predictions, what will happen to the continents in 250 million years?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: How Rock Deforms

1. What is *deformation*?

_____

_____

ISOSTASY

_____ **2.** When the weight of part of the Earth's crust changes, what sometimes occurs?
- **a.** isostasy
- **b.** isolation
- **c.** deformation
- **d.** lithoformation

_____ **3.** What is the asthenosphere?
- **a.** Earth's crust
- **b.** the plastic part of the mantle
- **c.** the lithospheric plates
- **d.** the atmosphere

_____ **4.** When parts of the lithosphere thicken and become heavier, they
- **a.** push up the atmosphere.
- **b.** sink deeper into the asthenosphere.
- **c.** push up the asthenosphere.
- **d.** are thrust into the atmosphere.

_____ **5.** If parts of the lithosphere thin and become lighter,
- **a.** they push down the mantle.
- **b.** they push up the asthenosphere.
- **c.** they push up the atmosphere.
- **d.** the lithosphere rises higher in the asthenosphere.

_____ **6.** A condition of gravitational and buoyant equilibrium between Earth's lithosphere and asthenosphere is called
- **a.** isostasy.
- **b.** deformation.
- **c.** slippage.
- **d.** downward pressure.

7. How often do isostatic adjustments occur in mountainous regions?

8. What is the effect of erosion on mountains?

9. Describe the process called *uplift*.

10. Describe the process known as *subsidence*.

11. When glaciers and ice sheets melt, what happens to the land they covered and to the ocean floor?

STRESS

_____ **12.** What changes occur in rock in the Earth's crust as the lithosphere moves?

a. It is liquified, solidified, and cemented.
b. It is squeezed, stretched, and twisted.
c. Since it is extremely hard, it keeps its shape.
d. It is stressed until it breaks like glass.

_____ **13.** What is stress?

a. the cracks caused by squeezing, stretching, and twisting
b. the type of isostatic adjustment the crust makes
c. the type of force exerted on each unit of area
d. the amount of force exerted on each unit of area

_____ **14.** The type of stress that squeezes and shortens a body is called
- **a.** collision.
- **b.** tension.
- **c.** compression.
- **d.** convergence.

_____ **15.** In addition to reducing the amount of space that rock occupies, compression
- **a.** pushes rocks higher up or deeper down into the crust.
- **b.** pulls rocks higher up into the crust.
- **c.** pushes rocks deeper down into the crust.
- **d.** transforms tectonic plates.

_____ **16.** Where is one place that compression occurs?
- **a.** where tectonic plates pull apart
- **b.** where tectonic plates are stable
- **c.** where tectonic plates collide
- **d.** where tectonic plates neither pull apart or collide

_____ **17.** The type of stress known as *tension*
- **a.** squeezes a body and reduces its volume.
- **b.** stretches and pulls a body apart.
- **c.** forces rock together.
- **d.** causes explosions.

_____ **18.** When tension pulls rocks apart, the rocks
- **a.** become distorted.
- **b.** thicken.
- **c.** take up more volume.
- **d.** become thinner.

19. Where is one place that tension occurs?

_____

_____

20. What effect does *shear stress* have?

_____

_____

_____

_____

21. What happens to sheared rocks as they slide past each other?

_____

_____

22. Where is shear stress common?

_____

_____

_____

STRAIN

_____ **23.** What is strain?
- **a.** the result of tension on rock
- **b.** any change in shape or volume of rock caused by stress
- **c.** when rock withstands any pressure put on it without changing
- **d.** when rock breaks because of compression

_____ **24.** The amount of stress rock can withstand without changing shape permanently is
- **a.** unlimited.
- **b.** nearly unlimited.
- **c.** limited.
- **d.** limited, but rarely tested.

_____ **25.** Materials that break as a result of stress are said to be
- **a.** brittle.
- **b.** fragile.
- **c.** delicate.
- **d.** ductile.

_____ **26.** Materials that bend or deform without breaking as a result of stress are referred to as
- **a.** brittle.
- **b.** fragile.
- **c.** delicate.
- **d.** ductile.

27. What affects whether rock is brittle or ductile?

_____

28. What other two factors also affect how rock will deform?

_____

_____

29. In what way will rock deform at lower temperature and pressure and at higher temperature and pressure?

_____

_____

30. What three factors determine the type of strain that stress will cause to rocks?

_____

_____

_____

FOLDS

_____ **31.** What is a fold?
- **a.** stress that causes deformed rock
- **b.** rock that causes deformation
- **c.** a bend in rock layers that results from stress
- **d.** a ductile strain of rock

_____ **32.** Rock folds are most easily observed where
- **a.** magma from volcanoes spreads downward.
- **b.** flat layers of rock were compressed inward.
- **c.** jagged layers of rock were squeezed outward.
- **d.** earthquakes flattened layers of rock.

_____ **33.** Which of the following is true of folds?
- **a.** Cracks never appear and the rock layers always remain intact.
- **b.** Sometimes cracks appear, but the rock layers never remain intact.
- **c.** Cracks never appear, but usually the rock layers remain intact.
- **d.** Sometimes cracks appear, but most commonly the rock layers remain intact.

34. What are two types of stress that can cause a fold?

_____

_____

35. What are the sloping sides of folds called, and what is the area in a fold called where limbs meet at the bend in the rock layer?

_____

36. What is the term for a plane that could slice a symmetrical fold?

_____

37. If a fold appears to be lying on its side, the fold is said to be _____.

38. Why is each fold unique?

_____

_____

39. To categorize a fold, what do scientists study?

_____

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **40.** anticline

_____ **41.** syncline

_____ **42.** monocline

_____ **43.** ridge

a. a fold in which both limbs are horizontal or almost horizontal

b. a large, narrow strip of elevated land, can occur near mountains

c. a fold in which the youngest layer is in the center, bowl shaped

d. a fold in which the oldest layer is in the center, arch shaped

44. How do monoclines form?

_____

_____

_____

45. Sometimes, a large anticline forms a(n) _____.

46. What type of fold may cause a valley?

47. What two types of folds formed the ridges and valleys of the Appalachian Mountains?

FAULTS

_____ **48.** Stresses on rock close to Earth's surface, where temperatures and pressures are low, may cause the rock to
- **a.** collapse.
- **b.** become ductile.
- **c.** bend.
- **d.** break.

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **49.** fracture

_____ **50.** fault

_____ **51.** fault plane

_____ **52.** hanging wall

_____ **53.** footwall

- **a.** the surface along which the motion occurs in a fault
- **b.** the rock below the fault plane
- **c.** a break along which one block slides relative to another
- **d.** a break around which there is no movement of the surrounding rock
- **e.** the rock above the rock plane in a nonvertical fault

54. What is a normal fault, and where does it usually form?

55. What kind of landforms can normal faults form?

Directed Reading *continued*

56. How does a reverse fault form?

57. What is a thrust fault?

58. Where are reverse faults and thrust faults common?

59. What does the strike of a fault describe?

60. What is a strike-slip fault?

61. What is one example of a large fault system?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: How Mountains Form

_____ **1.** How high is Mount Everest?
- **a.** about 1980 km above sea level
- **b.** more than 8 km below sea level
- **c.** more than 8 km above sea level
- **d.** more than 80 km above sea level

_____ **2.** What causes Mount Everest to grow taller every year?
- **a.** forces inside the Earth
- **b.** volcanoes
- **c.** the Earth's magnetic field
- **d.** gravity

MOUNTAIN RANGES AND SYSTEMS

3. Define mountain range, and provide two examples of mountain ranges.

4. What is the term for a group of adjacent mountain ranges?

5. Which four mountain ranges make up the Appalachian mountain system?

6. What are Earth's two major mountain belts?

7. Which mountain belt forms a ring around the Pacific Ocean?

8. Where does the Eurasian-Melanesian mountain belt run?

_____

_____

PLATE TECTONICS AND MOUNTAINS

_____ **9.** The major mountain belts are located along
- **a.** divergent plate boundaries.
- **b.** convergent plate boundaries.
- **c.** international boundaries.
- **d.** deep-ocean ridges.

_____ **10.** What does the location of the two major mountain belts tell scientists?
- **a.** Oceans form as a result of collision and divergence between tectonic plates.
- **b.** Mountains do not form as a result of collisions between tectonic plates.
- **c.** Most mountains form as a result of the divergence of tectonic plates.
- **d.** Most mountains form as a result of collisions between tectonic plates.

_____ **11.** The Appalachians are located along
- **a.** active and previously active convergent plate boundaries.
- **b.** active divergent plate boundaries.
- **c.** previously active convergent plate boundaries.
- **d.** previously active divergent plate boundaries.

_____ **12.** When oceanic lithosphere and continental lithosphere collide at convergent plate boundaries, what may be formed?
- **a.** mountains
- **b.** huge depressions
- **c.** oceanic trenches
- **d.** volcanoes

_____ **13.** What happens when moving plates collide at convergent plate boundaries?
- **a.** The continental lithosphere subducts beneath the oceanic lithosphere.
- **b.** The oceanic atmosphere subducts beneath the continental atmosphere.
- **c.** The oceanic lithosphere subducts beneath the continental lithosphere.
- **d.** The oceanic lithosphere subducts beneath the continental stratosphere.

_____ **14.** What happens when plate collision produces large-scale deformation?
- **a.** Oceans are created.
- **b.** High mountains are uplifted.
- **c.** Deep ocean trenches are created.
- **d.** Deep valleys are created.

_____ **15.** What is produced by the partial melting of the mantle and crust?
- **a.** mountains that may subduct to form volcanic mountains on Earth's surface
- **b.** magma that may erupt to form volcanic mountains on Earth's surface
- **c.** ocean currents that may warm the continental lithosphere so much that volcanoes result
- **d.** atmospheric changes that can eventually cause mountains to form

_____ **16.** Which is an example of volcanic mountains formed by colliding plates that eventually produced magma and eruptions?
- **a.** the Cascade Range
- **b.** the Appalachians
- **c.** Mount Sinai
- **d.** Mount Everest

17. What are terranes?

18. Where do volcanic mountains commonly form?

19. What happens during the collision of two plates whose edges consist of oceanic lithosphere?

20. When the denser oceanic plate subducts, what happens?

Directed Reading *continued*

21. What islands are an example of the peaks of volcanic mountains that rose above sea level?

22. When two continents collide, what can happen?

23. Where did what is now India come from?

24. What happened to the oceanic lithosphere of the Indian plate when it collided with the Eurasian plate?

25. Why did the subduction of the oceanic lithosphere of the Indian plate stop when the continental lithosphere of India collided with the continental lithosphere of Eurasia, and what happened to the Himalayas?

26. Why are the Himalayas still growing taller?

TYPES OF MOUNTAINS

_____ **27.** The rock formations of mountains
- **a.** are relatively uncomplicated structures.
- **b.** are just elevated parts of Earth's crust.
- **c.** provide evidence of the stresses that created the mountains.
- **d.** provide no evidence of the stresses that created the mountains.

_____ **28.** Scientists classify mountains according to
- **a.** the way the crust was deformed and shaped by mountain-building stresses.
- **b.** how the crust was preserved by subduction and collision.
- **c.** the amount of loose rock that results from continental collisions.
- **d.** the location either in the oceanic lithosphere or on a continental plate.

_____ **29.** What do the highest mountain ranges in the world consist of?
- **a.** ancient rock formations
- **b.** folded mountains that form when continents collide
- **c.** tectonic plates subducting under the continental lithosphere
- **d.** old mountains that form when continents diverge

_____ **30.** How do folded mountains form?
- **a.** Tectonic plate movements squeeze rock layers together into accordian-like folds.
- **b.** Tectonic plate movements melt rock layers together into magma.
- **c.** The continental lithosphere squeezes rock layers together and deposits them into the oceanic lithosphere.
- **d.** Tectonic plate movements squeeze rock layers together into tight places.

_____ **31.** What do the same stresses that form folded mountains also do?
- **a.** form folded valleys
- **b.** uplift rivers
- **c.** uplift plateaus
- **d.** fold rock formations

_____ **32.** What are plateaus?
- **a.** small, arched areas of rock high above sea level
- **b.** large, flat areas of rock high above sea level
- **c.** large, flat areas of rock below sea level
- **d.** small, flat areas of rock below sea level

Directed Reading *continued*

33. Where are most plateaus located?

34. Where is the Colorado plateau located?

35. What are fault-block mountains?

36. What mountain range consists of many fault-block mountains, and where is it located?

37. When do grabens form?

38. What is true of grabens and fault-block mountain ranges?

39. What is an example in the United States of grabens separated by fault-block mountain ranges?

40. Describe a dome mountain.

41. What are two ways dome mountains can form?

Directed Reading *continued*

42. Where in the United States are two examples of dome mountains?

43. How do volcanic mountains form?

44. Where do volcanic mountains usually form?

45. Where in the United States can an example of volcanic mountains be found?

46. Where are some of the world's largest volcanic mountains?

47. What makes mid-ocean ridges volcanically active areas?

48. How are volcanic islands formed? Give an example of Volcanic mountains.

49. Besides mid-ocean ridges, where else do large volcanic mountains form?

50. What are hot spots, and what happens at hot spots?

51. What is an example of a volcanic mountain that resulted from hot spots?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: How and Where Earthquakes Happen

1. Define *earthquake*.

_____

_____

_____

2. When do earthquakes usually occur?

_____

_____

_____

3. What is a fault?

_____

_____

_____

WHY EARTHQUAKES HAPPEN

_____ **4.** Rocks along both sides of a fault are usually
- **a.** not pressed together.
- **b.** tightly pressed together.
- **c.** loosely pressed together.
- **d.** not touching.

_____ **5.** What prevents rocks from moving past each other in a fault?
- **a.** stress
- **b.** energy
- **c.** friction
- **d.** weight

_____ **6.** What is a fault that is in an immobilized state called?
- **a.** rocked
- **b.** locked
- **c.** faulted
- **d.** frozen

_____ **7.** The trembling and vibrations of an earthquake are caused when
- **a.** the rocks become so pressed together that they shatter and release energy.
- **b.** the friction is reduced so much that the rocks cannot move past each other.
- **c.** the stress is reduced so much that the rocks of a fault suddenly break apart.
- **d.** the stress becomes so great that the rocks of a fault suddenly grind past each other.

_____ **8.** Geologists think that earthquakes are caused by
- **a.** elastic deformation.
- **b.** elastic rebound.
- **c.** elastic compression.
- **d.** elastic waves.

_____ **9.** The sudden return of elastically deformed rock to its undeformed shape is called
- **a.** elastic rebound.
- **b.** elastic decompression.
- **c.** elastic compression.
- **d.** elastic deformation.

_____ **10.** In the process of elastic rebound, rocks on each side of a fault
- **a.** are ground down into gravel.
- **b.** move quickly.
- **c.** move slowly.
- **d.** grind to a halt.

_____ **11.** What happens if a fault is locked?
- **a.** Stress in the rock decreases.
- **b.** Rocks pull apart.
- **c.** Rocks release energy.
- **d.** Stress in the rock increases.

_____ **12.** When rocks are stressed past the point at which they can maintain their integrity, they
- **a.** fracture.
- **b.** deform.
- **c.** compress.
- **d.** decompress.

_____ **13.** After the rocks fracture, what happens?
- **a.** They collapse and fall back to their original shape.
- **b.** They rebound and spring back to their original shape.
- **c.** They are ground down into gravel.
- **d.** They release their energy and disintegrate.

_____ **14.** The location within Earth along a fault where the first motion of an earthquake occurs is called the
- **a.** epicenter.
- **b.** fault.
- **c.** focus.
- **d.** shadow.

15. Define *epicenter*.

_____

_____

_____

16. About 90% of continental earthquakes have a

shallow _____.

17. Earthquakes that take place within 70 km of Earth's surface have

_____ foci.

18. Earthquakes with intermediate foci occur at what depths?

_____

_____

19. Earthquakes with deep foci occur at what depths?

_____

20. Where do earthquakes that have deep foci usually occur?

_____

_____

21. Why do earthquakes that usually cause the most damage have shallow foci?

_____

_____

SEISMIC WAVES

_____ **22.** When rocks along a fault slip into new positions, they release energy in the form of vibrations called
- **a.** tidal waves.
- **b.** elastic waves.
- **c.** seismic waves.
- **d.** focus waves.

_____ **23.** Where do seismic waves travel?

a. outward in all directions from the focus through the surrounding rock
b. inward in all directions from the epicenter through the surrounding rock
c. outward in all directions from Earth's core through its surface
d. inward in all directions from the focus through the epicenter

_____ **24.** How many types of waves do earthquakes produce?

a. three
b. six
c. two
d. 10

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **25.** body wave

_____ **26.** surface wave

_____ **27.** p wave

_____ **28.** s wave

a. a seismic wave that travels along the surface of a medium
b. the fastest seismic wave; causes particles of rock to move in a back-and forth direction parallel to the direction in which the wave is traveling; can travel through solids, liquids, and gases
c. the second-fastest seismic wave; causes particles of rock to move in a side-to-side direction perpendicular to the direction in which the wave is traveling; can only travel through solids
d. a seismic wave that travels through the body of a medium

29. What are two other names for P waves?

_____

_____

30. What are two other names for S waves?

_____

_____

31. How do surface waves form?

_____

32. What are the two types of surface waves called?

_____

_____

33. Rock moves in what way as a result of a Love wave?

34. The ground moves in what way as a result of a Rayleigh wave?

SEISMIC WAVES AND EARTH'S INTERIOR

_____ **35.** The composition of the material through which P waves and S waves travel affects
- **a.** the power and duration of the waves.
- **b.** the angle that the waves travel.
- **c.** the speed and direction of the waves.
- **d.** the intensity and composition of the waves.

_____ **36.** What type of materials do P waves travel through fastest?
- **a.** materials that are not rigid and not easily compressed
- **b.** materials that are very rigid and not easily compressed
- **c.** materials that are not rigid and are easily compressed
- **d.** materials that are very rigid and are easily compressed

_____ **37.** What did Croation scientist Andrija Monorovicic discover in 1909?
- **a.** The speed of seismic waves increases abruptly at about 30 km beneath the surface of continents.
- **b.** The speed of seismic waves decreases abruptly at about 30 km beneath the surface of continents.
- **c.** The speed of seismic waves increases abruptly at about 30 km above the surface of continents.
- **d.** The speed of seismic waves decreases abruptly at about 30 km beneath the surface of oceans.

38. Name the three main compositional layers of Earth.

39. Name the five mechanical layers of Earth.

40. Define *shadow zone.*

41. Why do shadow zones exist?

42. What happens to seismic waves as they travel through materials of differing rigidities?

43. Why don't S waves reach the S-wave shadow zone?

44. How does a P-wave shadow zone form?

EARTHQUAKES AND PLATE TECTONICS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **45.** tectonic plate boundaries

_____ **46.** convergent plate boundaries

_____ **47.** divergent plate boundaries

_____ **48.** continental plate boundaries

a. a point at which two continental plates converge, diverge, or move horizontally in opposite directions

b. a point at which plates move away from each other

c. a point at which stress on rock is the greatest

d. a point at which plates move toward each other and collide

49. Why do earthquakes occur along the mid-ocean ridges?

FAULT ZONES

_____ **50.** A fault zone is a region of

a. numerous, closely spaced faults.

b. a few, closely spaced faults.

c. Earth's core where the rocks form faults.

d. Earth's mantle where faults form.

51. Why do fault zones occur at plate boundaries?

52. What is the name of the fault zone that extends almost the entire length of Turkey?

53. How did the New Madrid, Missouri, earthquake differ from many other major earthquakes in terms of its location?

54. What was discovered in the Mississippi River region in the late 1970s?

55. When did a major fault zone in the North American plate form?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Studying Earthquakes

_____ **1.** What is the study of earthquakes and seismic waves called?
- **a.** meteorology
- **b.** seismology
- **c.** zoology
- **d.** cartography

RECORDING EARTHQUAKES

_____ **2.** A seismograph is an instrument that records vibrations
- **a.** in the ground.
- **b.** in the atmosphere.
- **c.** above the ground.
- **d.** in Earth's core.

3. Name the types of motion that a modern three-component seismograph records.

4. How do seismographs record motion?

5. A tracing of earthquake motion that is recorded by a seismograph is called a(n) _____.

6. Why are P waves the first waves to be recorded by a seismograph?

7. Which type of wave is the second wave to be recorded by a seismograph?

8. What types of waves are the slowest, and therefore the last to be recorded by a seismograph?

LOCATING AN EARTHQUAKE

_____ **9.** Scientists determine the distance to an epicenter by analyzing
- **a.** the length of the P waves and the S waves.
- **b.** the frequency of the P waves and the S waves.
- **c.** the power of the P waves and the S waves.
- **d.** the arrival times of the P waves and the S waves.

_____ **10.** The longer the lag time between the arrival of the P waves and the S waves,
- **a.** the closer the earthquake occurred.
- **b.** the weaker the earthquake's vibrations.
- **c.** the farther away the earthquake occurred.
- **d.** the stronger the earthquake's vibrations.

_____ **11.** Scientists consult a lag-time graph to determine how far an earthquake occurred from
- **a.** a given seismograph station.
- **b.** the earthquake's focus.
- **c.** the earthquake's epicenter.
- **d.** the equator.

_____ **12.** A lag-time graph translates the difference in arrival times of the P waves and S waves into distance from the epicenter to
- **a.** the earthquake.
- **b.** each station.
- **c.** each pole.
- **d.** the equator.

_____ **13.** What does a lag-time graph determine about an earthquake?
- **a.** its focus
- **b.** its strength
- **c.** its start time
- **d.** its end time

14. Before computers were widely available, how did scientists locate the epicenter of an earthquake?

_____

_____

_____

15. On the early maps, the radius of each circle was equal to what?

_____

_____

16. Where would the epicenter of the earthquake be found on the map?

_____

_____

_____

EARTHQUAKE MEASUREMENT

_____ **17.** Scientists who study earthquakes are interested in the amount of
- **a.** P waves and S waves in an earthquake.
- **b.** energy absorbed by an earthquake.
- **c.** energy released by an earthquake.
- **d.** electricity released by an earthquake.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **18.** magnitude

_____ **19.** Richter scale

_____ **20.** moment magnitude

_____ **21.** intensity

_____ **22.** Mercalli scale

- **a.** the amount of damage caused by an earthquake
- **b.** the measure of earthquake strength based on the size of the area of the fault that moves, the average distance that the fault block moves, and the rigidity of the rocks in the fault zone
- **c.** the measure of the strength of an earthquake
- **d.** a measurement system that expresses earthquake intensity in Roman numerals and describes the effects of each intensity
- **e.** a measurement system that bases earthquake strength on ground motion

23. Which magnitude scale was widely used for most of the 20th century?

_____

24. Which magnitude scale do scientists generally prefer now?

_____

25. The Richter scale and the moment magnitude scale provide similar values for what?

_____

26. The moment magnitude scale is more accurate for measuring what?

_____

Directed Reading *continued*

27. What is the highest moment magnitude recorded for an earthquake so far?

28. What was the moment magnitude of the earthquake in Kobe, Japan, in 1995?

29. What is the moment magnitude of earthquakes that generally are not felt by people?

30. How is Intensity I described on the modified Mercalli intensity scale?

31. How is Intensity XII described on the modified Mercalli intensity scale?

32. Upon what does the intensity of an earthquake depend?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Earthquakes and Society

1. What causes most injuries during an earthquake?

_____

_____

_____

_____

2. Name four other dangers that result from earthquakes.

_____

_____

_____

_____

TSUNAMIS

_____ **3.** A giant ocean wave that forms after a volcanic eruption, submarine earthquake, or landslide is called a
- **a.** tsunami.
- **b.** hurricane.
- **c.** tornado.
- **d.** riptide.

_____ **4.** A tsumani may begin to form as a result of a sudden drop or rise in the ocean floor associated with
- **a.** seismic gaps.
- **b.** riptides.
- **c.** undersea earthquakes.
- **d.** mudslides.

_____ **5.** Which of the following drops and rises with the ocean floor as it moves?
- **a.** a tall building
- **b.** the earthquake's epicenter
- **c.** a large mass of sea water
- **d.** floodwater

_____ **6.** What occurs when water moves up and down as it adjusts to a change in sea level?
- **a.** a series of long, low waves that increase in height as they near the shore
- **b.** a series of short, high waves that increase in height as they near the shore
- **c.** a series of long, low waves that decrease in height as they near the shore
- **d.** a series of short, low waves that decrease in height as they near the shore

DESTRUCTION TO BUILDINGS AND PROPERTY

_____ **7.** Most buildings are not designed to withstand the
- **a.** swaying motion caused by earthquakes.
- **b.** extreme vibrations caused by earthquakes.
- **c.** swaying motion caused by tsunamis.
- **d.** extreme vibrations caused by tsunamis.

_____ **8.** During an earthquake, buildings with weak walls
- **a.** will not sway.
- **b.** may collapse completely.
- **c.** will probably remain standing.
- **d.** will suffer no damage.

_____ **9.** What can affect the way that a building responds to seismic waves?
- **a.** the type of heating and cooling system in the building
- **b.** the type of ground beneath the building
- **c.** the type of windows in the building
- **d.** the type of plumbing in the building

10. What would a building likely to be damaged during an earthquake be built upon?

_____

_____

EARTHQUAKE SAFETY

_____ **11.** Where could a destructive earthquake take place?
- **a.** only in regions where tornadoes occur
- **b.** in any region of the United States
- **c.** only on the coastlines of large continents
- **d.** only in regions where tsunamis occur

_____ **12.** In what geographic areas in the United States are destructive earthquakes more likely to occur?
- **a.** the Midwest
- **b.** the East Coast
- **c.** the South
- **d.** California or Alaska

_____ **13.** Earthquake safety rules may help
- **a.** prevent buildings from collapsing.
- **b.** scientists predict earthquakes.
- **c.** prevent death, injury, and property damage.
- **d.** shorten the earthquake's duration.

_____ **14.** Before an earthquake occurs, people should
- **a.** be unprepared.
- **b.** be prepared.
- **c.** run away as fast as they can.
- **d.** board up their houses.

_____ **15.** Which of the following supplies are NOT necessary when preparing for an earthquake?
- **a.** canned food and bottled water
- **b.** flashlights and batteries
- **c.** portable radios
- **d.** piles of firewood

_____ **16.** Which of the following should you NOT do if an earthquake strikes?
- **a.** stay calm
- **b.** panic
- **c.** protect yourself from falling debris
- **d.** move to a safer position between tremors

17. What should you stay away from if you are indoors during an earthquake?

_____

_____

_____

18. What should you do if you are in a car during an earthquake?

_____

_____

_____

19. What should you check for after an earthquake?

_____

_____

20. What should you always avoid after an earthquake?

_____

_____

EARTHQUAKE WARNINGS AND FORECASTS

_____ **21.** Being able to predict earthquakes accurately could
- **a.** negatively affect people's lives.
- **b.** make it impossible for people to prepare.
- **c.** increase the number of injuries and deaths.
- **d.** help prevent injuries and deaths.

_____ **22.** Why do scientists study past earthquakes?
- **a.** to prevent future earthquakes
- **b.** to better understand why tsunamis occur
- **c.** to predict where future earthquakes are most likely to occur
- **d.** to change the history of earthquakes

_____ **23.** The best earthquake forecasts
- **a.** are totally accurate to the day.
- **b.** may be off by several years.
- **c.** will only be off by a day or two.
- **d.** are of no real use to scientists.

_____ **24.** By detecting changes in Earth's crust, scientists may be able to
- **a.** make forecasts more accurate.
- **b.** make forecasts less accurate.
- **c.** prevent future earthquakes.
- **d.** prevent future tsunamis.

_____ **25.** Faults near many population centers have been
- **a.** located and mapped.
- **b.** located and destroyed.
- **c.** relocated and mapped.
- **d.** relocated and destroyed.

_____ **26.** What can be measured by instruments placed along faults?
- **a.** large changes in rock movement around the faults
- **b.** small changes in epicenter movement around the faults
- **c.** small changes in rock movement around the faults
- **d.** large changes in crust movement around the faults

_____ **27.** What else can be detected when instruments are placed along faults?
- **a.** a decrease in stress
- **b.** an increase in stress
- **c.** an increase in fault size
- **d.** a decrease in fault size

_____ **28.** Using instruments placed along faults to predict earthquakes
- **a.** is both reliable and accurate.
- **b.** is a useless exercise.
- **c.** is not a method currently used.
- **d.** can detect an increase in stress.

29. Define *seismic gap*.

30. What do some scientists think will occur near seismic gaps?

31. Scientists believe that future earthquakes may occur at gaps along which fault zone?

32. Some earthquakes are preceded by _____.

33. What is a foreshock?

34. How long before an earthquake might foreshocks occur?

35. Where and when did the only earthquake that has ever been predicted by foreshocks occur?

Directed Reading *continued*

36. For what do scientists use a variety of sensors?

37. What happens when the cracks in rocks, caused by stress in fault zones, are filled with water?

38. What do scientists monitor in fault zones?

39. What do scientists hope to do with information gathered at fault zones?

40. Earthquake prediction is mostly unreliable because not all earthquakes have _____ or other precursors.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Volcanoes and Plate Tectonics

_____ **1.** Some volcanic eruptions can be more powerful than a(n)
- **a.** hand grenade.
- **b.** earthquake.
- **c.** geyser.
- **d.** atomic bomb.

_____ **2.** The cause of many volcanic eruptions is the movement of
- **a.** Earth's mesosphere.
- **b.** Earth's inner core.
- **c.** Earth's tectonic plates.
- **d.** Earth's oceans.

_____ **3.** The movement of tectonic plates is driven by Earth's
- **a.** mantle.
- **b.** internal heat.
- **c.** internal forces.
- **d.** internal pressure.

_____ **4.** Scientists can learn more about volcanic eruptions by studying
- **a.** temperatures within Earth.
- **b.** temperatures in Earth's atmosphere.
- **c.** external Earth temperatures.
- **d.** the movements of migrating animals.

_____ **5.** Combined temperature and pressure in the lower part of Earth's mantle keeps rocks
- **a.** at their melting point.
- **b.** below their melting point.
- **c.** from reaching their melting point.
- **d.** above their melting point.

FORMATION OF MAGMA

_____ **6.** Despite high temperature, most of the mantle remains solid because of the
- **a.** large amount of ice above the mantle.
- **b.** space between the rock.
- **c.** large amount of pressure from the surrounding rock.
- **d.** lack of pressure from the surrounding rock.

_____ **7.** Sometimes Earth's solid mantle and crust melt to form
- **a.** magma.
- **b.** mesosphere.
- **c.** petroleum.
- **d.** mineral elements.

_____ **8.** Which of the following is NOT a way magma can form?
- **a.** The temperature of rock rises above the melting point of the minerals the rock is composed of.
- **b.** Excess pressure is removed from rock that is above its melting point.
- **c.** Addition of fluids, such as water, increase the melting point of some minerals in the rock.
- **d.** Addition of fluids, such as water, may decrease the melting point of some minerals in the rock.

VOLCANISM

_____ **9.** Magma rises upward through the crust because
- **a.** the magma is less dense than surrounding rock.
- **b.** magma is more dense than surrounding rock.
- **c.** magma is the same density as the surrounding rock.
- **d.** the surrounding rock is porous.

_____ **10.** As hot bodies of magma rise toward the surface and melt surrounding rock,
- **a.** they become smaller.
- **b.** they become larger.
- **c.** their size remains the same.
- **d.** they disperse.

_____ **11.** As magma rises, and is forced into cracks in the surrounding rock,
- **a.** large blocks of rock break off and melt.
- **b.** large blocks of rock hold magma inside.
- **c.** large rocks are broken down.
- **d.** magma disperses.

_____ **12.** Lava flows from an opening in Earth's surface called a
- **a.** depression.
- **b.** geyser.
- **c.** vent.
- **d.** blowhole.

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **13.** volcanism

_____ **14.** lava

_____ **15.** volcano

a. a vent or fissure in Earth's surface through which magma and gases are expelled

b. any activity that includes the movement of magma toward or onto Earth's surface

c. magma that flows onto Earth's surface; the rock that forms when lava cools and solidifies

MAJOR VOLCANIC ZONES

_____ **16.** Volcanoes erupt on Earth's surface
- **a.** mostly in random locations.
- **b.** in all mountainous areas.
- **c.** only along the Pacific coast.
- **d.** mostly near tectonic plate boundaries.

_____ **17.** A major zone of active volcanoes encircling the Pacific Ocean is called
- **a.** the Major Pacific Earthquake Zone.
- **b.** the Pacific Ring of Volcanoes.
- **c.** the Pacific Ring of Fire.
- **d.** the Pacific tectonic plate.

_____ **18.** The Pacific Ring of Fire is also one of Earth's major
- **a.** flood zones.
- **b.** hurricane zones.
- **c.** drought zones.
- **d.** earthquake zones.

_____ **19.** Many volcanoes are located along
- **a.** reduction zones.
- **b.** subduction zones.
- **c.** earthquake zones.
- **d.** continental zones.

_____ **20.** One tectonic plate moves under another along a(n)
- **a.** reduction zone.
- **b.** subduction zone.
- **c.** earthquake zone.
- **d.** continental zone.

_____ **21.** When a plate of oceanic lithosphere meets one that consists of continental lithosphere, the oceanic lithosphere
- **a.** moves over the continental lithosphere.
- **b.** becomes continental lithosphere.
- **c.** moves beneath the continental lithosphere.
- **d.** moves through the continental lithosphere.

_____ **22.** On the ocean floor, along the edge of the continent where the plate is subducted,
- **a.** a deep trench forms.
- **b.** a shallow trench forms.
- **c.** a narrow trench forms.
- **d.** a wide trench forms.

_____ **23.** At subduction zones, the plate of continental lithosphere
- **a.** buckles and folds to form a mountain on the edge of the continent.
- **b.** buckles and folds to form a line of mountains along the edge of the continent.
- **c.** creates a line of earthquakes along the edge of the continent.
- **d.** creates a line of denser oceanic lithosphere.

_____ **24.** As the oceanic plate sinks into the asthenosphere, water can combine with crust and mantle material
- **a.** and increase the melting point of the rock.
- **b.** and decrease the melting point of the rock.
- **c.** leaving the melting point of the rock unchanged.
- **d.** and cause rock to solidify.

_____ **25.** When magma rises through the lithosphere to Earth's surface,
- **a.** volcanic mountains form along the tectonic plate.
- **b.** volcanic ash builds up along the tectonic plate.
- **c.** lava creates mountains along the tectonic plate.
- **d.** lava levels mountains along the tectonic plate.

_____ **26.** When two plates with oceanic lithosphere at their boundaries collide,
- **a.** both plates subduct, forming a trench.
- **b.** one plate subducts, forming a trench.
- **c.** magma never reaches the surface.
- **d.** magma is trapped in the resulting trench.

_____ **27.** If two plates with oceanic lithosphere collide,
- **a.** magma cannot form since no additional fluids are introduced into the mantle.
- **b.** magma forms as fluids are introduced into the mantle.
- **c.** magma cannot reach the surface.
- **d.** magma sinks deep into ocean trenches.

_____ **28.** When oceanic lithosphere subducts beneath oceanic lithosphere, magma rises to the surface to form an
- **a.** island chain.
- **b.** island cone.
- **c.** island arc.
- **d.** island trench.

_____ **29.** An example of the early stages of an island arc are the
- **a.** Aleutian Islands.
- **b.** Faroe Islands.
- **c.** Channel Islands.
- **d.** islands of Japan.

_____ **30.** As island arcs become larger, they join to form one landmass, such as the islands that make up the
- **a.** Solomon Islands.
- **b.** Aleutian Islands.
- **c.** Channel Islands.
- **d.** islands of Japan.

31. Explain what happens as magma comes to the surface where plates move apart at mid-ocean ridges.

32. Why don't humans notice most volcanic eruptions that take place along mid-ocean ridges?

33. What is happening in Iceland, where volcanic eruptions happen along mid-ocean ridges?

Use the numbers 1 through 4 to show the sequence of volcano development in a hot spot.

_____ **34.** Volcanoes form in the interior of a tectonic plate.

_____ **35.** Columns of solid, hot material called mantle plumes rise and reach the lithosphere.

_____ **36.** Magma rises to the surface and breaks through the overlying crust.

_____ **37.** A mantle plume reaches the lithosphere, and spreads out.

38. Describe what happens to volcanic activity when the lithospheric plate above a mantle plume continues to drift.

_____

_____

_____

_____

39. Besides developing within the interior of a lithospheric plate, what is another way a hot spot may form?

_____

_____

_____

INTRUSIVE ACTIVITY

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **40.** igneous rocks

_____ **41.** plutons

_____ **42.** dikes

_____ **43.** batholiths

a. rocks that form when magma cools

b. small tubular plutons; may be only a few centimeters wide

c. large formations of igneous rock, created by magma that does not reach Earth's surface, but cools and solidifies inside the crust

d. large plutons that cover an area of at least 100 km^2 when exposed on Earth's surface

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Volcanic Eruptions

_____ **1.** Lava provides an opportunity for scientists to study
- **a.** the nature of Earth's inner core.
- **b.** the nature of Earth's tectonic plates.
- **c.** temperatures within Earth.
- **d.** the nature of Earth's crust and mantle.

_____ **2.** By analyzing the composition of volcanic rocks, geologists have concluded that there
- **a.** is only one general type of magma.
- **b.** are two general types of magma.
- **c.** are three general types of magma.
- **d.** are two minerals in magma.

_____ **3.** Magma or igneous rock that is rich in feldspar and silica and is generally light in color is called
- **a.** felsic.
- **b.** oceanic.
- **c.** mantle.
- **d.** mafic.

_____ **4.** Magma or igneous rock that is rich in magnesium and iron and is generally dark in color is called
- **a.** felsic.
- **b.** oceanic.
- **c.** mantle.
- **d.** mafic.

_____ **5.** Mafic rock commonly makes up
- **a.** oceanic crust.
- **b.** continental crust.
- **c.** Earth's inner core.
- **d.** tectonic plates.

_____ **6.** Felsic rock commonly makes up
- **a.** oceanic crust.
- **b.** continental crust.
- **c.** Earth's inner core.
- **d.** tectonic plates.

TYPES OF ERUPTIONS

_____ **7.** The force of a volcanic eruption is affected by
- **a.** magma temperature.
- **b.** the distance from the top of the volcano to its base.
- **c.** the viscosity of magma.
- **d.** the geologic age of the volcano.

_____ **8.** Mafic magmas, with low viscosity and runny lava, cause
- **a.** quiet eruptions.
- **b.** explosive eruptions.
- **c.** continuous eruptions.
- **d.** most volcanic eruptions.

_____ **9.** Felsic magmas, with high viscosity and sticky lava, cause
- **a.** quiet eruptions.
- **b.** explosive eruptions.
- **c.** continuous eruptions.
- **d.** most volcanic eruptions.

_____ **10.** Explosive eruptions are most likely to be caused by magma with
- **a.** small amounts of dissolved gases.
- **b.** large amounts of trapped, dissolved gases.
- **c.** any amount of dissolved gases.
- **d.** small amounts of dissolved rock.

_____ **11.** Oceanic volcanoes commonly form from
- **a.** mafic magma.
- **b.** felsic magma.
- **c.** mafic or felsic magma.
- **d.** solid magma.

_____ **12.** Eruptions from oceanic volcanoes are usually
- **a.** quiet eruptions.
- **b.** explosive eruptions.
- **c.** continuous eruptions.
- **d.** small eruptions.

_____ **13.** When mafic lava cools rapidly it
- **a.** becomes less viscous.
- **b.** becomes explosive.
- **c.** forms a crust.
- **d.** shoots pyroclastic material.

14. How does pahoehoe form? Why is the word *pahoehoe* used to describe this kind of volcanic rock?

_____

_____

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **15.** pahoehoe

_____ **16.** aa lava

_____ **17.** blocky lava

a. forms jagged, sharp chunks when it cools

b. forms a smooth, ropy texture as it cools

c. breaks into large chunks at the surface while hot lava continues to flow underneath

18. What is pyroclastic material?

_____

_____

_____

_____

Use the terms from the following list to complete the sentences below. Each term may be used only once.

volcanic bombs lapilli volcanic ash
volcanic blocks volcanic dust

19. Pyroclastic particles less than 2 mm in diameter that mostly fall on the land that immediately surrounds the volcano are called _____.

20. Pyroclastic particles less than 0.25 mm in diameter that are so small they might travel around Earth in the upper atmosphere are called _____.

21. Large pyroclastic particles less than 64 mm in diameter that generally fall near the vent are called _____, a name taken from a Latin word meaning "little stones."

22. Large clots of lava thrown out of an erupting volcano while red-hot, that spin through the air, cool, and develop a round or spindle shape are called _____.

23. The largest pyroclastic particles, which form from solid rock blasted from the volcano's vent, are called _____.

TYPES OF VOLCANOES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **24.** volcanic cone

_____ **25.** crater

_____ **26.** shield volcano

_____ **27.** cinder cone

_____ **28.** composite volcano

a. a volcanic cone that is broad at the base and has gently sloping sides

b. structure formed by lava and pyroclastic material ejected during volcanic eruptions

c. volcano with very steep slopes that are rarely more than a few hundred meters high and have angles close to 40°

d. volcano made of alternating layers of hardened lava flows and pyroclastic material

e. the funnel-shaped pit at the top of a volcanic vent

CALDERAS

29. What is a *caldera*?

_____

_____

_____

30. What are the three steps that most often occur in the formation of a caldera?

_____

_____

_____

31. How did the caldera on the volcanic island of Krakatau form?

_____

_____

_____

32. How was Crater Lake in Oregon formed?

PREDICTING VOLCANIC ERUPTIONS

_____ **33.** One of the most important warning signals of volcanic eruptions is
- **a.** a change in earthquake activity around the volcano.
- **b.** a change in air pressure around the volcano.
- **c.** a change in animal behavior around the volcano.
- **d.** increased steepness of the volcanic cone.

34. What are three causes of small earthquakes that could signal a volcanic eruption?

35. What happens before an eruption that may cause the surface of the volcano to bulge outward?

36. What are three comparisons scientists make between a volcano's past behavior and its current behavior in order to help predict an eruption?

37. What are two problems scientists face in using a volcano's past behavior to predict a future eruption?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Weathering Processes

_____ **1.** Most rocks deep within Earth's crust formed under extreme conditions of
- **a.** gas and water.
- **b.** change and uplift.
- **c.** temperature and pressure.
- **d.** weathering and erosion.

_____ **2.** Rocks that are uplifted to the surface are exposed to what in Earth's atmosphere?
- **a.** gases and water
- **b.** radiation and pressure.
- **c.** temperature and pressure
- **d.** weathering and erosion

_____ **3.** What is the change in the physical form and chemical composition of rock called?
- **a.** radiation
- **b.** erosion
- **c.** uplift
- **d.** weathering

MECHANICAL WEATHERING

_____ **4.** In addition to ice and running water, common agents of mechanical weathering are
- **a.** radioactivity, animals, and humans.
- **b.** gravity, wind, and plants and animals.
- **c.** sunlight, gravity, and wind.
- **d.** erosion, gravity, and farming.

_____ **5.** What can happen to rocks as plants grow?
- **a.** They attract animals that crack the rock.
- **b.** Their roots grow and expand to create pressure that wedges rocks apart.
- **c.** They pull weaker rock up to the surface.
- **d.** They attract water that freezes in cracks.

_____ **6.** Over time, the digging activities of what kinds of animals can weather rock?
- **a.** birds and fishes
- **b.** climbing animals
- **c.** burrowing animals
- **d.** domesticated animals

In the space provided, write the letter of the definition or description that best matches the term or phrase.

_____ **7.** mechanical weathering

_____ **8.** joints

_____ **9.** exfoliation

_____ **10.** ice wedging

_____ **11.** abrasion

a. a process in which rock breaks into curved sheets and then peels away from the underlying rock

b. the grinding and wearing away of rock surfaces through the physical action of other rock or sand particles

c. long, curved cracks in rocks that run parallel to the surface, resulting from decreasing pressure when rock is uplifted

d. the process by which rocks break down into smaller pieces by physical means

e. weathering in which water seeps into rocks, freezes, expands, and widens existing cracks, eventually splitting rocks apart

CHEMICAL WEATHERING

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **12.** chemical weathering

_____ **13.** acids

_____ **14.** bases

_____ **15.** oxidation

_____ **16.** hydrolysis

_____ **17.** leaching

_____ **18.** carbonation

_____ **19.** organic acids

_____ **20.** acid precipitation

a. rain, sleet, or snow that contains a high concentration of acids, often due to air pollution

b. a process in which water carries dissolved minerals to lower layers of rock

c. the conversion of a compound into a carbonate, thus speeding weathering

d. the process by which rock is broken down as a result of chemical reactions with the environment

e. the process by which an element combines with oxygen

f. a chemical reaction between water and another substance to form two or more new substances

g. acids produced by lichens and mosses

h. substances that form hydroxide ions in water;

i. substances that form hydronium ions in rock;

Directed Reading *continued*

21. When chemical reactions act on the mineral in rock, what substances besides water and rock are commonly involved?

22. What are hydronium ions and how do they affect minerals?

23. What are hydroxide ions and how do they affect minerals?

24. What are two things that chemical weathering changes in rock?

25. What causes the red color of much of the soil in the southeastern United States and the red color of many rocks?

26. Describe the process by which the common clay called kaolin is produced.

27. When is carbonic acid formed?

28. What happens when carbonic acid reacts with the calcite in limestone?

29. What substances do fossil fuels produce when they are burned?

30. How does acid precipitation form?

31. What kind of damage does acid precipitation do and why?

32. What has the U. S. government done to regulate power plant emissions?

33. How have power plants reduced the occurrence of acid precipitation?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Rates of Weathering

1. Describe the general time frame for mechanical and chemical weathering.

2. What is the average rate at which carbonation dissolves limestone?

3. At the average rate, how long would it take to dissolve a layer of limestone 150 m thick?

4. List three important factors that determine the rate at which rock weathers.

DIFFERENTIAL WEATHERING

5. Define differential weathering.

6. Explain how mechanical and chemical weathering affect igneous rock that contains quartz.

ROCK COMPOSITION

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

silicates	weathering	sand
calcite	clay	grains
rocks	carbonation	

7. Limestone and other sedimentary rocks that contain _____ weather most rapidly.

8. Limestone weathers rapidly because it undergoes _____.

9. Other sedimentary rocks are affected mainly by mechanical _____.

10. The rates at which these sedimentary rocks weather depends mostly on the material that holds the sediment _____ together.

11. Shales that are not firmly cemented together may break up to form _____.

12. Conglomerates and sandstones that are strongly cemented by _____ resist weathering.

AMOUNT OF EXPOSURE

13. List two important factors related to exposure that determine the rate of weathering of a rock.

_____

_____

14. What is a rock's surface area?

_____

_____

15. What effect does breaking a rock into smaller pieces have on its surface area and how does this effect weathering?

_____

_____

_____

_____

16. Describe the natural zones of weakness within a rock.

17. How does the water that enters cracks in rock mechanically weather those rocks?

18. How does chemical weathering affect cracked rocks?

CLIMATE

19. In general, what type of climate allows the fastest type of weathering? Explain your answer.

20. In what other type of climate is weathering fairly quick? Explain your answer.

21. Why is the rate of weathering slowest in hot, dry climates?

22. Explain how weathering has affected Cleopatra's Needle, both in Egypt and in New York City.

TOPOGRAPHY

_____ **23.** Topography, which influences the rate of weathering, is
- **a.** the fertility and flatness of the land.
- **b.** the moisture and temperature of the land.
- **c.** the elevation and slope of the land.
- **d.** the hotness and dryness of the land.

_____ **24.** Because temperatures are generally cold at high elevations, what is more common at high elevations than at low?
- **a.** ice wedging
- **b.** carbonation
- **c.** oxidation
- **d.** silicates

_____ **25.** What happens to weathered rock fragments on steep slopes?
- **a.** They are more exposed to chemical weathering.
- **b.** They become more firmly attached to the slopes.
- **c.** They are carried away by animals and humans.
- **d.** They are pulled downhill by gravity and washed out by rain.

_____ **26.** New surfaces of mountains are continually exposed to weathering as a result of
- **a.** the constant rain and winds.
- **b.** the dryness of the mountain climate.
- **c.** the removal of surface rocks.
- **d.** the actions of animals and humans.

HUMAN ACTIVITIES

27. In general, how do the human activities of mining and construction affect rocks?

_____

_____

28. How does mining contribute to the weathering of rock?

_____

_____

29. How does construction contribute to the weathering of rock?

_____

_____

_____

30. What are two recreational activities that can speed up weathering by exposing new rock surfaces?

PLANT AND ANIMAL ACTIVITIES

31. How do the roots of plants promote the weathering of rocks?

32. Describe two ways in which animals can contribute to the weathering of rocks.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Soil

1. The layer of weathered rock fragments that covers much of Earth's surface is called _____.
2. The solid, unweathered rock that lies beneath the top layer is called _____.
3. A loose mixture of rock fragments and organic material that can support the growth of vegetation is called _____.

CHARACTERISTICS OF SOIL

4. What is a soil's parent rock?

_____

5. What is soil that forms and stays directly over its parent rock called?

_____

6. Describe transported soil.

_____

_____

7. What does parent rock that is rich in feldspar or other minerals that contain aluminum weather to form?

_____

8. What kinds of rocks weather to form sandy soils?

_____

9. What is the color of soil generally related to?

_____

10. Give two examples of soil colors and tell what each means.

_____

_____

11. Describe the three main types of rock particles in soil.

_____

_____

_____

SOIL PROFILE

In the space provided, writer the letter of the description that best matches the terms or phrase.

_____ **12.** soil profile

_____ **13.** horizon

_____ **14.** the A horizon

_____ **15.** humus

_____ **16.** the B horizon

_____ **17.** the C horizon

a. a mixture of organic materials and rock particles where most organisms that inhabit soil live

b. a vertical section of soil that shows the layers of horizons

c. a layer that consists of partially-weathered bedrock, where the first mechanical and chemical changes happen

d. a horizontal layer of soil that can be distinguished from the layers above and below it

e. a layer that contains the minerals leached from the topsoil, clay, and, sometimes, humus

f. a dark organic material made from the decayed remains of organisms

SOIL AND CLIMATE

_____ **18.** What is one of the most important factors that influences soil formation?
- **a.** plants
- **b.** climate
- **c.** erosion
- **d.** leaching

_____ **19.** Heavy rainfalls and high temperatures in tropical climates support chemical weathering that creates thick soils called
- **a.** clay.
- **b.** laterites.
- **c.** silt.
- **d.** sand.

_____ **20** What happens to tropical topsoil as a result of heavy rains?
- **a.** The soil in the A horizon grows thick.
- **b.** Minerals are quickly broken down to enrich the soil.
- **c.** The topsoil washes into the ocean.
- **d.** Leaching of the topsoil keeps the A horizon thin.

_____ **21.** In tropical climates, a thin layer of humus usually covers the B horizon because
- **a.** organic material is continuously added to the soil.
- **b.** thin soils develop rapidly.
- **c.** mineral are broken down by weathering.
- **d.** farming continuously takes place in the tropics.

_____ **22.** In temperate zones, where temperatures range between cool and warm, which soil horizons reach a thickness of several meters?
- **a.** horizons A and C
- **b.** horizons A and B
- **c.** horizons B and C
- **d.** all horizons

_____ **23.** What soil type forms in temperate climates that receive more than 65 cm of rain per year and contains clay, quartz, and iron compounds.
- **a.** pedalfer
- **b.** laterites
- **c.** regolith
- **d.** pedocal

_____ **24.** What fertile soil type containing large amounts of calcium carbonate forms in temperate climates that receive less than 65 cm of rain per year?
- **a.** pedalfer soil
- **b.** laterite soil
- **c.** regolith
- **d.** pedocal soil

_____ **25.** The soil that forms in desert and arctic climates, where mechanical and chemical weathering occur slowly,
- **a.** is thick and fertile.
- **b.** contains large amounts of clay and calcium carbonate.
- **c.** is thin and has little humus.
- **d.** contains large amounts of quartz and iron.

SOIL AND TOPOGRAPHY

26. Explain how the topography of a slope affects its soil.

27. Why is soil on the sides of mountains generally of poor quality?

28. Describe the soil composition of lowlands that retain water.

29. What area provides the best surface for formation of thick, fertile layers of residual soil?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Erosion

1. Define erosion.

_____

_____

_____

2. List the four most common agents of erosion.

_____

_____

_____

_____

3. List three important ways by which water moves weathered rock.

_____

_____

_____

SOIL EROSION

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

wind	humus	climate
water	solution	gullying
subsoil	fertility	topsoil
air	erosion	

4. As rock weathers, it eventually becomes very fine particles that mix with humus, water, and _____ to form soil.

5. The natural balance of erosion and new soil formation can be upset by land use and _____.

6. Some farming and ranching practices increase soil _____.

7. An accelerated soil erosion caused by the plowing of furrows up and down slopes that allows water to run swiftly over soil, carrying away the topsoil, is called _____.

8. Sheet erosion strips away parallel layers of _____, eventually exposing the surface of the soil beneath.

9. During dry seasons, _____ can remove the topsoil in clouds of dust and drifting sand, creating large storms.

10. Constant erosion reduces the _____ of the soil by removing the A horizon, which contains humus.

11. How do some farming and ranching practices increase soil erosion?

_____

_____

_____

12. Why is erosion so dangerous in some countries?

_____

_____

_____

SOIL CONSERVATION

13. How can construction projects increase the rate of erosion?

_____

_____

14. Why is soil erosion a special concern for deserts and mountain regions?

_____

_____

_____

15. How are land developers working to prevent erosion?

_____

_____

_____

16. In addition to land developers, what other group is working to preserve topsoil?

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **17.** contour plowing

_____ **18.** strip-cropping

_____ **19.** terracing

_____ **20.** crop rotation

a. planting a field with one type of crop one year and a different type of crop the next year

b. plowing soil in curved bands that follow the shape of the land, thus preventing soil from flowing directly down slopes

c. building steplike ridges that follow the contours of a sloped field, thus slowing the downslope movement of water

d. planting crops in alternating bands, one of which is a cover crop that slows rain runoff

GRAVITY AND EROSION

_____ **21.** The movement of a large mass of sediment or a section of land down a slope is called
a. gullying.
b. mass movement.
c. erosion.
d. a rockslide.

_____ **22.** What is the rapid fall of rocks, ranging in size from tiny fragments to large boulders, from a steep cliff?
a. a rockfall.
b. a mudflow.
c. a landslide.
d. a slump.

_____ **23.** Occurring as a result of heavy rainfall, spring thaws, volcanic eruptions, or earthquakes, the sudden fall down a steep slope of masses of loose rock combined with soil is called a
a. rockfall.
b. mudflow.
c. landslide.
d. slump.

_____ **24.** What may occur in dry regions during a sudden, heavy rainfall or as a result of volcanic eruptions, with mud churning and tumbling down slopes and through valleys?
a. a rockfall.
b. a mudflow.
c. a landslide.
d. a slump.

_____ **25.** What occurs along very steep slopes when saturation by water and loss of friction with underlying rock cause loose soil to slip downhill in one huge piece?
a. a rockfall.
b. a mudflow.
c. a landslide.
d. a slump.

_____ **26.** The slow, downslope flow of soil saturated with water over hard or frozen layers in areas surrounding glaciers at high elevations is called
a. creep.
b. solifluction.
c. talus.
d. landslide.

_____ **27.** The extremely slow downhill movement of weathered rock material, occurring when water separates rock particles and allows them to move freely, is called
a. creep.
b. solifluction.
c. talus.
d. landslide.

_____ **28.** What are piles of rock fragments that accumulate at the base of a slope called?
a. creep.
b. solifluction.
c. talus.
d. landslide.

EROSION AND LANDFORMS

29. Define landform.

_____

_____

30. What are the three major landforms shaped by weathering and erosion?

_____

_____

_____

_____

Directed Reading *continued*

31. List three minor landforms.

32. Describe the two opposing forces that affect all landforms.

33. Explain what happens in the early stages in the history of a mountain.

34. Describe what happens to a mountain later in its history.

35. How is a peneplain formed?

36. What is a plain?

37. Define plateau.

38. How does a young plateau differ in shape from an older plateau?

39. Describe the effects of weathering and erosion on plateaus in dry climates.

40. What are *mesas?*

41. Define butte.

42. How does weathering and erosion affect landforms in wet climates?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Water Cycle

1. What question has puzzled people for centuries?

_____

_____

2. Once people were able to measure the amount of water that falls to Earth, what did they discover?

_____

_____

3. Once people had learned how much water falls to Earth, what more puzzling question remained?

_____

_____

MOVEMENT OF WATER ON EARTH

_____ **4.** What is essential for humans and all other organisms?
- **a.** water vapor
- **b.** rivers
- **c.** water
- **d.** icecaps

_____ **5.** How much of Earth's surface is covered with water?
- **a.** about a third
- **b.** about half
- **c.** more than two-thirds
- **d.** more than three-quarters

_____ **6.** Where is Earth's surface water NOT found?
- **a.** in the lakes and oceans
- **b.** in groundwater
- **c.** in rivers and streams
- **d.** in the atmosphere

_____ **7.** Groundwater is water that
- **a.** flows through the rock below Earth's surface.
- **b.** flows in streams and rivers on Earth's surface.
- **c.** falls to Earth as rain.
- **d.** has melted from snow and the polar icecaps.

_____ **8.** In addition to streams and rivers, lakes, oceans, polar icecaps, and groundwater, where else is water found on Earth?
- **a.** trapped in volcanoes
- **b.** sealed inside fossils
- **c.** in the tissues of living organisms
- **d.** in mineral crystals

_____ **9.** Water occurring as an invisible gas is called
- **a.** water vapor.
- **b.** water particulate.
- **c.** water distillate.
- **d.** water transpiration.

_____ **10.** Where is water vapor found?
- **a.** in underground streams
- **b.** deep in the oceans
- **c.** in the polar icecaps
- **d.** in the atmosphere

_____ **11.** Where can you find small particles of liquid water in the atmosphere?
- **a.** in clouds and fog
- **b.** in rivers and streams
- **c.** in groundwater
- **d.** in water vapor

_____ **12.** What is always happening to Earth's water?
- **a.** It is all rapidly changing from a liquid to a gas.
- **b.** It is all slowly changing from a gas to a solid.
- **c.** It is all rapidly changing from a liquid to a solid.
- **d.** It is constantly changing from one form to another.

_____ **13.** An example of water changing from a solid to a liquid is
- **a.** water vapor escaping from oceans into the atmosphere.
- **b.** water vapor falling from the sky as rain.
- **c.** glaciers melting to form streams.
- **d.** puddles freezing into ice.

_____ **14.** What is the continuous movement of water from the atmosphere to the land and oceans and back to the atmosphere?
- **a.** the hydrogen cycle
- **b.** the water cycle
- **c.** evaporation
- **d.** condensation

_____ **15.** By what process does liquid water change into water vapor?
- **a.** evaporation
- **b.** condensation
- **c.** precipitation
- **d.** respiration

_____ **16.** About how much water evaporates into the atmosphere each year?
- **a.** 5,000 km^3
- **b.** 50,000 km^3
- **c.** 500,000 km^3
- **d.** 5,000,000 km^3

_____ **17.** About 86% of the atmosphere's water vapor comes from
- **a.** living organisms.
- **b.** rivers, lakes, and streams.
- **c.** clouds and fog.
- **d.** the oceans.

_____ **18.** What is the process by which plants release water into the atmosphere?
- **a.** precipitation
- **b.** transpiration
- **c.** evaporation
- **d.** condensation

_____ **19.** Total loss of water from an area is equal to all of the water
- **a.** that runs off in rivers and streams and is absorbed by the ground.
- **b.** lost by precipitation and transpiration.
- **c.** lost by evaporation and transpiration.
- **d.** that evaporates from the soil and from streams and lakes.

_____ **20.** In what part of the water cycle does water change from a gas to a liquid?
- **a.** evaporation
- **b.** transpiration
- **c.** precipitation
- **d.** condensation

_____ **21.** When water vapor rises in the atmosphere, it
- **a.** expands, cools, and condenses.
- **b.** freezes into ice.
- **c.** expands, warms up, and condenses.
- **d.** compresses and heats up.

_____ **22.** When water vapor cools and condenses into tiny droplets in the atmosphere, what do they form?
- **a.** snow
- **b.** ice
- **c.** clouds
- **d.** sleet

_____ **23.** What is any form of water that falls to Earth's surface from the clouds?
- **a.** condensation
- **b.** transpiration
- **c.** evaporation
- **d.** precipitation

_____ **24.** Which is not a form of precipitation?
- **a.** rain
- **b.** fog
- **c.** sleet
- **d.** snow

25. What percentage of all precipitation falls on Earth's oceans?

_____

26. What happens to rain, snow, sleet, or hail that falls on land?

_____

27. Describe what happens to all water that falls as precipitation.

_____

_____

_____

WATER BUDGET

_____ **28.** What is the continuous cycle of evapotranspiration, condensation, and precipitation?
- **a.** runoff
- **b.** Earth's water budget
- **c.** the water cycle
- **d.** the hydrogen cycle

_____ **29.** Using the language of a financial statement, the "income" of Earth's water budget is
- **a.** precipitation.
- **b.** evaporation.
- **c.** condensation.
- **d.** runoff.

_____ **30.** Using the language of a financial statement, the "expenses" of Earth's water budget are
- **a.** precipitation and condensation.
- **b.** clouds and fog.
- **c.** condensation and freezing.
- **d.** evapotranspiration and runoff.

_____ **31.** In what way is the water budget of the whole Earth balanced?
- **a.** The amount of evapotranspiration and runoff is less than the amount of precipitation.
- **b.** The amount of precipitation is greater than the amount of condensation and freezing.
- **c.** The amount of precipitation is equal to the amount of runoff and condensation.
- **d.** The amount of precipitation is equal to the amount of evapotranspiration and runoff.

_____ **32.** Which of the following factors affect the local water budget?
- **a.** just the temperature and the amount of rainfall
- **b.** temperature, vegetation, wind, and rainfall
- **c.** temperature, human habitation, season of the year, and sunlight
- **d.** vegetation, season of the year, sunlight, and day of the week

_____ **33.** What occurs when precipitation exceeds evapotranspiration and runoff in an area?
- **a.** dry soil
- **b.** irrigation
- **c.** moist soil and possible flooding
- **d.** vegetation

_____ **34.** What is a possible local result when evapotranspiration and runoff are greater than precipitation in an area?
- **a.** Soil will become moist, and flooding is possible.
- **b.** Soil will stabilize, making irrigation unnecessary.
- **c.** Soil can become moist and wash away.
- **d.** Soil can become dry, and irrigation may be necessary.

_____ **35.** How does vegetation affect the water budget in an area?
- **a.** Vegetation reduces runoff but increases evapotranspiration.
- **b.** Vegetation reduces runoff and evapotranspiration.
- **c.** Vegetation increases runoff and decreases evapotranspiration.
- **d.** Vegetation increases runoff and evapotranspiration.

_____ **36.** Which of the following factors increases the rate of evapotranspiration?
- **a.** precipitation
- **b.** steep slopes
- **c.** wind
- **d.** clouds

_____ **37.** The factors that affect the local water budgets worldwide vary
- **a.** randomly.
- **b.** geographically.
- **c.** artificially.
- **d.** geologically.

_____ **38.** How does precipitation in a desert compare with precipitation in a tropical rain forest?
- **a.** It is much greater.
- **b.** It is much less.
- **c.** It is about the same.
- **d.** It is slightly less.

_____ **39.** In most places on Earth, the local water budget also changes with
- **a.** the phase of the moon.
- **b.** the time of the day.
- **c.** the days of the week.
- **d.** the seasons.

_____ **40.** How do cooler temperatures affect the rate of evapotranspiration?
- **a.** They speed it up.
- **b.** They slow it down.
- **c.** They have no effect.
- **d.** They first slow it down and then later speed it up.

_____ **41.** What happens to the rate of evapotranspiration in warmer months?
- **a.** It increases.
- **b.** It decreases.
- **c.** It does not change.
- **d.** It first decreases and then increases.

_____ **42.** When do streams transport more water?
- **a.** in cooler months
- **b.** in warmer months
- **c.** in months with long days
- **d.** in months with little rain

_____ **43.** On average, how much water does each person in the United States use each year?
a. 25,000 gal
b. 25,000 L
c. 95,000 gal
d. 95,000 L

_____ **44.** Which of the following is NOT a common use of water by people in the United States?
a. bathing
b. cooling food
c. watering lawns
d. drinking

_____ **45.** In addition to personal use by people, large amounts of water are also used by
a. agriculture and industry.
b. colleges and universities.
c. mining and manufacturing.
d. agriculture and water parks.

_____ **46.** As the population of the United States increases, the demand for water
a. is unaffected.
b. also increases.
c. remains the same.
d. decreases.

_____ **47.** What happens to about 90% of the water used by cities and industry in the United States?
a. It evaporates into the atmosphere.
b. It is completely consumed by human uses.
c. It is treated in water treatment plants and reused.
d. It is returned to rivers or to the oceans as wastewater.

_____ **48.** What is a problem with some of the wastewater that people dispose of?
a. Some of it has been changed into ice.
b. Too much of it evaporates.
c. Some of it contains harmful materials.
d. Too much of it is allowed to flow away.

_____ **49.** What can pollute rivers and harm plants and animals in the water?
a. toxic materials
b. ice
c. discolored materials
d. materials downstream

50. Why is water conservation important to people?

51. What is water conservation?

52. How can individuals help save water resources?

53. What can governments do to help conserve water?

54. What are antipollution laws designed to prevent?

55. In addition to conservation, what is another way of protecting the water supply?

56. What is desalination?

57. What are the drawbacks of desalination?

58. Explain today's best way of ensuring our supplies of fresh water.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Stream Erosion

1. When does a river system begin to form?

2. What happens when the soil in an area soaks up as much water as it can hold?

3. What is a narrow ditch formed when runoff erodes rock and soil?

4. What landscape feature can develop from a gully?

5. What processes are responsible for the formation of a valley?

PARTS OF A RIVER SYSTEM

6. What are the two parts of a river system?

7. What happens to a stream channel over time?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **8.** tributary

_____ **9.** watershed

_____ **10.** divide

_____ **11.** channel

_____ **12.** bank

_____ **13.** bed

a. ridge or elevated area that separates watersheds

b. part of a stream channel that is below water level

c. the narrow depression that a stream follows as it flows downhill

d. a stream that flows into a lake or larger stream

e. edge of a stream channel above water level

f. the land that is drained by a river system

CHANNEL EROSION

_____ **14.** What causes river systems to change continuously?

a. precipitation
b. evapotranspiration
c. condensation
d. erosion

_____ **15.** What is the process by which channels lengthen and branch out at their upper ends, where runoff enters the streams?

a. forward erosion
b. runoff erosion
c. headward erosion
d. branch erosion

_____ **16.** What effect can erosion of the slopes in a watershed have on the river system?

a. It can make it narrower and faster.
b. It can extend a river system and add to the area of the watershed.
c. It can shrink a river system and remove area from the watershed.
d. It can make the river system wider and deeper.

_____ **17.** When a stream from one watershed is "captured" by a stream from another watershed, the process is known as

a. stream theft.
b. stream growth.
c. stream expansion.
d. stream piracy.

_____ **18.** What characteristic of a stream makes it able to "capture" another stream?
- **a.** The "capturing" stream is older.
- **b.** The "capturing" stream is longer.
- **c.** The "capturing" stream has a higher rate of erosion.
- **d.** The "capturing" stream begins at a higher elevation.

_____ **19.** What does a stream do once it has been "captured"?
- **a.** It develops a lower rate of erosion.
- **b.** It soon escapes from the "capturing" river system.
- **c.** It adds its silt to the "capturing" stream's bed.
- **d.** It drains into the "capturing" river system.

_____ **20.** What does a stream transport as it flows downhill?
- **a.** boulders, trees, and coal
- **b.** soil, sand, and vegetation
- **c.** soil, rock fragments, and minerals
- **d.** mostly large pieces of rock

_____ **21.** The materials carried by a stream are called the
- **a.** stream baggage.
- **b.** stream load.
- **c.** stream channel.
- **d.** stream bank.

_____ **22.** The three forms of stream load are
- **a.** stream load, stream bed, and stream channel.
- **b.** suspended load, sustained load, and retained load.
- **c.** sustained load, bed load, and dissolved load.
- **d.** suspended load, bed load, and dissolved load.

_____ **23.** Which stream load consists of particles of fine sand and silt?
- **a.** suspended load
- **b.** sustained load
- **c.** bed load
- **d.** dissolved load

_____ **24.** What is meant by a stream's rate of downstream travel?
- **a.** load of the water
- **b.** flow rate of the water
- **c.** velocity of the water
- **d.** outflow of the water

_____ **25.** How does a stream's velocity create its suspended load?
- **a.** It prevents the particles from sinking to the stream bed.
- **b.** It raises the temperature and makes the particles rise.
- **c.** It pushes rocks to the side.
- **d.** It changes water's chemistry so that it suspends some particles.

_____ **26.** The bed load is made up of
- **a.** dissolved materials such as salt.
- **b.** larger, coarser materials such as gravel and pebbles.
- **c.** plant materials such as leaves.
- **d.** fine materials such as sand and silt.

_____ **27.** How does a stream's bed load move?
- **a.** It is carried in suspension in the water.
- **b.** It jumps and rolls along the bed of the stream.
- **c.** It is dissolved in the stream's water.
- **d.** It is pushed along the tops of the banks.

_____ **28.** Mineral matter that is transported in liquid solution is the stream's
- **a.** suspended load.
- **b.** bed load.
- **c.** dissolved load.
- **d.** mineral load.

_____ **29.** A stream's discharge is
- **a.** the total volume of water moved by a stream over a given time period.
- **b.** the total volume of water moved by a stream in its lifetime.
- **c.** the total volume of a stream's load.
- **d.** the direction in which a stream flows.

30. What is the relationship between a stream's speed, the stream's discharge, and the load the stream can carry?

_____

_____

_____

31. How does the load of a swift stream compare with the load of a slow stream?

_____

_____

_____

_____

32. How does a stream's velocity affect its channel?

_____

_____

_____

Directed Reading *continued*

33. What factor plays the biggest role in a stream's velocity?

34. Describe the gradient of a stream.

35. At what point is a stream's gradient generally steep?

36. How does the gradient at a stream's headwaters affect its velocity and channel?

37. What is the mouth of a stream?

38. At a stream's mouth, how does its gradient often change?

39. Why does a stream's velocity and erosive power often decrease at its mouth?

40. In what way does a stream's channel change by the time it reaches the sea?

EVOLUTION OF RIVER CHANNELS

_____ **41.** The erosive power of a stream decreases
- **a.** as its load, discharge, and gradient increase.
- **b.** as its load, channel, and velocity increase.
- **c.** as its load, discharge, and gradient stay the same.
- **d.** as its load, discharge, and gradient decrease.

_____ **42.** What happens to a stream's channel over time?
- **a.** It becomes deeper and rockier.
- **b.** It becomes wider and deeper.
- **c.** It becomes narrower and deeper.
- **d.** It becomes wider and more shallow.

_____ **43.** A stream is called a river when
- **a.** the stream becomes longer and wider.
- **b.** the stream is added to a map.
- **c.** the stream becomes faster and deeper.
- **d.** the stream joins another body of water.

_____ **44.** What may develop as a river evolves?
- **a.** a deeper and faster flow
- **b.** a straighter channel
- **c.** sharp turns
- **d.** curves and bends

_____ **45.** A river with many bends probably has
- **a.** a steeper gradient than a river with fewer bends.
- **b.** a heavier discharge than a river with more bends.
- **c.** a lower gradient than a river with fewer bends.
- **d.** a lower discharge than a river with fewer bends.

_____ **46.** What are meanders?
- **a.** a winding pattern of wide curves in a river
- **b.** a series of waterfalls in a river
- **c.** single curves in a river
- **d.** deep cuts in a river channel

_____ **47.** Meanders develop when
- **a.** a river's channel gets deeper, and its velocity decreases.
- **b.** the gradient of a river decreases, and the velocity of water decreases.
- **c.** the gradient of a river increases, and the velocity of water increases.
- **d.** a river ages and slows down.

_____ **48.** When the velocity of water decreases,
- **a.** a river cuts a deeper channel.
- **b.** a river is more likely to erode down into its bed.
- **c.** a river is less able to erode down into its bed.
- **d.** a river is less able to erode its banks.

_____ **49.** As a river's water velocity slows and it flows through its channel, what happens?
- **a.** More energy is directed against the river's banks, causing greater erosion of the banks.
- **b.** More energy is directed against the river's banks, causing less erosion of the banks.
- **c.** Less energy is directed against the river's banks, causing greater erosion of the banks.
- **d.** Less energy is directed against the river's banks, causing less erosion of the banks.

_____ **50.** What happens on the outside of a curve as a river rounds a bend?
- **a.** The velocity of water decreases, and the outside of the curve erodes less.
- **b.** The velocity of water increases, and the outside of the curve erodes more.
- **c.** The velocity of water decreases, and the outside of the curve erodes more.
- **d.** The velocity of water decreases, and the outside of the curve erodes more.

_____ **51.** What happens to the velocity of water on the inside of a curve as a river rounds a bend?
- **a.** It increases.
- **b.** It stays the same as on the outside of the curve.
- **c.** It decreases.
- **d.** It is unchanged.

_____ **52.** What effect does the change in water velocity on the inside of a river's bend have?
- **a.** The channel erodes more rapidly.
- **b.** A bar of deposited sediment forms.
- **c.** The inside bank becomes wider and lower.
- **d.** The bend begins to straighten out.

_____ **53.** Why does sediment build up where it does in the bend of a river?

a. Because water is moving more slowly inside the bend, more sediment settles out of the stream.

b. Because water is blocked by the inside of the bend, sediment cannot continue to flow downstream.

c. Because water is moving more slowly outside the bend, sediment deposits on the inside of the curve.

d. Because the inside of the bend erodes more rapidly, it makes room for more sediment.

_____ **54.** In what way does a curve in a stream become larger?

a. Erosion shrinks the inside of a curve while further sediment is deposited on the opposite bank, where the water is moving more slowly.

b. Erosion enlarges the outside of the curve, and further sediment is deposited where the curve has become wider.

c. Erosion shrinks the outside of the curve where water is moving more quickly, while further sediment is washed away.

d. Erosion enlarges the outside of the curve while further sediment is deposited on the opposite bank, where the water is moving more slowly.

55. How can an oxbow lake form?

56. How many channels do most rivers have?

57. How do some rivers end up with multiple channels?

58. What is a braided stream?

59. What is it about a stream's sediment load that causes it to be a braided stream?

60. Compare a braided stream with a meandering stream.

61. How does the channel of a braided stream change?

62. What could cause a single river to change from a braided stream to a meandering stream?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Stream Deposition

1. When is the total load that a stream can carry greatest?

_____

_____

2. What decreases a stream's ability to carry its load?

_____

_____

_____

3. What happens when the velocity of water in a stream decreases?

_____

_____

DELTAS AND ALLUVIAL FANS

_____ **4.** Where can a stream deposit sediment?
- **a.** only in water
- **b.** only on land
- **c.** on land or in water
- **d.** only in the ocean

_____ **5.** The load carried by a stream may be deposited when
- **a.** the stream reaches an ocean or lake.
- **b.** the stream's banks erode.
- **c.** the stream is "captured."
- **d.** the stream dries up.

_____ **6.** What happens when a stream empties into a large body of water?
- **a.** The stream comes to a sudden stop.
- **b.** The stream's velocity can increase or decrease.
- **c.** The stream's velocity increases sharply.
- **d.** The stream's velocity decreases sharply.

_____ **7.** In what shape is a stream's load usually deposited at its mouth?
- **a.** rectangle
- **b.** square
- **c.** triangle
- **d.** circle

_____ **8.** What is a delta?
- **a.** a triangular-shaped deposit of sediment formed at the bends of rivers
- **b.** a triangular-shaped deposit of sediment where the mouth of a stream enters a larger body of water
- **c.** a deposit of sediment with multiple channels in a braided stream
- **d.** a pyramid-shaped deposit of sediment that may form at any point in a stream

_____ **9.** How is the exact shape of a delta determined?
- **a.** by waves, tides, offshore depths, and a stream's sediment load
- **b.** by the amount of sediment carried by a stream
- **c.** by winds, rainfall, climate zone, and a stream's sediment load
- **d.** by construction of human structures on a stream's banks

_____ **10.** Which of the following results in a decrease in a stream's speed?
- **a.** when a stream leaves a plateau and descends a steep slope
- **b.** when a stream descends a steep slope and reaches a flat plain
- **c.** when a stream moves from a slope into rocky terrain
- **d.** when a stream ascends a steep slope and reaches a plateau

_____ **11.** What happens when a stream descends a slope and enters a flat plain?
- **a.** The stream cuts a new channel higher on the slope.
- **b.** The stream deposits its load on the side of the slope.
- **c.** The stream forms a meander at the base of the slope.
- **d.** The stream deposits some of its load at the base of the slope.

12. Describe an alluvial fan.

_____

_____

_____

13. In which direction does an alluvial fan's tip point?

_____

_____

14. Where do alluvial fans commonly form?

_____

_____

15. What kinds of streams commonly form alluvial fans?

_____

_____

16. How do alluvial fans differ from deltas?

_____

_____

_____

FLOODPLAINS

Use terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

floodplain	banks	delta
flood	channel	natural levee
velocity	rainfall	

17. The volume of water in nearly all streams varies depending on the amount of _____ and snowmelt in the watershed.

18. When the volume of water in a stream increases dramatically, it can overflow its _____ and wash over the valley floor.

19. The area along a river that forms from sediments deposited when a river floods is called a _____.

20. A stream loses _____ when it overflows its banks and spreads out over its floodplain.

21. When a stream overflows, it deposits its coarser sediments along the banks of the channel, which eventually produces a _____.

22. Why does all of the load deposited by a stream in a flood not form levees?

_____

_____

_____

_____

23. What is the effect of a series of floods on a stream's floodplain?

_____

_____

_____

24. Why are swampy areas common on floodplains?

25. Why do people choose to live in floodplains, despite the risk of flooding and the sometimes swampy soil?

HUMAN IMPACTS ON FLOODING

_____ **26.** Which of the following contributes to the size and number of floods in many areas?
- **a.** sunspot activity
- **b.** human activity
- **c.** cloud cover
- **d.** animal activity

_____ **27.** How does vegetation protect the ground surface from erosion?
- **a.** It takes up water that would otherwise run off.
- **b.** It changes the direction water flows.
- **c.** It prevents water from reaching the ground.
- **d.** It dries the soil quickly so it can hold more water.

_____ **28.** What happens when people remove much of the ground cover in an area?
- **a.** Water evaporates more slowly, and the likelihood of flooding increases.
- **b.** Water is absorbed more quickly, and the likelihood of flooding decreases.
- **c.** Water flows more slowly across the surface, and the likelihood of flooding decreases.
- **d.** Water flows more freely across the surface, and the likelihood of flooding increases.

_____ **29.** What are two examples of human activities that can increase the volume and speed of runoff?
- **a.** logging and building dams
- **b.** clearing land and planting trees
- **c.** logging and clearing land
- **d.** digging shipping channels and harbors

_____ **30.** What kind of natural event can increase the likelihood of flooding?
- **a.** a forest fire that removes vegetation
- **b.** a population explosion among one kind of animal
- **c.** an increased growth of plants
- **d.** a tornado that blows down trees

FLOOD CONTROL

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **31.** forest and soil conservation

_____ **32.** dams

_____ **33.** artificial levees

_____ **34.** floodways

- **a.** flood-control method that requires protection against erosion
- **b.** indirect methods of flood control that prevent excess runoff during heavy rainfall
- **c.** structures behind which artificial lakes act as reservoirs for excess runoff
- **d.** permanent overflow channels that carry away excess water

35. What can the stored water behind a dam be used for?

_____

_____

36. What is one concern with artificial levees?

_____

_____

37. What can happen if a river erodes an artificial levee?

_____

_____

38. How do floodways help prevent flooding?

_____

_____

THE LIFE CYCLE OF LAKES

_____ **39.** When a stream flows into a depression in the land instead of flowing to the ocean,
- **a.** a delta forms.
- **b.** a lake forms.
- **c.** a new stream forms.
- **d.** a braided stream forms.

_____ **40.** Where are most lakes found?
- **a.** at high latitudes and in mountainous areas
- **b.** at sea level throughout the world
- **c.** below sea level throughout the world
- **d.** in river valleys

_____ **41.** Most of the water in lakes comes from
- **a.** dams built by humans.
- **b.** canals built by humans.
- **c.** precipitation and melting ice and snow.
- **d.** precipitation and fog.

_____ **42.** Other sources of water in lakes are
- **a.** springs, rivers, and runoff coming from the land.
- **b.** icebergs and glaciers.
- **c.** pumping stations along rivers.
- **d.** seasonal monsoons.

_____ **43.** In geologic terms, for how long do most lakes exist?
- **a.** a long time
- **b.** a short time
- **c.** an unknown amount of time
- **d.** a human lifetime

_____ **44.** Many lakes eventually disappear because
- **a.** people drain away their water for agriculture.
- **b.** amounts of precipitation suddenly fall.
- **c.** the rivers or streams that feed into them dry up.
- **d.** too much of their water drains away or evaporates.

_____ **45.** What commonly causes a lake's water to drain away?
- **a.** Animals drink too much of it.
- **b.** People dig a canal below the level of the lake basin.
- **c.** An outflowing stream forms above the level of the lake basin.
- **d.** An outflowing stream erodes its bed below the level of the lake basin.

_____ **46.** What is another way a lake can lose water?
- **a.** If the climate becomes drier, evaporation may exceed precipitation.
- **b.** If people use the lake's water, water use may exceed precipitation.
- **c.** If vegetation grows around the lake, not enough runoff enters the lake.
- **d.** If the climate becomes wetter, too much precipitation may cause the lake to overflow.

_____ **47.** How else might a lake basin disappear?
- **a.** It can turn into a river.
- **b.** Rainfall can suddenly stop altogether.
- **c.** It can freeze solid.
- **d.** It can fill with sediment.

_____ **48.** Where do sediments that build up in a lake come from?
- **a.** from streams that feed the lake and sediments that are dumped into the lake by people
- **b.** from people who dump them and from plants
- **c.** from streams that feed the lake and from water that runs off the land directly into the lake
- **d.** from streams that feed the lake and are trapped by dams

_____ **49.** What happens as sediments build up in a lake over time?
- **a.** Large banks develop on the sides of the lake, new water cannot enter the lake, and the lake dries up.
- **b.** New shorelines are created by the sediments, and the sediments gradually fill the lake.
- **c.** New shorelines are created by the sediments, blocking streams from entering the lake.
- **d.** New shorelines develop, the lake becomes narrower, and it eventually turns into a river.

_____ **50.** What effect can vegetation have in a shallow lake?
- **a.** Organic deposits can pollute the lake's water.
- **b.** Vegetation can use up all the water.
- **c.** Organic deposits may accumulate in the bottom.
- **d.** Vegetation can block the streams feeding the lake.

_____ **51.** As organic deposits from vegetation grow denser on the bottom of a shallow lake, what can happen?
- **a.** More vegetation grows.
- **b.** Water can no longer enter the lake.
- **c.** Coal forms.
- **d.** A bog or swamp may form.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Water Beneath the Surface

1. When water seeps underground, it fills _____ between rock particles.
2. The water below Earth's surface is called _____.
3. Groundwater is an important source of _____ in the United States.

PROPERTIES OF AQUIFERS

4. What is an aquifer?

_____

_____

_____

5. The percentage of the total volume of rock or sediment that consists of open spaces is called _____.
6. The amount of uniformity in the size of rock or sediment particles is called _____.
7. How do well-sorted and poorly sorted sediment differ in terms of their particle size?

_____

_____

_____

8. Loosely packed particles of rock have many open spaces, which results in _____ porosity.
9. Rock with tightly packed particles contains few open spaces, so it has _____ porosity.
10. In addition to sorting and particle packing, _____ also affects porosity.
11. Generally, the more irregular the grain shape, the more _____ the rock or sediment.

12. The ability of a rock or sediment to let fluids pass through its open pores, or spaces, is called _____.

13. For a rock to be permeable, the open spaces must be _____.

14. Sandstone is one of the most _____ rocks.

15. Because clay is composed of flat, fine-grained particles, it is _____.

ZONES OF AQUIFIERS

16. What pulls water down through rock and soil layers until it reaches a layer of impermeable rock?

_____

_____

17. Define *zone of saturation.*

_____

18. What does the term *saturation* mean?

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **19.** water table

_____ **20.** capillary action

_____ **21.** capillary fringe

_____ **22.** zone of aeration

a. the attraction of water molecules to other materials

b. the upper surface of the zone of saturation

c. the area in which water is drawn from the zone of saturation

d. area between the water table and Earth's surface

23. How many regions does the zone of aeration have?

_____

_____

_____

MOVEMENT OF GROUNDWATER

24. Upon what does the rate at which groundwater moves horizontally depend?

25. Define *gradient*.

26. The velocity of groundwater increases as the water table's gradient _____.

TOPOGRAPHY AND THE WATER TABLE

27. The water table generally mirrors the surface _____.

28. List four factors that affect the depth of a water table.

29. What happens to water tables during times of prolonged rainfall?

30. What happens to water tables during times of drought?

31. How many water tables do most areas of Earth have?

32. What is a perched water table?

CONSERVING GROUNDWATER

33. In many communities, the only source of fresh water is _____.

34. How long might it take for the water level in an aquifer to renew itself?

_____

35. List three ways that a community might regulate the use of groundwater.

_____

_____

_____

36. What is a recharge zone?

_____

_____

37. Why are recharge zones environmentally sensitive areas?

_____

38. Name four ways that pollution can reach an aquifer.

_____

_____

_____

_____

WELLS AND SPRINGS

_____ **39.** A hole that is drilled to below the level of the water table and through which groundwater is brought to Earth's surface is called a(n)
- **a.** well.
- **b.** spring.
- **c.** ditch.
- **d.** artesian.

_____ **40.** A natural flow of groundwater to the surface where the water table meets Earth's surface is called a(n)
- **a.** well.
- **b.** spring.
- **c.** hole.
- **d.** artesian.

_____ **41.** Ordinary wells work only if they penetrate
- **a.** highly permeable sediment or rock.
- **b.** the water table.
- **c.** impermeable rock.
- **d.** groundwater.

_____ **42.** Pumping water from a well lowers the water table around the well and forms a(n)
- **a.** ordinary well.
- **b.** cone of depression.
- **c.** ordinary spring.
- **d.** drought.

_____ **43.** If too much water is pumped from a well, what might happen as a result?
- **a.** Nothing will happen.
- **b.** The well and surrounding wells might go dry.
- **c.** The well will refill.
- **d.** A spring will form.

_____ **44.** Which of the following formations are usually found in rugged terrain where the ground surface drops below the water table?
- **a.** cones of depression
- **b.** ordinary springs
- **c.** ordinary wells
- **d.** perched water tables

_____ **45.** When might an ordinary spring go dry?
- **a.** when a nearby well goes dry
- **b.** during the rainy season
- **c.** during dry seasons or severe droughts
- **d.** during periods of high winds

_____ **46.** An extensive aquifer through which water travels to a distant location may become part of a(n)
- **a.** ordinary well.
- **b.** ordinary spring.
- **c.** water table.
- **d.** artesian formation.

_____ **47.** An artesian formation is a(n)
- **a.** sloping layer of permeable rock between two layers of impermeable rock.
- **b.** aquifer at a recharge zone.
- **c.** artesian well.
- **d.** artesian spring.

_____ **48.** In an artesian formation, the top layer of impermeable rock is called the
- **a.** artesian well.
- **b.** aquifer.
- **c.** recharge zone.
- **d.** caprock.

49. When water enters the aquifer through the recharge zone of an artesian formation, the weight of the overlaying water causes the pressure in the aquifer to _____.

50. Water can flow freely through a(n) _____ without being pumped.

51. When cracks occur naturally in the caprock, water from an aquifer flows through the cracks, forming a(n) _____.

HOT SPRINGS

52. Groundwater is heated when it passes through rock that has been heated by _____.

53. Groundwater that has been heated to at least 37°C and then rises to the surface of Earth before cooling produces a(n) _____.

54. Mineral deposits around a hot spring create step-like terraces of calcite called_____.

55. When chemically weathered rock mixes with hot water from the spring, it forms a sticky, liquid clay called a(n) _____.

56. Mud pots that are brightly colored by minerals or organic materials are called _____.

GEYSERS

57. What is a geyser?

_____

_____

_____

_____

58. What happens when the water in a geyser vent begins to boil?

59. How long will a geyser eruption continue?

60. What happens after a geyser erupts?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Groundwater and Chemical Weathering

1. Water that is high in dissolved minerals such as calcium, magnesium, and iron is called _____.
2. Water that is relatively low in concentrations of dissolved minerals is called _____.
3. Water that is high in dissolved minerals tends to have a _____ taste, so many people do not like to drink it.
4. Some people think that using _____ is unappealing because household appliances or fixtures might be damaged by the buildup of mineral deposits.

RESULTS OF WEATHERING BY GROUNDWATER

5. How does chemical weathering work to dissolve minerals in rock?

6. Define the word *cavern*.

7. How does a cavern form?

8. What is one example of a large limestone cavern in the United States?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **9.** stalactite

_____ **10.** stalagmite

_____ **11.** column

a. created when upward- and downward-forming calcite deposits meet

b. created when calcite builds to form an upward-pointing cone

c. created when calcite drips form a cone- shaped deposit on a cavern ceiling

12. Define the word *sinkhole*.

13. A depression that forms when rock dissolves and overlying sediments settle into cracks in the rock is called a(n) _____ sinkhole.

14. Why do collapse sinkholes sometimes develop during dry periods?

15. Explain how natural bridges are formed.

KARST TOPOGRAPHY

16. Define *karst topography*.

17. What are the common features of karst topography?

Directed Reading *continued*

18. In which five regions of the United States can karst topography be found?

_____

_____

_____

_____

_____

19. Karst topography usually forms in regions with _____ weather.

20. Formations made of _____ are usually found in karst topography.

21. In karst regions, as the plentiful groundwater dissolves the limestone, cracks in the rocks enlarge to form _____.

22. In dry regions, karst topography is the result of many _____ forming close to each other.

23. Karst topography in dry regions is characterized by _____ and _____.

24. Karst topography in dry regions might point to a climate that is becoming _____.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Glaciers: Moving Ice

1. What is a glacier?

_____

_____

_____

FORMATION OF GLACIERS

_____ **2.** An almost motionless mass of permanent snow and ice is called a
- **a.** glacier.
- **b.** snowfield.
- **c.** snowline.
- **d.** snowball.

_____ **3.** How do snowfields form?
- **a.** Wind blows snow into drifts.
- **b.** Snow melts into ice in sunlight.
- **c.** Overlying layers flatten ice grains.
- **d.** Ice and snow accumulate above the snowline.

_____ **4.** The elevation above which snow and ice remain throughout the year is called the
- **a.** glacier.
- **b.** snowfield.
- **c.** snowline.
- **d.** air.

_____ **5.** How can snow accumulate year after year at high elevations and in polar regions?
- **a.** It is very dry at high elevations and in polar regions.
- **b.** There is little wind to blow the fallen snow away.
- **c.** Very little rain falls, so the snow does not melt and run off.
- **d.** The average temperature is near or below the freezing point of water.

_____ **6.** Cycles of partial melting and refreezing cause snow to change into grainy ice called
- **a.** firn.
- **b.** drizzle.
- **c.** hail.
- **d.** rain.

_____ **7.** What forces air out from between the ice grains in deep layers of snow and firn?
- **a.** more snowfall
- **b.** melting ice
- **c.** constant wind
- **d.** pressure from overlying snow layers

_____ **8.** Which of the following causes a glacier to move downslope or outward?
- **a.** its own weight
- **b.** underlying ice
- **c.** a stream of melted ice
- **d.** heat from the sun

_____ **9.** The size of a glacier depends on
- **a.** the amount of ice added and the amount of snow blown away.
- **b.** the amount of snow received and the amount of ice lost.
- **c.** the amount of ice received and the amount of snow lost.
- **d.** the amount of snow received and the amount of ice added.

10. Under what conditions does a glacier get smaller?

11. Explain how changes in the size of a glacier may indicate climatic change.

TYPES OF GLACIERS

12. A glacier that forms in a mountainous region is called

a(n) _____ glacier.

13. Why are alpine glaciers confined to small areas?

14. Name five regions in the world where alpine glaciers are found.

_____

_____

_____

_____

_____

15. Massive sheets of ice that may cover millions of square kilometers are called _____ glaciers.

16. Another name for a continental glacier is a(n) _____.

17. In which two regions of the world do continental glaciers exist?

_____

_____

18. The maximum thickness of the Antarctic ice sheet is more than _____ in some places.

19. If the Antarctic and Greenland ice sheets melted, the water they contain would raise the sea level worldwide by more than _____.

MOVEMENT OF GLACIERS

_____ **20.** What causes glaciers to flow downward?
- **a.** melting
- **b.** gravity
- **c.** wind
- **d.** snowfall

_____ **21.** By how many processes do glaciers move?
- **a.** one
- **b.** two
- **c.** three
- **d.** four

_____ **22.** The process that causes a glacier's base to melt and the glacier to slide is called
- **a.** glacial flow.
- **b.** ice sheeting.
- **c.** basal slip.
- **d.** glacial impact.

_____ **23.** In the process of basal slip, the glacier moves
- **a.** after ice particles change shape and slide past one another.
- **b.** after temperatures drop below freezing.
- **c.** by sliding over a thin layer of water and sediment.
- **d.** when wind pushes the ice downhill.

_____ **24.** A glacier that moves by basal slip can work its way over small barriers by
- **a.** melting and refreezing.
- **b.** moving more slowly.
- **c.** moving more quickly.
- **d.** touching the ground.

25. Explain the process of *internal plastic flow*.

26. Name three factors that determine the rate at which ice flows at a given point.

27. Why do the edges of a glacier move more slowly than its center?

FEATURES OF GLACIERS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **28.** crevasse

_____ **29.** ice shelf

_____ **30.** iceberg

- **a.** large block of ice that breaks from an ice shelf
- **b.** part of an ice sheet that moves out over the ocean
- **c.** large crack on the surface of a glacier

Directed Reading *continued*

31. Why does the ice on the surface of a glacier remain brittle?

_____

32. How does a crevasse form on the surface of a glacier?

_____

33. A crevasse on the surface of a glacier can be as deep as _____.

34. In which direction do continental glaciers move?

_____

35. Rising and falling tides can cause a(n) _____ to break off of an ice shelf.

36. Why do icebergs pose a hazard for ships?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Glacial Erosion and Deposition

1. Name three examples of landforms created by glaciers.

_____

_____

_____

2. Glaciers create landforms through which two processes?

_____

GLACIAL EROSION

_____ **3.** In what way are glaciers similar to rivers?
- **a.** Both are a result of rain.
- **b.** Both are agents of erosion.
- **c.** Both move only downhill.
- **d.** Both begin only high in mountains.

_____ **4.** Why would landforms that result from glacial action differ from those formed by rivers?
- **a.** There is no real difference because both rivers and glaciers contain water.
- **b.** Glaciers move very slowly and do not affect landforms as much as rivers.
- **c.** Rivers flow so quickly that they have little effect on rock but a major effect on soil.
- **d.** Because of the size and density of glaciers, the landforms that result are different than those formed by rivers.

_____ **5.** When rocks dragged by a glacier cause parallel grooves in bedrock, the grooves show
- **a.** that the rocks were harder than the bedrock.
- **b.** that the rocks were carried in a stream inside the glacier.
- **c.** the direction of the glacier's movement.
- **d.** how far the glacier moved in a day.

_____ **6.** Glacial processes that shape mountains begin
- **a.** at the top of the valley where an alpine glacier forms.
- **b.** at the base of the valley where an alpine glacier moves.
- **c.** on the sides of the valley where an alpine glacier moves.
- **d.** at the leading edge of an alpine glacier in a valley.

_____ **7.** Rock fragments that become embedded in a glacier's ice as it moves down a river valley range in size from
- **a.** microscopic particles to pebbles.
- **b.** pebbles to large rocks.
- **c.** large rocks to large boulders.
- **d.** microscopic particles to large boulders.

_____ **8.** Which of the following do NOT form when rock particles become embedded in a moving glacier?
- **a.** deep grooves in bedrock
- **b.** hanging valleys
- **c.** polished rock surfaces
- **d.** round, large rock projections

9. What happens to the walls of a V-shaped river valley as a glacier moves through it?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **10.** cirque

_____ **11.** arête

_____ **12.** horn

_____ **13.** roches moutonées

- **a.** sharp, jagged ridge
- **b.** rounded knobs of rock
- **c.** bowl-shaped depression
- **d.** sharp, pyramid-like peak

14. Explain how a cirque, an arête, and a horn are formed.

Directed Reading *continued*

15. When a rock projection has been rounded by a glacier, which side is smooth and gently sloping?

16. Why is one side of a rock projection that has been rounded by a glacier steep and jagged?

17. What does *roches moutonées* mean in French?

18. Explain the process by which a V-shaped valley becomes a U-shaped valley.

19. The only way a U-shaped valley can form is through the process of glacial _____.

20. How does a hanging valley form?

21. How do landforms created by alpine glaciers differ from landforms created by continental glaciers?

_____

_____

_____

_____

_____

GLACIAL DEPOSITION

22. When does glacial deposition occur?

_____

23. Under what conditions will a glacier melt?

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **24.** stratified drift

_____ **25.** erratic

_____ **26.** glacial drift

_____ **27.** till

a. large rock carried by a glacier from a distant source

b. unsorted glacial sediments that have been deposited

c. term used to describe all glacial sediments

d. glacial sediments that have been sorted and deposited

28. Why is the composition of an erratic usually different from that of the bedrock over which it lies?

_____

29. Stratified drift is sorted and deposited in layers by streams flowing from the _____.

30. Landforms that result when a glacier deposits till are called _____.

Directed Reading *continued*

31. What is the typical shape of a lateral moraine?

32. How does a medial moraine form?

33. Unsorted material left beneath a glacier when the ice melts is called _____.

34. What is the soil of a ground moraine usually like?

35. What are drumlins?

36. What do clusters of drumlins reveal about a glacier?

37. Where are terminal moraines located?

38. In the Midwest, where are many large terminal moraines found?

39. Where does meltwater come from, and what does it carry?

40. Why does glacial meltwater sometimes have beautiful colors?

_____

_____

41. A deposit of stratified drift that lies in front of a terminal moraine and is crossed by many meltwater streams is called a(n) _____.

42. How does a kettle form?

_____

_____

_____

_____

43. A long, winding ridge of gravel and coarse sand deposited by glacial meltwater streams is called a(n) _____.

GLACIAL LAKES

_____ **44.** When glaciers erode surfaces and leave depressions in bedrock,
- **a.** mountains rise up.
- **b.** new rivers flow.
- **c.** lake basins usually form.
- **d.** moraines are left.

_____ **45.** Lake basins form as a result of
- **a.** both glacial erosion or glacial deposition.
- **b.** only glacial deposition.
- **c.** only glacial erosion.
- **d.** neither glacial erosion nor glacial deposition.

_____ **46.** Long, narrow lakes that form where terminal and lateral moraines block streams are called
- **a.** deep lakes.
- **b.** cold lakes.
- **c.** northern lakes.
- **d.** finger lakes.

_____ **47.** Evidence of all kinds of glacial lakes can be seen in
- **a.** Illinois.
- **b.** Iowa.
- **c.** Minnesota.
- **d.** Ohio.

_____ **48.** Many large lakes that formed during the last glacial advance lost their outlet streams because
- **a.** glaciers no longer provided meltwater.
- **b.** climate changes occurred.
- **c.** snow no longer fell much.
- **d.** moraines blocked rivers.

_____ **49.** In a lake without outlet streams, water leaves only by
- **a.** deposition.
- **b.** sedimentation.
- **c.** evaporation.
- **d.** precipitation.

_____ **50.** In a salt lake, the lake becomes increasingly salty when water evaporates and
- **a.** dissolved salt is left behind.
- **b.** the lake becomes more polluted.
- **c.** there is additional rainfall.
- **d.** the lake level gets higher.

_____ **51.** Salt lakes commonly form in
- **a.** wet climates where evaporation is slow and precipitation is high.
- **b.** cold climates where the lakes often freeze.
- **c.** cool, moist climates where precipitation is high.
- **d.** dry climates where evaporation is rapid and precipitation is low.

52. Explain how the Great Lakes of North America formed.

53. During their early stages, the Great Lakes emptied into which rivers?

54. When the Great Lakes became larger, where did they also begin to drain?

55. What caused the Great Lakes to drain to the northeast after the glacial period?

_____

_____

_____

_____

_____

56. The northeasterly flow of the Great Lakes resulted in the formation of _____.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ice Ages

1. Where are continental glaciers mainly located today?

_____

_____

2. A long period of climatic cooling during which continents are glaciated repeatedly is called a(n) _____.

3. When did the earliest known ice age begin?

_____

_____

4. When did the most recent ice age begin?

_____

_____

5. When did the last advance of the most recent ice age's ice sheets begin to retreat?

_____

_____

6. What conditions probably exist at the beginning of an ice age?

_____

_____

GLACIAL AND INTERGLACIAL PERIODS

_____ **7.** What happens to continental glaciers during an ice age?
- **a.** They stay where they are.
- **b.** They advance once and retreat once.
- **c.** They advance and retreat several times.
- **d.** No one knows.

_____ **8.** During an ice age, ice sheets advance
- **a.** during colder periods.
- **b.** during warmer periods.
- **c.** all the time.
- **d.** when the ice sheets begin to melt.

_____ **9.** During an ice age, ice sheets retreat
- **a.** all the time.
- **b.** during warmer periods.
- **c.** in a northerly direction.
- **d.** during colder periods.

_____ **10.** What is a period of cooler climate that is characterized by the advancement of glaciers called?
- **a.** an ice age
- **b.** an interglacial period
- **c.** a glacial period
- **d.** global warming

_____ **11.** What is a period of warmer climate that is characterized by the retreat of glaciers called?
- **a.** an ice age
- **b.** an interglacial period
- **c.** a glacial period
- **d.** global warming

12. At this time, is Earth experiencing a glacial period or an interglacial period?

_____

13. How much of Earth's surface was covered by glaciers during the last glacial period?

_____

14. During the last glacial period, in what regions of the world did most glaciation take place?

_____

_____

15. Why did the coastlines of the continents extend farther during the last glacial period than they do today? Explain your answer.

_____

_____

16. What parts of North America were buried beneath ice during the last glacial period?

_____

_____

_____

_____

17. What type of glaciers covered parts of the western United States during the last glacial period?

18. How and from where did glaciers advance in the western United States?

19. Where was the great continental ice sheet in North America centered?

20. During the last glacial period, a continental ice sheet was centered on what is now the Baltic Sea. What parts of Europe did it cover?

21. In which mountain ranges of Europe and Asia did long alpine glaciers form?

22. What parts of the Southern Hemisphere were buried beneath ice during the last glacial period?

23. How do we know where glaciers existed during the last glacial period?

CAUSES OF GLACIATION

_____ **24.** Which of the following theories provides an explanation for the cause of glacial periods?
- **a.** Earth's atmosphere warms and cools periodically over time.
- **b.** Earth experienced periods of gradual warming that caused precipitation and led to the formation of glaciers.
- **c.** Temperature was not a factor in causing ice ages.
- **d.** Earth experienced periods of gradual cooling that brought on the advancement and eventual retreat of glaciers.

_____ **25.** Which of the following observations led Serbian scientist Milutin Milankovitch to propose his theory about glacial periods?
- **a.** Glaciers form in warm regions of the world.
- **b.** There has only been one ice age.
- **c.** Climate change occurs in cycles.
- **d.** Earth is presently in a glacial period.

_____ **26.** What did Milankovitch think the cycles of glaciation could be linked to?
- **a.** the buildup of greenhouse gases in Earth's atmosphere
- **b.** cycles in Earth's movement relative to the sun
- **c.** cycles of lunar energy released by the moon
- **d.** periods of volcanic activity on Earth

_____ **27.** The Milankovitch theory states that
- **a.** cyclical changes in Earth's orbit and in the tilt of Earth's axis over long periods cause climatic changes.
- **b.** random changes in Earth's orbit and in the tilt of Earth's axis may cause ice ages.
- **c.** cyclical changes in Earth's orbit indicate that the next glacial period will begin in about 3,000 years.
- **d.** cyclical changes in sunspot activity increase and decrease the amount of solar energy that reaches Earth.

_____ **28.** According to the Milankovitch theory, over what time period do the cycles that cause glaciation occur?
- **a.** days and months
- **b.** decades
- **c.** thousands of years
- **d.** millions of years

_____ **29.** How many periodic changes occur that affect the way Earth moves around the sun?
- **a.** two
- **b.** three
- **c.** four
- **d.** five

_____ **30.** What is the shape of Earth's orbit around the sun called?
- **a.** tilt
- **b.** precession
- **c.** eccentricity
- **d.** circular

_____ **31.** Every 100,000 years, the shape of Earth's orbit changes from
- **a.** entirely circular to slightly elongated.
- **b.** perfectly elongated to slightly circular.
- **c.** perfectly circular to a little less than circular and back again.
- **d.** nearly circular to elongated and back to nearly circular.

_____ **32.** How long is the cycle during which the tilt of Earth's axis varies?
- **a.** 15,000 years
- **b.** 31,000 years
- **c.** 37,000 years
- **d.** 41,000 years

_____ **33.** How much does the tilt of Earth's axis vary during this period?
- **a.** between about 22.2° and 24.5°
- **b.** between about 24.5° and 27.5°
- **c.** between about 25.1° and 25.9°
- **d.** between about 26° and 30°

_____ **34.** The circular motion that causes Earth's axis to change its position, or wobble, is called
- **a.** eccentricity.
- **b.** precession.
- **c.** tilt.
- **d.** elongation.

_____ **35.** As Earth wobbles on its axis, how long does it take for the axis to trace a complete circle?
- **a.** 22,500 years
- **b.** 25,700 years
- **c.** 27,500 years
- **d.** 41,000 years

_____ **36.** Milankovitch calculated how changes in eccentricity, tilt, and precession might affect
- **a.** the distribution of solar energy that reaches Earth's surface.
- **b.** the distribution of lunar energy between Earth and the moon.
- **c.** the amount of precipitation on Earth.
- **d.** the orbit of the moon over the next century.

_____ **37.** Changes in the distribution of solar energy on Earth
- **a.** cause crevasses to form in glaciers.
- **b.** result in the formation of moraines.
- **c.** affect global temperatures, which may cause glaciation.
- **d.** probably have no impact on global temperatures.

38. Evidence of past glaciation is found in the _____ of marine organisms from the order Foraminifera.

39. Formation of the shells of Foraminifera is affected by the _____ of ocean water.

40. Temperature of ocean water affects how much _____ the ocean water dissolves.

41. The amount of oxygen in ocean water affects how _____ organisms form their shells.

42. Under what conditions did Foraminifera organisms coil their shells to the right or left?

43. Where are Foraminifera shells found?

44. How does the study of Foraminifera shells relate to the Milankovitch theory?

45. Explain how other scientific theories about the causes of glaciation differ from the Milankovitch theory.

46. Describe two theories that suggest glacial periods are related to changes in the amount of solar energy reaching Earth's surface.

47. According to one theory, how could shifts in the positions of Earth's continents cause glacial periods?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Wind Erosion

_____ **1.** Most sand grains are made up of
- **a.** quartz.
- **b.** salt.
- **c.** gold.
- **d.** iron ore.

_____ **2.** Which of the following minerals is NOT commonly found in sand grains?
- **a.** mica
- **b.** salt
- **c.** magnetite
- **d.** feldspar

_____ **3.** Which of the following is true of dust particles?
- **a.** They are the same size as sand grains.
- **b.** They are heavier than sand grains.
- **c.** They are smaller than sand grains.
- **d.** They are larger than sand grains.

_____ **4.** Which of the following are NOT sources of dust?
- **a.** rocks and minerals
- **b.** plants and animals
- **c.** bacteria and pollution
- **d.** wind and water

HOW WIND MOVES SAND AND DUST

_____ **5.** The movement of sand by short jumps and bounces is called
- **a.** weathering.
- **b.** saltation.
- **c.** pollution.
- **d.** deflation.

_____ **6.** During saltation, sand grains move
- **a.** north.
- **b.** south.
- **c.** in the same direction as the wind.
- **d.** in the opposite direction of the wind.

_____ **7.** Dust from volcanic eruptions may stay in the atmosphere
- **a.** for about a month.
- **b.** for several years.
- **c.** until it rains.
- **d.** until saltation is complete.

EFFECTS OF WIND EROSION

8. Why are the effects of wind erosion more obvious in deserts and along coastlines?

_____

_____

_____

_____

9. The type of erosion that removes fine, dry soil particles and leaves behind large rock particles is called _____.

10. The rock particles that often remain after deflation are closely packed and form a surface called _____.

11. Why is deflation a problem for farmers?

_____

12. A shallow depression that forms when wind removes natural plant cover is called a(n) _____.

13. Rocks that have been pitted or smoothed by wind abrasion and that can be used to tell the direction of the prevailing wind are called _____.

14. What do scientists now think is responsible for producing large rock structures such as desert basins, natural bridges, and rock pinnacles?

_____

_____

_____

_____

WIND DEPOSITION

15. What is one way sedimentary rocks form?

_____

_____

_____

_____

16. Mounds of wind-deposited sand are called _____.

17. A dune begins to form when wind speed is slowed by a(n) _____.

18. The gentlest slope of a dune is the side that faces the _____.

19. The steeper side of a dune upon which blown sand settles is called a(n) _____.

20. A crescent-shaped dune whose face opens away from the wind is called a(n) _____.

21. A crescent-shaped dune whose open side faces into the wind is called a(n) _____.

22. Dunes that form at right angles to the wind direction and create sand ridges in long, wavelike patterns are called _____.

23. Ridge-shaped dunes that form parallel to the direction that the wind blows are called _____.

24. The movement that occurs as sand is blown over the crest of a dune is called _____.

25. In mostly level areas, dunes migrate until they reach a(n) _____.

LOESS

_____ **26.** Wind carries dust higher and farther than it carries
- **a.** rocks.
- **b.** loess.
- **c.** sand.
- **d.** sediment.

_____ **27.** Thick deposits of yellowish, fine-grained sediment are called
- **a.** rocks.
- **b.** loess.
- **c.** sand.
- **d.** bluffs.

_____ **28.** Loess is composed of
- **a.** compost.
- **b.** quartz, feldspar, hornblende, mica, and clay.
- **c.** desert pavement.
- **d.** salt.

_____ **29.** In which of the following regions is loess NOT found?
- **a.** New Zealand
- **b.** central Europe
- **c.** North America
- **d.** China

_____ **30.** Loess deposits are good for farming because they are very
- **a.** moist.
- **b.** dry.
- **c.** dusty.
- **d.** fertile.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Wave Erosion

1. As wind moves over ocean water, it produces both currents and _____ that erode the coastline.

2. The place where the ocean and land meet is called _____.

SHORELINE EROSION

_____ **3.** The abrasive action that breaks rocks into small pebbles and sand grains is called
- **a.** chemical weathering.
- **b.** saltation.
- **c.** mechanical weathering.
- **d.** deflation.

_____ **4.** Shoreline erosion often occurs during storms, when waves crash and release large amounts of
- **a.** wind.
- **b.** rock.
- **c.** sand.
- **d.** energy.

_____ **5.** Cracks in shoreline rock can become larger as a result of
- **a.** deflation.
- **b.** pollution.
- **c.** chemical weathering.
- **d.** tornadoes.

_____ **6.** If waves erode the base of an overhanging rock and the rock collapses, the resulting feature is a
- **a.** sea cliff.
- **b.** headland.
- **c.** sea cave.
- **d.** sea arch.

_____ **7.** A resistant rock formation that reaches out from the shore into the water is called a
- **a.** sea cliff.
- **b.** headland.
- **c.** sea cave.
- **d.** sea arch.

_____ **8.** In areas with less-resistant rock, wave erosion can produce
- **a.** ventifacts.
- **b.** headlands.
- **c.** bays.
- **d.** deflation hollows.

_____ **9.** A large hole that forms when waves cut deep into weak shoreline rock is called a
- **a.** terrace.
- **b.** headland.
- **c.** sea cave.
- **d.** sea arch.

_____ **10.** A formation that is created when waves cut completely through a headland is called a
- **a.** sea cliff.
- **b.** sea stack.
- **c.** sea cave.
- **d.** sea arch.

_____ **11.** Offshore columns of rock that were once connected to a sea cliff or headland are called
- **a.** sea stacks.
- **b.** sea urchins.
- **c.** sea caves.
- **d.** sea arches.

_____ **12.** A sea cliff that erodes until it is a nearly level platform is called a
- **a.** wave-cut terrace.
- **b.** headland.
- **c.** sea cave.
- **d.** wave-built terrace.

_____ **13.** An offshore extension to a wave-cut terrace is called a
- **a.** sea arch.
- **b.** headland.
- **c.** sea cave.
- **d.** wave-built terrace.

BEACHES

_____ **14.** An area of shoreline that is made up of deposited sediment is called a
- **a.** berm.
- **b.** sand bar.
- **c.** beach.
- **d.** bay.

_____ **15.** Beaches form where
- **a.** more sediment is removed than is deposited.
- **b.** more sediment is deposited than is removed.
- **c.** sediment is equally deposited and removed.
- **d.** sediment is neither deposited nor removed.

_____ **16.** The size and kind of material that makes up a beach is determined by
- **a.** the size of the beach.
- **b.** the composition of the source rock.
- **c.** the distance the waves carried the material.
- **d.** the season of the year.

_____ **17.** The berm is a section of the beach that is
- **a.** raised.
- **b.** lower.
- **c.** flat.
- **d.** eroded.

_____ **18.** A berm is likely to be high and steep during winter because large storms
- **a.** remove beach sand from the seaward side of the berm.
- **b.** deposit sand on the beach.
- **c.** move sand to a headland.
- **d.** deposit sand in an inlet.

_____ **19.** Sand that is deposited offshore and forms a long underwater ridge is called a
- **a.** berm.
- **b.** sand bar.
- **c.** beach.
- **d.** inlet.

LONGSHORE-CURRENT DEPOSITS

_____ **20.** The direction in which a wave approaches the shore determines
- **a.** how the wave moves sediment.
- **b.** how much erosion will occur.
- **c.** how much rock will be washed ashore.
- **d.** whether the beach will become polluted.

_____ **21.** In a longshore current, water moves near the shoreline and
- **a.** perpendicular to it.
- **b.** at right angles to it.
- **c.** parallel to it.
- **d.** behind it.

_____ **22.** Along a relatively straight coastline, sand will keep moving until
- **a.** the shoreline changes direction.
- **b.** a sea arch forms.
- **c.** a headland erodes.
- **d.** a sea cliff forms.

_____ **23.** Shoreline deposits may build a long, narrow ridge of sand connected at one end to the shore called a
- **a.** tombolo.
- **b.** spit.
- **c.** terrace.
- **d.** bay.

_____ **24.** A beach deposit that connects an offshore island to the mainland is called a
- **a.** bay.
- **b.** terrace.
- **c.** spit.
- **d.** tombolo.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Coastal Erosion and Deposition

1. Coastlines are affected by the long-term rise and fall of _____ and the long-term uplifting and sinking of land that borders the water.

2. Coastlines are also affected by the rapid processes of wave erosion and _____.

ABSOLUTE SEA-LEVEL CHANGES

_____ **3.** Sea level rises or falls when
- **a.** deposition occurs.
- **b.** erosion occurs.
- **c.** the amount of ocean water changes.
- **d.** pollution occurs.

_____ **4.** Scientists estimate that during the last glacial period, some water that is now ocean existed as
- **a.** continental ice sheets.
- **b.** icebergs.
- **c.** ice drifts.
- **d.** alpine glaciers.

_____ **5.** During the last glacial period, it is estimated that ice sheets held
- **a.** about 40 million cubic kilometers of ice.
- **b.** about 70 million cubic kilometers of ice.
- **c.** about 1 million cubic kilometers of ice.
- **d.** about 125 million cubic kilometers of ice.

_____ **6.** Ice sheets in Antarctica and Greenland currently hold
- **a.** about 13 million cubic kilometers of ice.
- **b.** about 25 million cubic kilometers of ice.
- **c.** about 46 million cubic kilometers of ice.
- **d.** about 300 million cubic kilometers of ice.

_____ **7.** During the last glacial period, sea level was
- **a.** higher than it is today.
- **b.** first lower and then higher than it is today.
- **c.** the same as it is today.
- **d.** lower than it is today.

_____ **8.** If today's polar ice caps were to melt completely,
- **a.** the oceans would fall about 60 m.
- **b.** the oceans would rise about 60 m.
- **c.** the oceans would stay about the same.
- **d.** Antarctica and Greenland would be submerged.

RELATIVE SEA-LEVEL CHANGES

9. When land or features near the coast change, _____ sea level changes.

10. A coastline can rise or sink because movements in Earth's _____.

11. In addition, coastlines near a(n) _____ may change as _____ move.

Identify the type of coastline described by each of the following features by writing *submergent* or *emergent* in the space provided.

_____ **12.** when sea level rises or land level falls

_____ **13.** when land rises or sea level falls

_____ **14.** when erosion forms sea cliffs, narrow inlets, and bays

_____ **15.** when divides between neighboring valleys become headlands separated by bays and inlets

_____ **16.** when a gentle slope forms a smooth coastal plain with many long, wide beaches

_____ **17.** when beaches generally are short, narrow and rocky

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **18.** barrier island

_____ **19.** fiord

_____ **20.** estuary

_____ **21.** lagoon

a. long narrow ridge of sand parallel to the shoreline

b. narrow region of shallow water that separates the shoreline and a barrier island

c. narrow, deep bay with steep walls

d. wide, shallow bay

PRESERVING THE COASTLINE

_____ **22.** Which of the following activities are coastal lands NOT used for?
- **a.** development and recreation
- **b.** shipping
- **c.** creating pollution
- **d.** fishing

_____ **23.** Which of the following is NOT considered a threat to coastal areas?
- **a.** an oil spill
- **b.** industrial pollution
- **c.** residential sewage
- **d.** a wildlife habitat

_____ **24.** Coastal zones can be preserved by
- **a.** developing environmentally sensitive areas.
- **b.** increasing human activity along shorelines.
- **c.** following guidelines for use.
- **d.** introducing submerged coastlines.

_____ **25.** Coastal protection has included
- **a.** removing barrier islands.
- **b.** removing marine birds and other animals.
- **c.** drilling offshore.
- **d.** rebuilding beaches damaged by storms.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Water Planet

_____ **1.** The body of salt water covering nearly three-quarters of the Earth's surface is called the
- **a.** Earth's ocean.
- **b.** Pacific Ocean.
- **c.** salt-water ocean.
- **d.** global ocean.

_____ **2.** How many of the known planets have a covering of liquid water similar to that of Earth?
- **a.** one
- **b.** three
- **c.** all
- **d.** none

_____ **3.** Why is Earth called the water planet?
- **a.** Earth is three-quarters water.
- **b.** Earth is the largest planet that has water.
- **c.** No other known planet has water.
- **d.** The global ocean is 1/4,000 of Earth's mass.

_____ **4.** What percentage of water on Earth does the global ocean contain?
- **a.** 50%
- **b.** 85%
- **c.** 97%
- **d.** 100%

_____ **5.** The most prominent feature on Earth is
- **a.** the Pacific Ocean.
- **b.** the continent of Asia.
- **c.** the continental land mass.
- **d.** the global ocean.

_____ **6.** The global ocean is about 1/800 of Earth's total
- **a.** mass.
- **b.** volume.
- **c.** surface area.
- **d.** water area.

DIVISIONS OF THE GLOBAL OCEAN

_____ **7.** How many major oceans form the global ocean?
- **a.** seven
- **b.** five
- **c.** three
- **d.** one

_____ **8.** The major oceans include the Atlantic, Pacific, Indian, Arctic and
- **a.** Eastern oceans.
- **b.** Western oceans.
- **c.** Northern oceans.
- **d.** Southern oceans.

_____ **9.** The largest ocean on Earth's surface is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **10.** Earth's deepest ocean is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **11.** The ocean that contains more than one-half the ocean water on Earth is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **12.** The second-largest ocean on Earth's surface is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **13.** The average depth of the Atlantic Ocean is
- **a.** 4.3 km.
- **b.** 3.9 km.
- **c.** 2.7 km.
- **d.** 1.9 km.

_____ **14.** The third-largest ocean on Earth's surface is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **15.** The ocean extending from the coast of Antarctica to 60°S latitude is the
- **a.** Atlantic Ocean.
- **b.** Pacific Ocean.
- **c.** Indian Ocean.
- **d.** Southern Ocean.

_____ **16.** The Arctic Ocean is Earth's
- **a.** oldest ocean.
- **b.** deepest ocean.
- **c.** widest ocean.
- **d.** smallest ocean.

_____ **17** A body of salt water that is smaller than an ocean is a(n)
- **a.** sea.
- **b.** lake.
- **c.** river.
- **d.** inlet.

18. Name three major seas.

_____

_____

_____

EXPLORATION OF THE OCEAN

_____ **19.** The study of the physical and chemical make-up of the ocean as well a its life-forms is called
- **a.** oceanography.
- **b.** oceanology.
- **c.** sedimentology.
- **d.** oceano-biology.

_____ **20.** Modern oceanography began in
- **a.** the 1750s.
- **b.** the 1850s.
- **c.** the 1950s.
- **d.** ancient times.

_____ **21.** Matthew F. Maury was (a)n
- **a.** American army officer.
- **b.** American scientist.
- **c.** American naval officer.
- **d.** British naval officer.

_____ **22.** What did Matthew F. Maury use to learn about ocean currents, winds, depths, and weather conditions?
- **a.** records from weather stations
- **b.** records from merchant ships
- **c.** records from navy ships
- **d.** diaries and journals

23. What measurements were made by HMS *Challenger* between 1872 and 1876?

24. What three types of samples were collected by HMS *Challenger* between 1872 and 1876?

25. The voyages of the HMS *Challenger* laid the foundation for the modern science of _____.

26. Why do drilling ships use reentry cones?

27. What valuable information do scientists gather from samples drilled by *JOIDES Resolution*?

28. What organization operates the Japanese ship *CHIKYU*?

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **29.** the British navy ship HMS *Challenger*

_____ **30.** the Japanese ship *CHIKYU*

_____ **31.** the research ship *JOIDES Resolution*

a. the world's largest scientific drilling ship in the 1990s

b. the ship that laid the foundation for modern oceanography

c. the most advanced drilling ship now in use

32. Oceanographic research ships are often equipped with _____.

33. What is *sonar*?

_____

_____

_____

_____

34. What do the letters in *sonar* stand for?

_____

_____

_____

_____

35. About how fast do the sound waves from a sonar transmitter travel through sea water?

_____

_____

_____

_____

36. What happens to the continuous series of sound waves sent from a sonar transmitter?

37. What measurements do scientists make when using sonar?

38. What do scientists calculate with the information they collect from sonar?

39. How do scientists use the information they collect using sonar?

40. What are underwater research vessels called *submersibles* used for?

41. What are two types of piloted submersibles?

42. What is the difference between a *bathyscaph* and a *bathysphere*?

43. What are two kinds of underwater tasks performed by submarine robots?

44. What is one major advantage a remotely piloted robot submersible has over a piloted submersible?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **45.** bathysphere

_____ **46.** bathyscaph

_____ **47.** submarine robot

a. a spherical diving vessel that remains connected to the research ship for communication and life support

b. a piloted, self-propelled, free-moving submarine

c. remotely piloted submersible that allows oceanographers to study the ocean depths for long periods of time

48. Submersibles have helped scientists make exciting discoveries about the _____.

49. What types of marine life did scientists in one submersible find living at depths and temperatures where they thought no life would exist?

50. What are two characteristics of the deep ocean made it unlikely that oceanographers would discover life forms?

51. Why do life-forms in the deep ocean have unusual adaptations?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Features of the Ocean Floor

_____ **1.** How many major areas does the ocean floor have?
- **a.** one
- **b.** two
- **c.** three
- **d.** four

_____ **2.** The shallow sea floor between the shoreline and the deep-ocean bottom is called the
- **a.** continental margin.
- **b.** deep-ocean basin.
- **c.** continental crust.
- **d.** oceanic crust.

_____ **3.** Continental margins are made up of continental crust
- **a.** and a thin sediment layer.
- **b.** and a thick wedge of sediment.
- **c.** without a sedimentary layer.
- **d.** or a sedimentary layer.

_____ **4.** The part of the ocean floor under deep water beyond the continental margin is called the
- **a.** continental margin.
- **b.** deep-ocean basin.
- **c.** continental crust.
- **d.** oceanic crust.

_____ **5.** The deep-ocean basin is made up of oceanic crust
- **a.** and a thin sediment layer.
- **b.** and a thick wedge of sediment.
- **c.** without a sedimentary layer.
- **d.** or a sedimentary layer.

CONTINENTAL MARGINS

_____ **6.** The line that divides the continental crust from the oceanic crust is
- **a.** distinct.
- **b.** on the surface.
- **c.** under thick sediments.
- **d.** at the shoreline.

_____ **7.** The part of the continent covered by water is called the
- **a.** shoreline.
- **b.** continental margin.
- **c.** continental shelf.
- **d.** deep-ocean basin.

_____ **8.** The continental shelf slopes gently from the shoreline, and drops about 0.12 m every
- **a.** 10 m.
- **b.** 100 m.
- **c.** 1,000 m.
- **d.** 10,000 m.

_____ **9.** the average depth of the water covering a continental shelf is about
- **a.** 6 m.
- **b.** 60 m.
- **c.** 160 m.
- **d.** 600 m.

_____ **10.** The continental shelf is part of the
- **a.** continental margin.
- **b.** deep-ocean basin.
- **c.** ocean surface.
- **d.** oceanic crust.

_____ **11.** During glacial periods
- **a.** sea level rises.
- **b.** sea level falls.
- **c.** sea level is unchanged.
- **d.** continental shelves rise.

_____ **12.** More continental shelf is exposed to weathering and erosion
- **a.** when ice sheets melt and sea level rises.
- **b.** during glacial periods when ice sheets hold water.
- **c.** at the beginning of glacial periods when ice begins to freeze.
- **d.** at the end of glacial periods when ice begins to melt.

_____ **13.** The steep slope at the seaward edge of a continental shelf is called the
- **a.** continental rise.
- **b.** continental slope.
- **c.** oceanic slope.
- **d.** oceanic rise.

Directed Reading *continued*

14. Where is the boundary between the continental crust and the oceanic crust?

15. About how steeply does the ocean depth increase along the continental slope?

16. V-shaped valleys in the continental shelf and continental slope are called _____.

17. What is one place submarine canyons are often found?

18. How can turbidity currents help form submarine canyons?

19. How do turbidity currents form?

20. A raised wedge of sediment at the base of the continental slope is called a(n) _____.

DEEP-OCEAN BASINS

21. What are four features of deep-ocean basins?

22. How do the mountains and the plains in deep-ocean basins compare to those on the surface of the continents?

23. What is the name of the deepest place in Earth's crust?

24. Where is the deepest place in Earth's crust located?

25. About how deep is the deepest place in Earth's crust?

26. In the deep-ocean basins, what is a *trench*?

27. How do trenches form in the deep-ocean basins?

28. Name three things that occur or form near trenches.

29. In the deep-ocean basins, what are *abyssal plains*?

30. About half of the deep-ocean basins are covered by _____.

31. The flattest regions on Earth are _____.

32. Layers of fine _____ cover the abyssal plains.

33. What are the two sources of sediments covering the abyssal plains?

34. How does the age of the oceanic crust affect the thickness of sediments on the abyssal plains?

35. How would distance from the continental margin to the abyssal plains affect the thickness of sediments?

36. Compare the sediment cover on abyssal plains that are bordered by trenches with the sediment cover on abyssal plains not bordered by trenches.

37. The most prominent features of ocean basins are _____.

38. Mid-ocean ridges form underwater _____.

39. What is one place where a mid-ocean ridge rises above sea level?

_____

40. Where do mid-ocean ridges form?

_____

41. What runs along the center of a mid-ocean ridge?

_____

42. How does magma reach the sea floor?

_____

43. What is formed when magma reaches the sea floor?

_____

44. What happens to new lithosphere as it cools?

_____

45. Blocks of crust bounded by faults, called _____ , form parallel to ridges as lithosphere cools and contracts.

46. What happens as ridges adjust to changes in the direction of plate motions?

_____

_____

47. Faults create rough areas called _____, which run perpendicular across mid-ocean ridges.

48. Where do *seamounts* form?

_____

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **49.** guyot

_____ **50.** hot spot

_____ **51.** seamount

_____ **52.** atoll

_____ **53.** oceanic island

a. an area of increased volcanic activity where seamounts form

b. submerged seamount with a flat top

c. a seamount that rises above the ocean

d. an oceanic island that is in the process of being eroded into a guyot

e. submerged volcanic mountain taller than 1 km

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ocean-Floor Sediments

_____ **1.** Continental shelves and slopes are covered with
- **a.** sediments.
- **b.** turbidity currents.
- **c.** silica.
- **d.** petroleum.

_____ **2.** Ocean sediments are composed of
- **a.** the same materials no matter which part of the ocean the sediments form in.
- **b.** only coarse gravel and sand carried into the water by wind and currents.
- **c.** only light particles that have been suspended in ocean water.
- **d.** various materials depending on which part of the ocean the sediments form in.

_____ **3.** Sediments in the ocean are well sorted by
- **a.** shape.
- **b.** texture.
- **c.** age.
- **d.** size.

4. Name three ways sediments get into the ocean.

_____

_____

_____

5. The types of sediments found close to shore are

usually _____.

6. The types of sediments usually deposited far from shore

are _____.

SOURCES OF DEEP OCEAN-BASIN SEDIMENTS

_____ **7.** Compared to sediments found in shallow water, those found in the deep-ocean basin are usually
- **a.** coarser.
- **b.** sandier.
- **c.** heavier.
- **d.** finer.

_____ **8.** Cylinders of sediment that are taken from sediment layers on the ocean floor are called
- **a.** gravel.
- **b.** *JOIDES*.
- **c.** core samples.
- **d.** organic sediments.

_____ **9.** Most of the sediment in deep-ocean basins comes from
- **a.** the shoreline.
- **b.** rivers.
- **c.** ocean water above.
- **d.** core samples.

10. What are two ways to take sediment samples in deep ocean basins?

_____

_____

11. What is the name of one research vessel used to study ocean floor sediment core samples?

_____

12. What is one type of sediment carried into the ocean basin by land from rivers?

_____

13. In what two places does a river usually deposit a sediment load with rock particles?

_____

_____

14. Besides the shore and the continental shelf, where do large quantities of sediments occasionally end up?

_____

_____

15. Large quantities of sediments sliding from continental slopes to the ocean floor below create _____ currents.

16. How does volcanic dust become sediment in the deep-ocean basins?

17. How do icebergs provide sediments that end up on the ocean basins?

18. What happens to a meteorite as it enters Earth's atmosphere?

19. What happens to most meteorite fragments after the meteorite vaporizes?

20. How are underwater landslides caused?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **21.** biogenic sediments

_____ **22.** calcium carbonate

_____ **23.** silica

_____ **24.** nodules

a. formed by shells of radiolarians and diatoms

b. remains of marine plants and animals

c. lumps of minerals found on the ocean floor

d. formed by skeletons of foraminiferans

PHYSICAL CLASSIFICATION OF SEDIMENTS

_____ **25.** How many basic types of deep ocean-floor sediments are there?
- **a.** one
- **b.** two
- **c.** three
- **d.** four

_____ **26.** Fine silt- and clay-sized particles of rock, found on the deep ocean floor, are called
- **a.** muds.
- **b.** ooze.
- **c.** diatoms.
- **d.** nodules.

_____ **27.** Clay particles mixed with silt, sand, and biogenic material are called
- **a.** red ooze.
- **b.** red mud.
- **c.** red clay.
- **d.** red silt.

_____ **28.** About how much of the ocean floor is covered with ooze?
- **a.** 10%
- **b.** 20%
- **c.** 30%
- **d.** 40%

_____ **29.** About how much of the ooze on the ocean floor is made up of biogenic materials?
- **a.** 10%
- **b.** 20%
- **c.** 30%
- **d.** 40%

_____ **30.** Calcareous ooze is made up mostly of
- **a.** calcium carbide.
- **b.** calcium carbonate.
- **c.** calcium hydroxide.
- **d.** calcium silicate.

_____ **31.** Calcareous ooze is never found deeper than
- **a.** 1 km.
- **b.** 5 km.
- **c.** .5 km
- **d.** 10 km.

_____ **32.** In cold ocean water, between depths of 3 km and 5 km, calcium carbonate
- **a.** precipitates.
- **b.** expands.
- **c.** crystallizes.
- **d.** dissolves.

_____ **33.** Siliceous ooze can be found
- **a.** only at depths over 5 km on the ocean floor.
- **b.** only at depths less than 5 km on the ocean floor.
- **c.** only at depths between 3 km and 5 km on the ocean floor.
- **d.** at any depth on the ocean floor.

_____ **34.** Siliceous ooze is made up mostly of
- **a.** silicon carbide.
- **b.** silicon dioxide.
- **c.** calcium silicate.
- **d.** silica gel.

35. Why is most siliceous ooze found in the waters around Antarctica?

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **36.** mud

_____ **37.** siliceous ooze

_____ **38.** calcareous ooze

- **a.** deep ocean-floor sediments found above a depth of 5 km
- **b.** deep ocean-floor sediment usually found in the ocean around Antarctica
- **c.** deep ocean-floor sediments consisting of very fine silt- and clay-sized rock particles

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Properties of Ocean Water

_____ **1.** Water in the ocean
- **a.** is tasteless, odorless, and colorless.
- **b.** is muddy and brown.
- **c.** contains many dissolved solids and gases.
- **d.** is completely pure.

_____ **2.** Scientists do NOT describe ocean water by using properties such as
- **a.** presence of dissolved gases and the presence of dissolved solids.
- **b.** salinity and temperature.
- **c.** presence of dissolved vitamins and dissolved minerals.
- **d.** density and color.

3. Why do scientists study the properties of ocean water?

_____

_____

_____

_____

DISSOLVED GASES

_____ **4.** The two principal gases in the atmosphere are
- **a.** nitrogen and oxygen.
- **b.** oxygen and carbon dioxide.
- **c.** nitrogen and carbon dioxide.
- **d.** oxygen and carbon monoxide.

_____ **5.** Ocean water contains a large amount of dissolved
- **a.** carbon monoxide.
- **b.** helium.
- **c.** carbon dioxide.
- **d.** nitrous oxide.

_____ **6.** Most oxygen in the ocean
- **a.** enters at the surface of the ocean from the atmosphere.
- **b.** enters as dissolved gas from streams and rivers.
- **c.** is released as carbon dioxide dissolves.
- **d.** is made by plants in the ocean through photosynthesis.

_____ **7.** Gases dissolve most readily in what kind of water?
- **a.** ocean water
- **b.** fresh water
- **c.** warm water
- **d.** cold water

_____ **8.** When ocean temperature rises,
- **a.** excess gas is released into the atmosphere.
- **b.** the ocean absorbs and holds carbon dioxide.
- **c.** carbon dioxide is equalized between the ocean and atmosphere.
- **d.** no change takes place.

_____ **9.** How many times more carbon is in the oceans than in the atmosphere?
- **a.** 20 times
- **b.** 40 times
- **c.** 60 times
- **d.** 80 times

_____ **10.** For how long might dissolved carbon dioxide be trapped in the ocean?
- **a.** ten years
- **b.** hundreds of years
- **c.** from hundreds to thousands of years
- **d.** millions of years

_____ **11.** Because of their ability to dissolve and contain a large amount of carbon dioxide, oceans are often referred to as a(n)
- **a.** carbon trap.
- **b.** carbon sink.
- **c.** infinite water supply.
- **d.** Earth thermostat.

_____ **12.** Because gaseous carbon dioxide affects the atmosphere's ability to trap thermal energy from the sun,
- **a.** oceans warm easily in the tropics.
- **b.** the temperature of the ocean fluctuates with the daily temperature.
- **c.** oceans are important in the regulation of climate.
- **d.** land temperature is directly related to the carbon dioxide content of the closest ocean.

DISSOLVED SOLIDS

_____ **13.** Ocean water is made up of what percentage of dissolved solids?
- **a.** 3.5%
- **b.** 35.5%
- **c.** 50.5%
- **d.** 96.5%

_____ **14.** The dissolved solids that give the ocean its salty taste are commonly called
- **a.** sea solids.
- **b.** brine.
- **c.** sodium chloride.
- **d.** sea salts.

_____ **15.** Solids dissolved in ocean water are composed of about how many chemical elements?
- **a.** 25
- **b.** 50
- **c.** 75
- **d.** 100

_____ **16.** The most common salt, halite, which makes up more than 85% of the oceans solids, is made of
- **a.** sodium and chloride ions.
- **b.** zinc and sodium.
- **c.** sodium and phosphorus.
- **d.** sodium only.

17. Elements that exist in very small amounts are called _____.

18. What are three examples of trace elements found in the ocean?

_____

_____

_____

19. What are the three main sources of the elements that form sea salts?

_____

_____

_____

20. How do dissolved salts and other dissolved solids enter the ocean?

_____

_____

SALINITY OF OCEAN WATER

21. A measure of the amount of dissolved salts and other solids in a given amount of liquid is _____.

22. How is salinity measured?

_____

23. What is the average salinity of fresh water?

_____

FACTORS THAT CHANGE SALINITY

24. What happens when evaporation and freezing remove water particles from the ocean?

_____

_____

25. Will tropical waters or polar waters have a higher salinity at the surface? Explain your answer.

_____

_____

_____

26. Why does surface water generally have higher salinity than deep water?

_____

27. Is the salinity of the global ocean the same in all locations?

_____

28. Why is the salinity of the Red Sea more than 40%?

_____

_____

TEMPERATURE OF OCEAN WATER

_____ **29.** Ocean temperature varies depending on

- **a.** depth of water and percentage of salinity on the surface of the oceans.
- **b.** depth of water and location on the surface of the oceans.
- **c.** the number of plants and animals living in the surface water.
- **d.** the amount of dissolved minerals on the surface of the oceans.

30. Why does the temperature of the zone of surface water decrease only slightly as the depth increases?

31. What happens to the temperature of surface water as latitude increases?

32. Where does the greatest amount of solar energy reach the surface of the ocean?

33. What is the common temperature at the surface in tropical areas?

34. Why do vast amounts of sea ice exist in polar oceans? Explain your answer.

35. A floating layer of sea ice that completely covers an area of the ocean surface is called _____.

36. Why is pack ice rarely more than 5 m thick?

37. What determines changes in ocean surface temperature in the middle latitudes?

38. Why does the temperature of the water decrease sharply below the surface layer of the ocean?

39. The layer in a body of water in which water temperature drops with increased depth faster than it does in other layers is called a(n) _____.

40. Why does the thermocline exist in the ocean?

41. What happens to the temperature of the water in the zone beneath the thermocline?

42. How does the 2°C temperature of the deep zone affect the density of the ocean water?

43. How does the amount of dissolved gases in cold, deep ocean water compare to the amount of dissolved gases in warm shallow, ocean water?

DENSITY OF OCEAN WATER

44. The ratio of the mass of a substance to the volume of the substance; commonly expressed as grams per cubic centimeter for solids and liquids and as grams per liter for gases is called _____.

45. What two factors affect the density of ocean water?

46. What do dissolved solids, mostly salts, add to ocean water?

47. Which is more dense, ocean water or fresh water? Why?

48. In what region is the densest ocean water found? Explain why this is true.

COLOR OF OCEAN WATER

49. How is the color of ocean water determined?

50. Why does ocean water appear blue?

51. What are *phytoplankton*?

52. How do the presence and amount of phytoplankton affect the shade of blue of the ocean?

53. How do scientists determine the presence of phytoplankton in the ocean?

54. How does the presence or absence of phytoplankton in the ocean indicate the health of the ocean?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Life in the Oceans

_____ **1.** What two major factors do marine organisms depend on for their survival?

a. essential nutrients in ocean water and sunlight
b. density of ocean water and sunlight
c. essential nutrients in ocean water and density of ocean water
d. salinity of ocean water and density of ocean water

OCEAN CHEMISTRY AND MARINE LIFE

2. Describe the chemistry of the ocean.

_____

_____

_____

3. How do marine organisms help maintain the chemical balance of ocean water?

_____

_____

_____

4. What are three elements absorbed by marine plants?

_____

_____

_____

5. What is one way photosynthetic marine plants return oxygen to the ocean?

_____

_____

_____

6. One way that nutrients return to the surface is through a process called _____.

Directed Reading *continued*

7. How do bacteria help release essential nutrients into the ocean?

8. Where do organisms in the ocean consume all the elements necessary for life?

9. What happens to elements necessary for life when ocean organisms die?

10. Where are nutrients stored in the ocean?

11. What must happen to nutrients stored in deep water before they can be used by most organisms in the ocean?

12. What is one way nutrients stored in deep water return to the surface?

13. What happens when wind blows steadily parallel to a coastline?

14. In what part of the ocean do most marine organisms live?

_____

_____

_____

15. The mass of mostly microscopic organisms that float or drift freely in the waters of aquatic environments are called _____.

16. How do plankton form the base of food webs in the ocean?

_____

_____

_____

_____

17. Organisms such as dolphins and squid, that swim actively in open water, are called _____.

18. Organisms that live at the bottom of oceans or bodies of fresh water are called _____.

OCEAN ENVIRONMENTS

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

pelagic zone	oceanic zone	hadal zone
bathyal zone	benthic zone	sublittoral zone
intertidal zone	abyssal zone	neritic zone
epipelagic zone		

19. The general term for the bottom region of oceans and bodies of fresh water is _____.

20. The general term for the region of an ocean or body of fresh water above the benthic zone is _____.

21. This is the shallowest benthic zone, located between the low-tide and high-tide zones. Shifting tides make it a continually changing environment for marine organisms. It is called the _____.

Directed Reading *continued*

22. Most organisms that live in the benthic zone live in this shallow zone. This constantly submerged area is located on the continental shelf and is home to sea stars, brittle stars, and sea lilies. It is called the _____.

23. This zone begins at the continental slope and extends to a depth of 4,000 m. Little or no sunlight reaches this area so plant life is scarce. Animals living in this zone include octopuses, sea stars, and brachiopods. This zone is called the _____.

24. This zone has no sunlight because it begins at 4,000 m and goes to a depth of 6,000 m. Organisms that call this zone home are sponges and worms. It is called the _____.

25. This zone is confined to the ocean trenches—areas deeper than 6,000 m. This area is virtually unexplored, but scientists think that life here is sparse. It is called the _____.

26. The region of the pelagic zone above the continental shelves has abundant sunlight, moderate temperatures, and relatively low water pressure, which are ideal conditions for marine life. Nekton fill the area's waters and are the source of much of the fish and seafood that humans eat. It is called the _____.

27. The zone that extends into the deep waters beyond the continental shelf is divided into four zones based on depth. It is called the _____.

28. The uppermost area of the oceanic zone is sunlit and populated by sea life such as dolphins. It is called the _____.

29. What are the deepest three areas of the oceanic zone?

_____

_____

_____

30. What happens to the amount of marine life in the pelagic zone as depth increases?

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ocean Resources

1. What are three important resources supplied by the ocean?

_____

_____

_____

FRESH WATER FROM THE OCEAN

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **2.** freezing

_____ **3.** distillation

_____ **4.** desalination

_____ **5.** reverse osmosis desalination

a. a process of removing salt from ocean water

b. a process using special membranes that allow water under high pressure to pass through, while blocking dissolved salts

c. a process in which water is frozen, and ice crystals are removed and then melted to obtain fresh water

d. a process in which liquid water is heated, then evaporates leaving dissolved salts behind, and condenses, resulting in pure, fresh water

6. Although desalination may provide needed fresh water, there is one significant drawback. What is it?

_____

_____

7. What is one disadvantage of using distillation as a means of desalination?

_____

_____

8. What is one advantage freezing as a means of desalination has over other processes?

_____

_____

MINERAL AND ENERGY RESOURCES

_____ **9.** The most valuable resource found in the ocean is
- **a.** salt.
- **b.** minerals.
- **c.** petroleum.
- **d.** gold.

_____ **10.** Offshore oil and natural gas deposits exist
- **a.** along the shorelines of the northern hemisphere.
- **b.** under sandy-bottom beaches.
- **c.** along continental margins.
- **d.** under the deepest ocean floors.

_____ **11.** About how much of the world's oil supply is currently mined from offshore wells?
- **a.** one-third
- **b.** one-fourth
- **c.** one-half
- **d.** all

_____ **12.** Potato-shaped lumps of minerals, called *nodules*, are found
- **a.** on the abyssal floor of the ocean.
- **b.** washed up along the shorelines in remote areas.
- **c.** in underwater oil wells.
- **d.** in ocean waters heavy with organic materials.

_____ **13.** Recovery of nodules is difficult and expensive because
- **a.** they are so small.
- **b.** they contain manganese, iron, copper, nickel, cobalt, and phosphates.
- **c.** they are located in very deep water.
- **d.** the minerals they contain cost too much to recover.

_____ **14.** The ocean is an important source of
- **a.** copper and silver.
- **b.** magnesium and bromine.
- **c.** trace minerals and iron.
- **d.** salt and diamonds.

FOOD FROM THE OCEAN

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

overharvest	aquatic farms	food
protein	aquaculture	ecosystem

15. Of all the resources the ocean supplies, the one in greatest demand is _____.

16. Seafood is an important source of _____, which can be harvested by fishing or through aquaculture.

17. When people _____ the ocean over a long period of time, the fish populations can collapse.

18. A collapse of a fish population can damage the _____ and threaten the fishing industry.

19. The raising of aquatic plants and animals for human use or consumption is called _____.

20. Catfish, salmon, oysters, and shrimp are already being grown on _____.

21. Under the best conditions, which type of farm could produce more food, aquatic farms or agricultural farms? Why?

_____

_____

_____

22. How might aquatic farms be fertilized in the future?

_____

_____

_____

_____

OCEAN-WATER POLLUTION

_____ **23.** Which of the following items is NOT a source of ocean-water pollution?
- **a.** garbage
- **b.** nuclear waste
- **c.** decaying ocean organisms
- **d.** sewage

_____ **24.** What factors have reduced the ocean's ability to absorb wastes and renew itself?
- **a.** growth of world population and use of more-toxic substances
- **b.** shifting ocean floors and toxic ocean plant life
- **c.** underground volcanoes and offshore drilling
- **d.** oil spills and global warming

_____ **25.** In addition to beaches, what other area is in the greatest danger from increasing ocean-water pollution?
- **a.** warm tropical areas
- **b.** polar regions
- **c.** inland lakes
- **d.** coastal areas

_____ **26.** Which of the following items is NOT a dangerous pollutant in the ocean?
- **a.** mercury
- **b.** phosphates
- **c.** DDT from insecticides
- **d.** lead from gasoline

_____ **27.** What are two ways scientists and governments have worked to reduce pollution?
- **a.** DDT is banned worldwide, and use of leaded gasoline has been eliminated.
- **b.** Use of DDT and leaded gasoline have both been reduced in the United States.
- **c.** Insecticide use has been banned in the United States, and use of leaded gasoline has been reduced.
- **d.** Use of DDT has been banned in the United States, and use of leaded gasoline has been reduced.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ocean Currents

1. A horizontal movement of water in a well-defined pattern is called a(n) _____.

2. What are two ways that oceanographers identify ocean currents?

_____

_____

_____

3. What are the two major categories of ocean currents?

_____

FACTORS THAT AFFECT SURFACE CURRENTS

_____ **4.** Currents that are driven by winds and move horizontally on or near the ocean's surface are called
- **a.** air currents.
- **b.** high-pressure areas.
- **c.** surface currents.
- **d.** low-pressure areas.

_____ **5.** Which of the following factors do NOT control surface currents?
- **a.** floating debris
- **b.** air currents
- **c.** location of the continents
- **d.** Earth's rotation

_____ **6.** All surface currents are affected by
- **a.** glaciers.
- **b.** ocean pollution.
- **c.** winds.
- **d.** the equator.

7. Explain what causes winds to form.

_____

_____

8. How does wind make water on the ocean's surface move?

_____

_____

Directed Reading *continued*

9. Two types of global wind belts that affect the flow of ocean surface water are called _____ and _____.

10. Wind belts located just north and south of the equator are called _____.

11. In the Northern Hemisphere, trade winds blow from the _____.

12. In the Southern Hemisphere, trade winds blow from the _____.

13. In both hemispheres, trade winds push currents _____ across the tropical latitudes of all three major oceans.

14. In the Northern Hemisphere, westerlies blow from the _____.

15. In the Southern Hemisphere, westerlies blow from the _____.

16. In the higher latitudes of both hemispheres, westerlies push ocean currents in which direction?

_____

17. Why does a surface current get deflected and divided when it flows against a continent?

_____

_____

18. The curving of the path of oceans and winds due to Earth's rotation is called the _____.

19. Huge circles of moving water caused by wind belts and the Coriolis effect are called _____.

20. In which direction does the water flow in gyres of the Northern Hemisphere?

_____

_____

21. In which direction does the water flow in gyres of the Southern Hemisphere?

_____

_____

MAJOR SURFACE CURRENTS

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **22.** North Atlantic Current

_____ **23.** Canary Current

_____ **24.** Antarctic Circumpolar Current

_____ **25.** California Current

_____ **26.** Gulf Stream

_____ **27.** North Pacific Drift

_____ **28.** Equatorial Countercurrent

_____ **29.** Kuroshio Current

_____ **30.** Norway Current

_____ **31.** equatorial currents

_____ **32.** Labrador Current

a. the world's largest current

b. the Pacific equivalent of the Gulf Stream

c. a current that keeps the coast of Norway ice-free

d. a cool, southward current that flows along the California coast

e. a cool, southward current split off from the North Atlantic Current

f. an eastward-flowing current lying between equatorial currents

g. a swift, warm current in the North Atlantic

h. a vast, slow-moving warm current

i. a cold current that flows south in the North Atlantic and joins the Gulf Stream

j. warm currents in the Atlantic, Pacific, and Indian Oceans that move westward

k. a current also known as the Antarctic Circumpolar Current

33. A current that is uninterrupted by any continents and crosses all three major oceans is the _____.

34. Currents in the northern Indian Ocean are governed by _____, which are winds whose directions change seasonally.

35. The Gulf Stream, the North Atlantic Current, the Canary Current, and the North Equatorial Current form the _____.

36. A vast area of calm, warm water at the center of the North Atlantic Gyre is called the _____.

37. Name two things you would find floating on the surface of the Sargasso Sea.

_____

_____

38. The pattern of currents in the North Pacific is similar to that in the _____.

39. The Kuroshio Current flows toward North America as the _____, and then southward as the _____.

DEEP CURRENTS

40. A streamlike movement of ocean water far below the surface is called a(n) _____.

41. Deep currents move much more _____ than ocean currents.

42. What causes deep currents to form?

_____

_____

43. What causes the movement of polar waters?

_____

_____

44. Two factors that determine the density of water are temperature and _____.

45. Explain why water in polar regions has high salinity.

_____

_____

_____

46. Where is the world's densest and coldest ocean water?

_____

_____

47. A deep current of dense, cold water that moves northward to a latitude of about 40°N is called the _____

48. Where does the deep current that moves southward under the northward-flowing Gulf Stream form?

_____

_____

49. What causes the salinity of water in the Mediterranean Sea to increase?

_____

_____

_____

50. To where does the denser, highly saline water of the Mediterranean Sea flow?

_____

_____

51. A strong current caused by an underwater landslide is called a(n) _____.

52. Explain how a turbidity current forms.

_____

53. How does the water in a turbidity current appear compared with the surrounding water?

_____

54. Why does a turbidity current move beneath the clear water that surrounds it?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Ocean Waves

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **1.** wave period

_____ **2.** crest

_____ **3.** wave height

_____ **4.** wave

_____ **5.** wavelength

_____ **6.** trough

a. the lowest point between two crests of a wave

b. the vertical distance between the crest and the trough of a wave

c. a periodic disturbance in a solid, liquid, or gas as energy is transmitted through it

d. the highest point of a wave

e. the time required for two consecutive wave crests to pass a given point

f. the horizontal distance between two consecutive crests or two consecutive troughs

7. The formula for calculating the speed at which a wave moves is _____.

WAVE ENERGY

8. Moving air caused by the uneven heating of Earth's atmosphere is called _____.

9. What causes small waves or ripples to form on the ocean?

_____

_____

10. What causes a wave to become larger?

_____

_____

11. Explain why larger waves tend to grow larger and smaller waves die out.

_____

_____

_____

Directed Reading *continued*

12. Why does a bottle floating on water move in a circular path, even though it appears to be moving up and down?

13. Where does a water particle in a wave end up at the end of the wave period?

14. What is the diameter of the circle traced by a water particle on the ocean surface as a wave passes a given point?

15. What happens to the energy received by a wave as the depth of the water increases?

16. What happens to the diameter of a water molecule's circular path as water depth increases?

17. How much circular motion of water molecules occurs at a depth of one-half the wavelength?

18. What three factors determine the size of a wave?

19. The distance that the wind blows across open water to generate waves is called _____.

20. What kind of wind produces very large waves?

21. What kind of wind produces choppy water with waves of various heights and lengths?

22. One of a group of long, rolling waves of similar size is called

a(n) _____.

23. What causes a whitecap to form?

24. Why could whitecaps possibly have an effect on climate?

WAVES AND THE COASTLINE

25. At what point does a wave touch the ocean bottom in shallow water near the coastline?

26. What causes a wave near the coastline to break?

27. A foamy mass of water that washes onto the coastline is called

a(n) _____.

28. What is the height of a wave when it breaks?

Directed Reading *continued*

29. What effect do breakers have on ocean sediments?

30. What three factors determine the size and force of breakers?

31. What happens to a breaker if the slope of the ocean floor is steep?

32. What happens to a breaker if the slope of the ocean floor is gentle?

33. The process by which ocean waves bend toward the coastline as they come near shallow water is called _____.

34. What causes wave refraction?

35. An irregular current caused when the water of breaking waves is pulled back into deeper water by gravity is called a(n) _____.

36. Where can a normally weak undertow create problems for swimmers?

37. What causes rip currents to form?

38. How can a rip current be detected?

39. A current that forms when waves approach the beach at an angle is called a(n) _____.

40. Longshore currents flow _____ to the shore.

41. Explain how a sandbar forms.

_____

_____

_____

TSUNAMIS

_____ **42.** Which of the following is the most common cause of tsunamis?
- **a.** the wind
- **b.** volcanic eruptions
- **c.** underwater landslides
- **d.** earthquakes on the ocean floor

_____ **43.** Why is it incorrect to call a tsunami a tidal wave?
- **a.** because a tsunami is caused by earthquakes on land
- **b.** because a tsunami is not caused by tides
- **c.** because a tsunami is not a wave
- **d.** because a tsunami is not destructive

_____ **44.** The wave height of a tsunami in deep water is usually
- **a.** 100 m.
- **b.** 890 km.
- **c.** less than 1 m.
- **d.** 500 km.

_____ **45.** The wavelength of a tsunami in deep water may be as long as
- **a.** 91 m.
- **b.** 9 m.
- **c.** 2 km.
- **d.** 500 km.

_____ **46.** A tsunami has a huge amount of energy because of
- **a.** its great depth.
- **b.** its long wavelength.
- **c.** its trough.
- **d.** its low speed.

_____ **47.** Which of the following may signal the approach of a tsunami when its trough arrives before the crest?

a. The water level on shore rises quickly.
b. The water on the shore pulls back suddenly.
c. Waves of 9 to 12 m hit shore.
d. Low waves break on shore.

_____ **48.** Which of the following was NOT affected by the tsunami triggered by an earthquake in Chile in 1960?

a. the coast of South America
b. Hawaii
c. New York
d. Japan

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Tides

1. The periodic rise and fall of the water level in the oceans is called _____.

2. The period when the water level is highest is called _____.

3. The period when the water level is lowest is called _____.

THE CAUSES OF TIDES

4. According to Newton's law of gravitation, what causes tides?

_____

_____

5. Why does the ocean on the side of Earth facing the moon bulge slightly?

_____

_____

6. When tidal bulge occurs, what is caused in the area of the bulge?

_____

_____

7. Why does a tidal bulge form on the opposite side of Earth?

_____

_____

8. What causes low tides?

_____

_____

BEHAVIOR OF TIDES

_____ **9.** How long does it take for all areas of the ocean to pass under the moon?

a. 24 h
b. 29 h
c. 24 h 50 min
d. 29 days

_____ **10.** Most places in the ocean have two high tides and two low tides daily because
- **a.** there is a tidal range.
- **b.** there are two tidal bulges.
- **c.** the moon rises about 50 min later each day.
- **d.** the tidal range varies from place to place.

_____ **11.** What is the difference in levels of ocean water at high tide and low tide called?
- **a.** low tide
- **b.** tidal bulge
- **c.** tidal range
- **d.** high tide

_____ **12.** A tide that results when the gravitational pull of the sun and moon combine to create higher high tides and lower low tides is called a
- **a.** neap tide.
- **b.** tidal range.
- **c.** spring tide.
- **d.** new moon.

_____ **13.** When do spring tides occur?
- **a.** in March and April
- **b.** every two months
- **c.** between the full moon and new moon
- **d.** twice each month

_____ **14.** A tide that occurs when the gravity of the sun and the moon work against each other and create a small daily tidal range is called a
- **a.** tidal range.
- **b.** spring tide.
- **c.** neap tide.
- **d.** full moon.

TIDAL VARIATIONS

15. Name four features of the ocean basin that influence tidal patterns in the basin.

_____

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **16.** Gulf of Mexico coast

_____ **17.** Pacific Coast

_____ **18.** Atlantic Coast of the United States

a. experiences a mixed tidal pattern featuring a very high tide followed by a very low tide

b. experiences two high tides and two low tides each day

c. experiences one high tide and one low tide each day

19. The slow, rocking motion of ocean water caused by tidal bulges moving around the ocean basins is called _____.

20. Where is it difficult to see the effects of tidal oscillations?

21. Explain why the Baltic and Mediterranean Seas have a very small tidal range.

22. Where might tidal oscillations amplify the effects of tidal bulges?

TIDAL CURRENTS

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **23.** slack water

_____ **24.** ebb tide

_____ **25.** tidal current

_____ **26.** tidal bore

_____ **27.** flood tide

a. the movement of water toward and away from the coast

b. time period between flood tide and ebb tide

c. flow of tidal current toward the coast

d. surge of tidal water upstream in a river that enters the ocean through a long bay

e. flow of tidal current toward the ocean

28. Where are tidal currents strongest?

_____

_____

_____

29. Tidal currents in bays and other narrow coastlines may reach speeds of _____.

30. The tidal bores in the River Severn in England reach as far as _____ inland.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Characteristics of the Atmosphere

1. Define *atmosphere*.

_____

_____

2. Describe two important functions served by Earth's atmosphere.

_____

_____

_____

COMPOSITION OF THE ATMOSPHERE

_____ **3.** The most abundant elements in air include all of the following gases EXCEPT
- **a.** oxygen.
- **b.** hydrogen.
- **c.** nitrogen.
- **d.** argon.

_____ **4.** The composition of air is approximately the same all over Earth up to an altitude of about
- **a.** 40 km.
- **b.** 60 km.
- **c.** 80 km
- **d.** 100 km.

_____ **5.** The two most abundant compounds in air are the gases carbon dioxide and
- **a.** carbon monoxide.
- **b.** smog.
- **c.** water vapor.
- **d.** hydrocarbons.

_____ **6.** In addition to containing gaseous elements and compounds, the atmosphere carries various kinds of tiny solid particles such as dust and
- **a.** pollution.
- **b.** pollen.
- **c.** insects.
- **d.** rocks.

_____ **7.** How much of Earth's atmosphere is composed of nitrogen?
- **a.** 26%
- **b.** 78%
- **c.** 52%
- **d.** 87%

_____ **8.** The process by which nitrogen moves from air to the soil and then to plants and animals and eventually returns to the air is called the
- **a.** life cycle.
- **b.** atmospheric cycle.
- **c.** earth cycle.
- **d.** nitrogen cycle.

_____ **9.** Nitrogen is removed from the air primarily by
- **a.** salt water.
- **b.** airborne bacteria.
- **c.** nitrogen-fixing bacteria.
- **d.** evaporation.

10. Describe the four steps of the nitrogen cycle.

11. What percentage of Earth's atmosphere is made up of oxygen?

12. Identify six ways oxygen is removed from the atmosphere.

Directed Reading *continued*

13. Explain how oxygen is returned to the atmosphere.

14. Is the current oxygen content of the atmosphere lower, higher, or about the same as it was millions of years ago? Explain your answer.

15. As water evaporates from oceans, lakes, streams, and soil, it enters air as _____.

16. What is the life process by which plants and animals give off water vapor?

17. How is water vapor removed as it enters the atmosphere?

18. What are three factors that affect the percentage of water vapor in the air?

19. What percentage of water is in dry air?

20. What percentage of water is in moist air?

21. What is ozone? How does it differ from oxygen?

22. What purpose does the ozone layer serve?

23. Describe the effect of chlorofluorocarbons (CFCs) on the ozone layer.

24. What are particulates?

25. List seven different particulates.

26. Describe four common sources of particulates.

27. How do large particles in the atmosphere differ from small particles?

_____

_____

_____

ATMOSPHERIC PRESSURE

_____ **28.** What holds the gases of the atmosphere near Earth's surface?
- **a.** molecules
- **b.** air
- **c.** gravity
- **d.** pressure

_____ **29.** The pressure exerted on a surface by the atmosphere is called
- **a.** water pressure.
- **b.** gravitational pressure.
- **c.** surface pressure.
- **d.** atmospheric pressure.

_____ **30.** The pressure of the atmosphere is exerted
- **a.** unequally in all directions.
- **b.** equally in all directions.
- **c.** unequally sideways.
- **d.** unequally up and down.

_____ **31.** How much of the total mass of the atmosphere does gravity keep within 32 km of Earth's surface?
- **a.** 1%
- **b.** 32%
- **c.** 99%
- **d.** 78%

_____ **32.** Because the pull of gravity is not as strong at higher altitudes, the air molecules there are farther apart and exert
- **a.** less pressure.
- **b.** more pressure.
- **c.** the same pressure.
- **d.** no pressure.

_____ **33.** It can be said that atmospheric pressure decreases as altitude
- **a.** decreases.
- **b.** disappears.
- **c.** increases.
- **d.** remains the same.

34. Besides altitude, what are two other factors that cause atmospheric pressure to change?

35. In general, what happens to atmospheric pressure at sea level when the temperature increases?

36. Why is air that contains a lot of water vapor less dense than drier air?

37. What three units do meteorologists use to measure atmospheric pressure?

MEASURING ATMOSPHERIC PRESSURE

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **38.** standard atmospheric pressure

_____ **39.** barometer

_____ **40.** mercurial barometer

_____ **41.** aneroid barometer

_____ **42.** altimeter

a. instrument that measures atmospheric pressure using a column of liquid mercury

b. instrument that measures atmospheric pressure; changes in atmospheric pressure cause the sides of a sealed metal container to bend inward or bulge out

c. an instrument used to measure atmospheric pressure

d. an aneroid barometer that registers altitude above sea level rather than air pressure

e. 1 atmosphere; the average atmospheric pressure at sea level, equalling 760 mm of mercury or 1,000 millibars

43. In Earth's atmosphere, what causes the distinctive pattern of temperature changes with increasing altitude?

LAYERS OF THE ATMOSPHERE

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **44.** troposphere

_____ **45.** tropopause

_____ **46.** stratosphere

_____ **47.** stratopause

_____ **48.** mesophere

_____ **49.** mesopause

_____ **50.** thermosphere

_____ **51.** ionosphere

_____ **52.** auroras

_____ **53.** exosphere

a. the layer of atmosphere between the troposphere and the mesosphere, in which temperature increases as altitude increases

b. the uppermost layer of atmosphere, in which temperature increases as altitude increases

c. upper boundary of the stratosphere

d. the upper boundary of the troposphere

e. upper boundary of the mesosphere

f. the coldest layer of the atmosphere, between the stratosphere and the thermosphere, in which temperature decreases as altitude increases

g. the lowest layer of the atmosphere, in which temperature drops at a constant rate as altitude increases

h. the region above the ionosphere, where Earth's atmosphere blends into the almost complete vacuum of space

i. phenomena caused by interactions between solar radiation and the ionosphere

j. the lower region of the thermosphere

54. Explain why the temperature in the troposphere decreases as altitude increases.

55. Why does temperature begin to increase in the upper stratosphere?

56. Explain why the temperature in the thermosphere steadily rises.

TEMPERATURE INVERSIONS

57. What is an air pollutant?

58. How do fossil fuels cause air pollution?

59. What is a temperature inversion?

60. What is smog?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Solar Energy and the Atmosphere

1. How is Earth's atmosphere heated?

_____

_____

2. Name the two primary sources of heat in the atmosphere.

_____

_____

_____

RADIATION

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **3.** radiation

_____ **4.** wavelength

_____ **5.** electromagnetic waves

_____ **6.** electromagnetic spectrum

a. the waves that make up all forms of radiation

b. the distance from any point on a wave to the identical point on the next wave

c. all of the frequencies or wavelengths of electromagnetic radiation

d. all forms of energy that travel through space as waves, including the energy that Earth receives from the sun

7. What form of radiation can humans see?

_____

8. What are three forms of radiation that humans cannot see?

_____

_____

_____

9. How fast do waves of radiation travel through space?

_____

10. How are the wavelengths of visible light seen?

_____

11. Which wavelengths are shorter than visible light? Which are longer?

_____

_____

_____

_____

_____

_____

THE ATMOSPHERE AND SOLAR RADIATION

_____ **12.** Almost all radiation that has a wavelength shorter than the wavelengths of visible light is absorbed by the
- **a.** lower atmosphere.
- **b.** thermosphere.
- **c.** upper atmosphere.
- **d.** stratosphere.

_____ **13.** X rays, gamma rays, and ultraviolet rays are absorbed by molecules of nitrogen and oxygen in the mesosphere and
- **a.** lower atmosphere.
- **b.** thermosphere.
- **c.** upper atmosphere.
- **d.** stratosphere.

_____ **14.** Ultraviolet rays are absorbed and act upon oxygen molecules to form ozone in the
- **a.** lower atmosphere.
- **b.** thermosphere.
- **c.** upper atmosphere.
- **d.** stratosphere.

_____ **15.** Solar rays with longer wavelengths, such as visible and infrared waves, reach the
- **a.** lower atmosphere.
- **b.** thermosphere.
- **c.** upper atmosphere.
- **d.** stratosphere.

16. Most incoming infrared radiation is absorbed by carbon dioxide, water vapor, and other complex molecules in the _____.

Directed Reading *continued*

17. How much of the radiation from visible light waves is absorbed as they pass through the atmosphere?

18. What causes scattering?

19. What happens when particles and gas molecules in the atmosphere reflect and bend solar rays?

20. What does scattering do to solar rays that are traveling to Earth?

21. What effect does scattering have on the sky's appearance?

22. What happens to solar energy that reaches Earth's surface?

23. What are eight characteristics on which the amount of energy that is absorbed or reflected by Earth's surface depends?

24. What is the fraction of solar radiation that is reflected off a particular surface called?

25. What is Earth's albedo? Explain your answer.

ABSORPTION AND INFRARED ENERGY

_____ **26.** Solar radiation that is not reflected is
- **a.** absorbed.
- **b.** scattered.
- **c.** radiated.
- **d.** dissipated.

_____ **27.** When Earth's surface absorbs solar radiation, the surface materials are heated by
- **a.** longer-wavelength infrared rays and ultraviolet light.
- **b.** short-wavelength infrared rays and visible light.
- **c.** short-wavelength microwaves and infrared light.
- **d.** longer-wavelength microwaves and ultraviolet light.

_____ **28.** Heated materials on Earth's surface convert energy into infrared rays of longer wavelengths and
- **a.** reabsorb energy as infrared waves.
- **b.** reabsorb energy as radio waves.
- **c.** reemit energy as infrared rays.
- **d.** reemit energy as radio waves.

29. What happens to the infrared rays that are reemitted into the atmosphere?

30. What does the absorption of thermal energy from the ground do to Earth's surface?

31. Warm air near Earth's surface sometimes bends light rays to cause an effect called a _____.

32. One process that helps heat Earth's atmosphere that is similar to the process that heats a greenhouse is called the _____.

33. The warming of the surface and lower atmosphere of Earth that occurs when carbon dioxide, water vapor, and other gases in the air absorb and reradiate infrared radiation is called the _____.

34. How does the amount of solar energy that enters Earth's atmosphere generally compare to the amount that escapes into space?

35. What is one human activity that may have caused the average temperature of the atmosphere to increase in recent years?

VARIATIONS IN TEMPERATURE

_____ **36.** What is the primary factor that affects how much solar energy reaches any point on Earth's surface?
- **a.** surface features
- **b.** time of year
- **c.** latitude
- **d.** time of day

_____ **37.** Near the equator, the rays of the sun strike the ground at an angle of about
- **a.** 90%.
- **b.** 45%.
- **c.** 60%.
- **d.** 10%.

_____ **38.** Temperatures are higher at the equator because
- **a.** solar energy is spread out over a larger area.
- **b.** solar energy is concentrated in a small area.
- **c.** clouds hold in the solar energy.
- **d.** more solar energy is reflected into space.

_____ **39.** Seasonal variations in temperature occur because of
- **a.** the changing distance between Earth and the sun.
- **b.** the speed of Earth's rotation.
- **c.** the tilt of Earth's axis.
- **d.** the variations in the sun's energy.

_____ **40.** Why does the amount of water in the air affect the temperature of a region?
- **a.** Water vapor reflects sunlight.
- **b.** Water vapor cools the air.
- **c.** Water vapor creates clouds.
- **d.** Water vapor stores heat.

_____ **41.** Which regions will generally have more moderate temperatures?
- **a.** regions in which winds blow from the land
- **b.** regions receiving ocean winds
- **c.** regions receiving high winds
- **d.** regions receiving little rain

42. Why are the warmest hours of the day usually mid- to late afternoon?

43. What happens to the energy when sunlight hits Earth at an angle smaller than 90°?

44. Why are average temperatures higher at the equator than near the poles?

45. Why does the Northern Hemisphere have higher temperatures for one part of the year and lower temperatures the rest?

46. Why does the amount of water in the air affect the temperature of a region?

47. Why do areas of high elevation become warm during the day and cool quickly at night?

48. Why do desert temperatures vary widely between day and night?

49. Why are land areas close to large bodies of water generally cooler during the day and warmer at night than similar inland areas?

CONDUCTION

_____ **50.** As they become heated, molecules in a substance
- **a.** move at the same rate as when they are cooled.
- **b.** move faster.
- **c.** move more slowly.
- **d.** do not move at all.

_____ **51.** What effect do collisions between molecules have on the molecules?
- **a.** It changes their structure.
- **b.** It breaks them apart.
- **c.** It cools them.
- **d.** It warms them.

_____ **52.** The transfer of energy as heat from one substance to another by direct contact is called
- **a.** conduction.
- **b.** collision.
- **c.** firing.
- **d.** baking.

_____ **53.** Solid substances are good conductors because
- **a.** molecules are close together.
- **b.** molecules are far apart.
- **c.** molecules cannot collide.
- **d.** molecules move slowly.

_____ **54.** Air is a poor conductor because
- **a.** molecules are close together.
- **b.** molecules are far apart.
- **c.** molecules cannot collide.
- **d.** molecules move slowly.

_____ **55.** Conduction heats only the lowest few centimeters of the atmosphere because
- **a.** air does not come into direct contact with Earth.
- **b.** air comes into direct contact with Earth.
- **c.** molecules of air in the lower atmosphere are closer together.
- **d.** molecules in the upper atmosphere do not collide.

CONVECTION

56. What is the primary cause of the heating of the lower atmosphere?

57. The movement of matter due to differences in density caused by temperature variations resulting in the transfer of heat is called _____.

58. When does convection occur?

59. What happens to air heated by radiation or conduction?

60. How is Earth's atmosphere warmed evenly?

61. Why is the atmospheric pressure lower beneath a mass of warm air?

62. Explain how atmospheric pressure differences create winds.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Atmospheric Circulation

1. What causes the movement of air worldwide?

_____

_____

2. In what pattern does air near Earth's surface generally flow?

_____

_____

3. Why does air near Earth's surface flow from the poles to the equator?

_____

_____

4. Where do high pressure regions form?

_____

_____

5. Where do low-pressure regions form?

_____

_____

THE CORIOLIS EFFECT

_____ **6.** The circulation of the atmosphere and of the oceans is affected by
- **a.** the rotation of Earth at the equator.
- **b.** the rotation of Earth on its axis.
- **c.** the rotation of the moon on its axis.
- **d.** seasonal storms.

_____ **7.** Earth's rotation causes its diameter to be
- **a.** greatest through the equator.
- **b.** greatest through the poles.
- **c.** equal through the equator and the poles.
- **d.** greater at the North Pole than at the South Pole.

8. Do points near the equator or points near the poles travel farther and faster in a day?

9. Why does air follow a curved path?

10. The curving of the path of a moving object from an otherwise straight path due to earth's rotation is called the _____.

11. What impact does the Coriolis effect have on the winds?

12. What determines the path along which the Coriolis effect deflects moving objects?

13. In which direction does the Coriolis effect deflect moving objects in the Northern Hemisphere? In the Southern Hemisphere?

14. How does the speed of an object relate to the Coriolis effect?

15. How do the mass and travel distances of air or ocean currents relate to the Coriolis effect?

_____

_____

16. In general, on what type of objects is the Coriolis effect detectable?

_____

_____

GLOBAL WINDS

_____ **17.** What are the three looping patterns of air flow in each hemisphere called?
- **a.** wind belts
- **b.** convection cells
- **c.** prevailing winds
- **d.** global air flow

_____ **18.** A wind belt is characterized by prevailing winds that
- **a.** flow in one main direction.
- **b.** flow from the southwest.
- **c.** flow from the northeast.
- **d.** flow in all directions.

_____ **19.** The prevailing winds that blow from east to west from 30° latitude to the equator in both hemispheres are called the
- **a.** trade winds.
- **b.** polar easterlies.
- **c.** wind belts.
- **d.** westerlies.

_____ **20.** In the Northern Hemisphere, trade winds flow from the
- **a.** southeast.
- **b.** south.
- **c.** northeast.
- **d.** northwest.

_____ **21.** From what direction do trade winds flow in the Southern Hemisphere?
- **a.** the northeast
- **b.** the southeast
- **c.** the north
- **d.** the southwest

_____ **22.** The prevailing winds that blow from west to east through the contiguous United States are the
- **a.** trade winds.
- **b.** doldrums.
- **c.** polar easterlies.
- **d.** westerlies.

_____ **23.** What are the prevailing winds that blow from east to west between 60° and 90° in both hemispheres?
- **a.** the westerlies
- **b.** the polar easterlies
- **c.** wind belts
- **d.** the trade winds

_____ **24.** A stormy region created where the polar easterlies meet warm air from the westerlies is called a
- **a.** trade wind.
- **b.** doldrum.
- **c.** front.
- **d.** wind belt.

_____ **25.** The sun's rays shift northward and southward during the changing seasons of the year causing a shift in the position of
- **a.** convection zones and horse latitudes.
- **b.** fronts and trade winds.
- **c.** pressure belts and wind belts.
- **d.** convection zones and pressure belts.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **26.** doldrums

_____ **27.** horse latitudes

_____ **28.** jet streams

_____ **29.** subtropical jet streams

_____ **30.** polar jet streams

- **a.** narrow bands of winds formed when warm equatorial air meets the cooler air of the middle latitudes
- **b.** narrow bands of strong winds that blow in the upper troposphere
- **c.** bands of winds formed as a result of density differences between cold polar air and warmer air of the middle latitudes
- **d.** subtropical high-pressure zones with weak and variable winds
- **e.** a zone of low pressure at the equator where the trade wind systems meet

LOCAL WINDS

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

valley breeze	breezes	sea breeze
land breeze	mountain breeze	local winds

31. Air movement influenced by local conditions and local temperature variations often cause _____, which are not part of the global wind belts.

32. Gentle winds that extend over distances of less than 100 km are called _____.

33. As warm air above land rises and cool air from above water moves in to replace it, a cool wind moving from water to land, called a _____, forms in the afternoon.

34. Overnight, the land offshore cools more rapidly than the water does, and a sea breeze is replaced by a _____, which flows from the cool land toward the warmer water.

35. During the day in mountainous regions, a gentle breeze called a _____ forms when warm air from the valleys moves upslope.

36. At night in the mountains, cool air descends from the peaks to the valleys, creating a _____.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Atmospheric Moisture

1. The states in which water exists in the atmosphere are called _____.

2. The gas phase of water is called _____.

3. The solid phase of water is called _____.

4. The liquid phase of water is called _____.

CHANGING FORMS OF WATER

_____ **5.** When does water change from one phase to another?
- **a.** when water molecules are held stationary
- **b.** when evaporation occurs
- **c.** when heat energy is absorbed or released
- **d.** when molecules are in a crystalline arrangement

_____ **6.** When ice absorbs energy, the molecules of ice
- **a.** move more quickly.
- **b.** become stationary.
- **c.** become crystals.
- **d.** slow down.

_____ **7.** What phase does ice change into when it absorbs energy?
- **a.** gas
- **b.** liquid
- **c.** crystals
- **d.** solid

_____ **8.** When liquid water absorbs energy, it changes to
- **a.** a gas.
- **b.** a liquid.
- **c.** crystals.
- **d.** a solid.

_____ **9.** What happens to the water molecules when the water absorbs energy?
- **a.** They move closer together.
- **b.** They collide more frequently.
- **c.** They become stationary.
- **d.** They move more slowly.

_____ **10.** The process in which the fastest-moving molecules escape from liquid and form invisible water is called
- **a.** condensation.
- **b.** latent heat.
- **c.** evaporation.
- **d.** collision.

_____ **11.** The name for heat energy that is absorbed or released during a phase change is
- **a.** latent heat.
- **b.** evaporation.
- **c.** water vapor.
- **d.** potential energy.

_____ **12.** When liquid water evaporates, the water
- **a.** releases energy into the atmosphere.
- **b.** condenses into water vapor.
- **c.** starts to flow more rapidly.
- **d.** absorbs energy from the environment.

_____ **13.** What happens to energy absorbed by water during evaporation?
- **a.** It condenses to form a liquid.
- **b.** It melts ice.
- **c.** It is reflected into the atmosphere.
- **d.** It becomes potential energy between water molecules.

_____ **14.** The name for the process in which water vapor changes back into a liquid is
- **a.** condensation.
- **b.** latent heat.
- **c.** collision.
- **d.** evaporation.

_____ **15.** During the condensation of water, latent heat
- **a.** is released into the water.
- **b.** disappears.
- **c.** is released into the surrounding air.
- **d.** is absorbed by the water.

_____ **16.** What happens to latent heat when ice thaws?
- **a.** It is released.
- **b.** It is absorbed.
- **c.** It is recycled.
- **d.** It is lost.

_____ **17.** When water freezes, latent heat
- **a.** condenses.
- **b.** is released into the air.
- **c.** evaporates.
- **d.** is absorbed.

_____ **18.** Through what process does most water enter the atmosphere?
- **a.** evaporation
- **b.** absorption
- **c.** condensation
- **d.** release

19. Where on Earth does most evaporation take place?

_____

_____

20. Name four other important sources of water vapor in the atmosphere.

_____

_____

_____

_____

21. How are plants, volcanoes, and burning fuels related to water vapor in the atmosphere?

_____

_____

22. What usually happens to ice before it changes into a gas?

_____

23. What is the name of the process in which a solid changes directly into a gas?

_____

24. Under what conditions might sublimation of snow and ice occur?

_____

_____

25. Water vapor can turn directly into ice without becoming a(n)

_____.

HUMIDITY

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **26.** humidity

_____ **27.** dew point

_____ **28.** absolute humidity

_____ **29.** mixing ratio

a. the temperature at which condensation equals evaporation

b. water vapor in the atmosphere

c. the mass of water vapor contained in a given volume of air

d. the mass of water vapor in a unit of air relative to the mass of the dry air

30. What controls humidity?

_____

31. What determines the rate of evaporation?

_____

32. What happens to the rate of evaporation as the temperature gets higher?

_____

33. What determines the rate of condensation?

_____

34. The part of the total atmospheric pressure that is caused by water vapor is _____.

35. When there is equilibrium between the rate of evaporation and the rate of condensation, the air is _____.

36. The measure of the actual amount of water vapor in the air is called the _____.

37. What equation is used to calculate the absolute humidity?

_____

38. Why do meteorologists prefer to describe humidity by using the mixing ratio of air?

_____

_____

39. What is the mixing ratio of air that has 18 g of water vapor in 1 kg of air?

_____

40. What is a common mixing ratio for air in polar regions?

41. Why is the mixing ratio not affected by changes in temperature or pressure?

42. The ratio of the actual water vapor content of the air to the amount of water vapor needed to reach saturation is called

_____.

43. If a person wanted to know how close the air is to reaching the dew point, he or she would calculate the _____.

44. At what point does air become saturated at 25°C?

45. How would you express the relative humidity of air that is 25°C and contains 5 g of water?

46. What can make the relative humidity change even if the temperature does not change?

47. What can make the relative humidity increase if the moisture in the air remains the same?

48. What happens to the relative humidity if the temperature increases as the moisture in the air remains constant?

49. What can cause air to cool to its dew point?

50. What is the name of the condensation that forms during the night?

51. What causes dew to form?

52. Under what conditions is dew most likely to form?

_____

53. What is the form of condensation that forms if the dew point falls below the freezing temperature of water?

_____

54. What is the difference between frost and frozen dew?

_____

_____

MEASURING HUMIDITY

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **55.** dew cell

_____ **56.** electrical conductance

_____ **57.** psychrometer

a. an instrument used to measure relative humidity consisting of two identical thermometers

b. the ability to conduct electricity

c. an instrument used to measure humidity consisting of a heater and two electrodes

58. Why do meteorologists measure humidity?

_____

59. What happens when the lithium chloride in a dew cell absorbs water from the air?

_____

_____

60. What happens as the water evaporates from the LiCl?

_____

_____

61. The temperature at which the LiCl in a dew cell loses its ability to conduct electricity is the _____.

62. What is the difference between the two thermometers of a psychrometer?

_____

_____

63. What happens to the wet bulb-thermometer when the psychrometer is whirled through the air?

64. How does the temperature of the wet-bulb thermometer differ from that of the dry-bulb thermometer after the psychrometer is whirled through the air?

65. What would you use to calculate the relative humidity from a psychrometer?

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **66.** hair hygrometer

_____ **67.** radiosonde

_____ **68.** electric hygrometer

a. an instrument that measures humidity at high altitudes

b. an instrument that measures relative humidity by using a bundle of hairs

c. a package that carries instruments into the atmosphere

69. As relative humidity increases, what happens to hair?

70. What is a disadvantage of using a hair hygrometer?

71. How does an electric hygrometer work?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Clouds and Fog

1. A collection of small water droplets or ice crystals falling slowly through the air is a(n) _____.

2. The crystals or droplets that make up clouds form when condensation occurs more quickly than the process of _____.

3. A cloud that forms near or on Earth's surface is _____.

CLOUD FORMATION

_____ **4.** What must be available for water vapor to condense and form a cloud?
- **a.** a solid surface
- **b.** empty space
- **c.** high winds
- **d.** a body of water

_____ **5.** The lowest layer of the atmosphere is the
- **a.** stratosphere.
- **b.** ionosphere.
- **c.** troposphere.
- **d.** thermosphere.

_____ **6.** What is present in the troposphere that is essential for cloud formation?
- **a.** a large solid surface
- **b.** large particles
- **c.** stationary dust surfaces
- **d.** tiny suspended particles

_____ **7.** Suspended particles that provide a surface for water vapor to condense are called
- **a.** water molecules.
- **b.** salt molecules.
- **c.** condensation nuclei.
- **d.** saturated air.

_____ **8.** What happens when water molecules collect on condensation nuclei?
- **a.** The rate of condensation decreases.
- **b.** Water droplets form.
- **c.** The air temperature reaches the dew point.
- **d.** The rate of evaporation decreases.

_____ **9.** What condition must the air be in for clouds to form?
- **a.** It must not be saturated with water vapor.
- **b.** It must have a low relative humidity.
- **c.** The rate of evaporation must be higher than the rate of condensation.
- **d.** The rate of condensation must be higher than the rate of evaporation.

_____ **10.** The net condensation that forms clouds may be caused by
- **a.** the warming of air.
- **b.** the cooling of air.
- **c.** rapid evaporation of air.
- **d.** constant air temperature.

ADIABATIC COOLING

_____ **11.** What happens to molecules in rising air?
- **a.** They move closer together.
- **b.** They move farther apart.
- **c.** They do not move.
- **d.** They have more collisions.

_____ **12.** What occurs in adiabatic cooling?
- **a.** Two bodies of moist air mix and change the air temperature.
- **b.** The temperature of an air mass decreases as the air rises.
- **c.** Air rises on a mountain and cools.
- **d.** Air moves over a warm surface and cools.

_____ **13.** What does the adiabatic lapse rate describe?
- **a.** the temperature of a rising or sinking parcel of air
- **b.** the amount the temperature of rising or sinking air changes
- **c.** the amount of clouds in rising or sinking air
- **d.** the rate at which the temperature of rising or sinking air changes

_____ **14.** What is the adiabatic lapse rate of clear air?
- **a.** 1°C for every 100 m that air rises
- **b.** 1°C for every 1000 m that air rises
- **c.** -1°C for every 100 m that air rises
- **d.** -0.5°C for every 100 m that air rises

_____ **15.** What is the average adiabatic lapse rate of cloudy air?
- **a.** more than 1°C per 100 m that air rises
- **b.** -1°C per 100 m that air rises
- **c.** between 0.5°C and 0.9°C per 100 m that air rises
- **d.** between -0.5°C and -0.9°C per 100 m that air rises

16. Why does cloudy air have a slower rate of cooling than clear air?

17. What two things happen to the energy from the sun when it reaches Earth's surface?

18. Describe what happens to air near Earth's surface.

19. What is the name of the altitude where net condensation begins to form clouds.

MIXING

20. How does the mixing of two bodies of moist air with different temperatures cause clouds to form?

LIFTING

21. What are the results of air being forced upward?

22. What kind of terrain may force air upward?

23. How do large clouds associated with storm systems form?

ADVECTIVE COOLING

24. What is the name of the process in which the temperature of an air mass decreases as it moves over a cold surface, such as cold ocean or land?

25. What happens when an air mass moves over a surface colder than the air is?

26. What must happen in order for air cooled by adiabatic cooling, mixing, lifting, or advective cooling to form clouds?

CLASSIFICATION OF CLOUDS

27. What two features are used to classify clouds?

28. Name the three basic forms of clouds.

29. What are the three altitude groups of clouds and their heights?

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **30.** stratus clouds

_____ **31.** altostratus clouds

_____ **32.** cumulus clouds

_____ **33.** cumulonimbus clouds

_____ **34.** cirrus clouds

_____ **35.** cirrostratus clouds

a. feathery clouds composed of ice crystals

b. middle-altitude clouds that usually produce little precipitation

c. high, dark storm clouds

d. clouds that form a high, transparent veil

e. billowy, low-altitude clouds

f. clouds with a flat base forming at very low altitudes

36. Clouds that form where a layer of warm, moist air lies above a layer of cool air are called _____.

37. What do the prefix *nimbo-* and the suffix *–nimbus* mean?

_____

38. How do nimbostratus clouds differ from other stratus clouds?

_____

39. What does *cumulus* mean?

_____

40. What does the characteristic flat base of cumulus clouds represent?

_____

41. On what two factors does the height of a cumulus cloud depend?

_____

_____

42. In what kind of weather do cumulus clouds grow highest?

_____

43. What are cumulus clouds at middle altitudes called?

_____

44. Name the low clouds that are a combination of two kinds of clouds.

_____

45. What do *cirrus* and *cirro-* mean?

_____

46. At what altitude do cirrus clouds form?

_____

47. Why does light easily pass through cirrus clouds?

_____

48. What kind of clouds often appear before a snowfall or rainfall?

_____

_____

FOG

49. Compare and contrast fog and clouds.

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **50.** radiation fog

_____ **51.** advection fog

_____ **52.** upslope fog

_____ **53.** steam fog

a. forms when cool air moves over an inland warm body of water

b. forms due to the loss of heat by radiation when Earth cools at night

c. forms when warm, moist air from above water moves over a cold surface

d. forms when air rises along land slopes

54. Why is radiation fog thickest in valleys and other low places?

_____

_____

55. Why is radiation fog often thick around cities?

_____

_____

56. Where is advection fog common?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Precipitation

1. Any form of water that falls to Earth's surface from the clouds is called _____.

2. Name four major types of moisture that fall from the air to Earth.

_____

_____

_____

_____

FORMS OF PRECIPITATION

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **3.** rain

_____ **4.** drizzle

_____ **5.** snow

_____ **6.** sleet

_____ **7.** glaze ice

_____ **8.** ice storm

_____ **9.** hail

a. precipitation consisting of ice particles

b. solid precipitation in the form of lumps of ice

c. a thick layer of ice on a surface

d. clear ice pellets formed when rain falls through a layer of freezing air

e. liquid precipitation

f. rain consisting of drops smaller than 0.5 mm in diameter

g. the condition which produces glaze ice

10. What is the size of normal raindrops?

_____

11. What is the most common form of solid precipitation?

_____

12. What are three forms in which snow may fall?

_____

_____

_____

13. How do snowflakes change in size as the temperature goes below 0°C?

_____

14. In what kind of clouds does hail usually form?

_____

15. What process causes hail to form and fall to the ground?

_____

_____

_____

16. Why is hail potentially harmful?

_____

CAUSES OF PRECIPITATION

_____ **17.** The diameter of most cloud droplets is about
- **a.** 5 millimeters.
- **b.** 20 micrometers.
- **c.** 100 micrometers.
- **d.** 20 millimeters.

_____ **18.** What must happen in order for a cloud droplet to fall as precipitation?
- **a.** It must freeze.
- **b.** It must decrease in size.
- **c.** It must increase in size.
- **d.** It must warm up.

_____ **19.** What two processes cause cloud droplets to fall to Earth?
- **a.** coalescence and ultracooling
- **b.** coagulation and supercooling
- **c.** coalescence and supercooling
- **d.** coagulation and superwarming

_____ **20.** What happens in the process of coalescence?
- **a.** Small droplets slow down as they fall.
- **b.** Small droplets combine to form larger droplets.
- **c.** Small droplets break up into smaller droplets.
- **d.** Large droplets divide into smaller droplets.

_____ **21.** During supercooling, a substance becomes extremely cold and
- **a.** changes to a solid.
- **b.** changes to a gas.
- **c.** changes to a liquid.
- **d.** does not change its state.

_____ **22.** What is NOT true of freezing nuclei?
- **a.** They are a form of precipitation.
- **b.** They are suspended in the air.
- **c.** They are solid particles.
- **d.** They are similar to ice in structure.

_____ **23.** Why don't supercooled water droplets freeze?
- **a.** They are too cold.
- **b.** They are too large.
- **c.** There are not enough freezing nuclei available.
- **d.** There are too many solid particles in the air.

_____ **24.** What does water vapor from supercooled water droplets do?
- **a.** It condenses on ice crystals that have formed on freezing nuclei.
- **b.** It evaporates from the freezing nuclei.
- **c.** Water vapor from the droplets evaporates.
- **d.** Water vapor makes ice crystals increase in size.

_____ **25.** Which of the following are created by the process of supercooling?
- **a.** drizzle and rain
- **b.** sleet and hail
- **c.** glaze ice and snow
- **d.** snow and rain

MEASURING PRECIPITATION

26. What is the name of an instrument used to measure rainfall?

_____

27. In one type of _____, a funnel fills one side of a divided bucket with 0.25 mm of rainwater, and then tips and sets off an electrical device that records the amount.

28. What instrument measures snow depth?

_____

29. About how much snow does it take to produce 1 cm of water?

_____

30. What does Doppler radar measure?

_____

31. How does Doppler radar work?

_____

_____

32. Name three things meteorologists can determine with Doppler radar.

33. How does Doppler radar save lives?

WEATHER MODIFICATION

_____ **34.** The process in which freezing or condensation nuclei are introduced into a cloud to cause rain is called
- **a.** rain seeding.
- **b.** cloud seeding.
- **c.** precipitation growing.
- **d.** nuclei dropping.

_____ **35.** Which of the following are introduced into a cloud to cause rain because they resemble ice crystals?
- **a.** snow flakes
- **b.** hail stones
- **c.** carbon monoxide pellets
- **d.** silver iodide crystals

_____ **36.** The substance used in cloud seeding to cool cloud droplets and cause ice crystals to form is
- **a.** powdered dry ice.
- **b.** sleet.
- **c.** water vapor.
- **d.** snow.

37. What are three ways in which cloud seeding materials are released?

38. Does cloud seeding cause a significant increase in precipitation?

39. What are two ways in which cloud seeding could help people?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Air Masses

Use the terms from the following list to complete the sentences below. Each term may be used only once.

high pressure	poles	low pressure
equator	wind patterns	air pressure

1. Differences in _____ are caused by unequal heating of Earth's surface.

2. The region along the _____ receives more solar energy than the polar regions do.

3. Heated equatorial air rises and creates a belt of _____.

4. Cold air near the poles sinks and creates a belt of _____.

5. Differences in air pressure at various locations on Earth create _____.

HOW AIR MOVES

_____ **6.** Air moves from
- **a.** east to west.
- **b.** west to east.
- **c.** areas of high pressure to areas of low pressure.
- **d.** areas of low pressure to areas of high pressure.

_____ **7.** There is a general world-wide movement of air from the
- **a.** poles toward the equator.
- **b.** equator toward the poles.
- **c.** Northern Hemisphere to the Southern Hemisphere.
- **d.** Southern Hemisphere to the Northern Hemisphere.

FORMATION OF AIR MASSES

8. What happens to air when the air pressure differences are small?

_____

_____

_____

9. What is an air mass?

_____

_____

_____

10. What are the characteristics of air masses that form over polar areas?

_____

11. What are the characteristics of air masses that form over tropical oceans?

_____

TYPES OF AIR MASSES

_____ **12.** Air masses are categorized according to their
- **a.** destination region.
- **b.** source region.
- **c.** polar region.
- **d.** tropical region.

_____ **13.** Cold air masses come from
- **a.** polar areas.
- **b.** tropical areas.
- **c.** equatorial areas.
- **d.** temperate areas.

_____ **14.** Warm air masses come from
- **a.** arctic areas.
- **b.** temperate areas.
- **c.** tropical areas.
- **d.** polar areas.

_____ **15.** What are air masses that form over the ocean called?
- **a.** oceanic
- **b.** maritime
- **c.** continental
- **d.** dry

_____ **16.** Air masses that form over land are called
- **a.** wet.
- **b.** maritime.
- **c.** grounded.
- **d.** continental.

Directed Reading *continued*

17. Name three large land masses over which continental air masses form.

18. What weather conditions do continental land masses generally bring when they move into a region?

19. Name and describe the two types of continental air masses.

20. How do air masses that form over the ocean differ from continental air masses?

21. What weather conditions do maritime air masses generally bring when they travel to a new location?

22. Name and describe the two types of maritime air masses.

NORTH AMERICAN AIR MASSES

23. List the four types of air masses that affect the weather of North America with their six source regions.

24. What type of weather does an air mass usually bring?

25. What may happen to an air mass as it moves away from its source region? Give an example.

26. What develops when cold, dry air turns warm and moist?

27. Describe the weather created by maritime tropical air masses that form over the tropical Atlantic Ocean.

28. How does the weather created by maritime tropical air masses that form over the tropical Pacific Ocean differ from that created by air masses that form over the tropical Atlantic?

29. Explain where continental polar air masses generally originate and move and the type of weather they bring.

30. Describe maritime polar air masses that form over the North Pacific Ocean and the type of weather they create.

31. How do continental polar Canadian air masses differ from the polar air masses that form over the North Pacific Ocean?

32. How do maritime polar Atlantic air masses differ in movement and weather creation from the maritime Pacific air masses?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Fronts

_____ **1.** When two unlike air masses meet, what usually keeps them separate?
- **a.** temperature differences
- **b.** moisture differences
- **c.** differences in density
- **d.** differences in pressure

_____ **2.** The boundary that forms between two air masses when they meet is called a
- **a.** front.
- **b.** storm line.
- **c.** squall line.
- **d.** midlatitude.

TYPES OF FRONTS

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **3.** cold front

_____ **4.** warm front

_____ **5.** stationary front

_____ **6.** occluded front

- **a.** a front of air masses that moves either very slowly or not at all
- **b.** the front edge of a moving mass of cold air that pushes beneath a warmer air mass like a wedge
- **c.** the front edge of an advancing warm air mass that replaces colder air with warmer air
- **d.** a front that forms when a cold air mass overtakes a warm air mass and lifts the warm air mass off the ground and over another air mass

7. Describe the storms that form along a cold front.

8. How does a slow-moving cold front differ from a fast-moving cold front?

9. How does a warm front form?

10. What kind of weather does a warm front generally produce?

11. Describe how a stationary front forms.

12. Compare the weather produced by a stationary front to the weather produced by a warm front.

POLAR FRONTS AND MIDLATITUDE CYCLONES

Use the terms from the following list to complete the sentences below. Each term may be used only once. Some terms may not be used.

midlatitude cyclone	warm front	anticyclone
waves	polar front	wave cyclones

13. The boundary where cold polar air meets the tropical air mass of the middle latitudes, especially over the ocean, is called the _____.

14. Bends that form in a stationary or cold fronts that are the beginnings of low-pressure storm centers are called _____.

15. Also known as midlatitude cyclones, _____ are low-pressure storm centers.

16. An area of low pressure that is characterized by rotating wind that moves toward the rising air of the central low-pressure region is called a _____.

17. Unlike the air in a midlatitude cyclone, the air of a(n) _____ sinks and flows outward from a center of high pressure.

18. Summarize the four stages of a midlatitude cyclone.

19. Describe how midlatitude cyclones travel and move in North America.

20. Describe an anticyclone.

21. What kind of weather does an anticyclone bring?

SEVERE WEATHER

22. List five weather events that are considered severe weather.

_____

_____

_____

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **23.** thunderstorm

_____ **24.** lightning

_____ **25.** mature stage

_____ **26.** dissipating stage

_____ **27.** cumulus stage

_____ **28.** thunder

a. the first stage of a thunderstorm, in which warm, moist air rises and water vapor in the air condenses to form a cumulus cloud

b. electricity that is discharged during a thunderstorm

c. an effect created when electricity heats the air, and the air expands rapidly

d. a usually brief, heavy storm that consists of rain, strong winds, lightning, and thunder

e. the third stage of a thunderstorm, in which strong downdrafts stop air currents from rising and the storm dies out as water vapor decreases

f. the second stage of a thunderstorm, in which condensation continues as the cloud rises and becomes a dark cumulonimbus cloud, perhaps producing torrential rain and hail

29. Describe how lightning forms and explain what it is.

_____

_____

_____

_____

_____

Directed Reading *continued*

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

Safir-Simpson scale	tornado	storm surge
cumulonimbus cloud bands	eyewall	eye
water vapor	hurricane	latent heat

30. A severe storm that develops over tropical oceans and whose winds of more than 120 km/h spiral in toward the intensely low-pressure storm center is called a(n) _____.

31. During a hurricane, large amounts of _____ are released, increasing the force of the rising air.

32. A fully developed hurricane consists of a series of thick _____ that spiral upward around the center of the storm.

33. Winds increase toward the calm, clear _____ of the storm and may reach speeds of 275 km/h.

34. The most dangerous aspect of a hurricane is a rising sea level and large waves, called a _____ .

35. Every hurricane is categorized on the _____ by using several factors, including central pressure, wind speed, and storm surge.

36. Define tornado.

_____

_____

_____

_____

37. Explain how a tornado forms.

_____

_____

_____

_____

_____

38. What happens when a tornado funnel touches ground?

39. When and where do most tornadoes occur?

40. What makes a tornado so destructive?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Weather Instruments

1. Name five measurements on which weather observations are based.

_____

_____

_____

_____

_____

2. How do meteorologists use these measurements?

_____

_____

MEASURING LOWER ATMOSPHERIC CONDITIONS

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **3.** thermometer

_____ **4.** electrical thermometer

_____ **5.** thermistor

_____ **6.** barometer

_____ **7.** anemometer

_____ **8.** wind vane

a. an instrument that measures atmospheric pressure

b. a thermal resistor that measures temperature and responds quickly to temperature changes

c. an instrument that measures wind speed

d. an instrument that measures and indicates temperature, often in the form of a sealed glass tube filled with mercury or alcohol

e. an instrument that determines the direction of wind with an arrow shaped device that turns freely as the tail catches the wind

f. an instrument that measures and indicates temperature using an electric current

9. Describe how an electrical thermometer works.

_____

_____

_____

10. Why do scientists use barometers to help them predict the weather?

11. Explain how an anemometer works.

MEASURING UPPER-ATMOSPHERIC CONDITIONS

12. Why do meteorologists study upper-atmospheric conditions?

13. What is a radiosonde?

14. Explain how a radiosonde works.

15. What is radar?

16. How does radar track a storm?

17. Explain what Doppler radar can tell meteorologists.

18. What important purpose do weather satellites serve?

19. How do weather satellites measure the direction and speed of the wind at the level of the clouds?

20. How do weather satellites monitor weather at night?

21. What types of marine conditions do weather satellites monitor?

22. Explain how meteorologists use supercomputers to forecast weather.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Forecasting the Weather

1. How did people of early civilizations meet the challenges of weather prediction?

2. Describe the origins of scientific weather forecasting.

GLOBAL WEATHER MONITORING

3. List seven types of weather observations reported from weather stations around the world.

4. What are three services provided by the World Meteorological Organization?

WEATHER MAPS

_____ **5.** The data that weather stations collect are transferred
- **a.** onto weather satellites.
- **b.** to weather stations.
- **c.** onto weather maps.
- **d.** to weather instruments.

_____ **6.** What do meterologists use to communicate data on a weather map that can be understood around the world?
- **a.** words and colors
- **b.** words and numbers
- **c.** symbols and letters
- **d.** symbols and colors

_____ **7.** A pattern of meteorological symbols that represents the weather at a particular observing station and that is recorded on a weather map is
- **a.** a station model.
- **b.** a station report.
- **c.** the station forecast.
- **d.** the station weather.

_____ **8.** Lines that connect points of equal temperature on a weather map are called
- **a.** isolines.
- **b.** isotherms.
- **c.** thermal lines.
- **d.** isobars.

_____ **9.** Lines on a weather map that connect points of equal atmospheric pressure are
- **a.** isopressures.
- **b.** isotherms.
- **c.** pressure lines.
- **d.** isobars.

_____ **10.** Closely spaced lines of atmospheric pressure indicate high wind speeds and
- **a.** no change in pressure.
- **b.** wet weather.
- **c.** a gradual change in pressure.
- **d.** a rapid change in pressure.

_____ **11.** Isobars that form circles on a weather map are marked with an H or an L and indicate centers of
- **a.** heat and light.
- **b.** high pressure and low pressure.
- **c.** high temperature and low temperature.
- **d.** high clouds and low clouds.

12. What do common weather symbols describe?

13. Besides cloud cover, wind speed and direction, and weather conditions, what else do stations models indicate?

14. What is the dew point and what does it indicate about the air?

15. Describe the number and the line in the upper right hand corner of the station model and explain what they show.

16. On a weather map, what identifies a front?

17. How are areas of precipitation commonly marked on weather maps?

WEATHER FORECASTS

18. How do meteorologists forecast the weather?

19. How do computers use information supplied by Doppler radar and satellite images?

20. Explain why meteorologists use more than one computer model to forecast weather.

21. What types of weather information can be predicted most accurately?

22. What types of weather information are more difficult to predict accurately?

23. Explain how meteorologists use computers to make more accurate forecasts.

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **24.** nowcasts

_____ **25.** daily forecasts

_____ **26.** extended forecasts

_____ **27.** medium-range forecasts

_____ **28.** long-range forecasts

_____ **29.** watch

_____ **30.** warning

a. predict weather accurately 3 to 7 days ahead

b. predict weather over monthly and seasonal periods

c. predict weather for a 48-hour period

d. predict weather 8 to 14 days ahead using computer analysis of slowly changing large-scale movements of air

e. issued when severe weather has been spotted or is expected within 24 hours

f. use radar and enable forecasters to focus on timing precipitation and tracking severe weather

g. issued when the conditions are ideal for severe weather

CONTROLLING THE WEATHER

31. What is cloud seeding?

32. How has cloud seeding been used in Russia?

Directed Reading *continued*

33. How have scientists attempted to control hurricanes?

34. Why have scientists abandoned storm and hurricane control?

35. How have scientists attempted to control lightning?

36. What have been the results of attempts at lightning control?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Factors That Affect Climate

1. The average weather conditions for an area over a long period of time are referred to as _____.

2. The condition of the atmosphere at a particular time, such as temperature, humidity, wind, and precipitation is called _____.

TEMPERATURE AND PRECIPITATION

_____ **3.** Climates are chiefly determined by using
- **a.** average wind velocity.
- **b.** average temperature.
- **c.** average temperature and precipitation.
- **d.** average wind velocity and precipitation.

_____ **4.** Adding the high and low temperatures of the day and dividing by two determines the average
- **a.** monthly temperature range.
- **b.** weekly temperature range.
- **c.** yearly temperature range.
- **d.** daily temperature range.

_____ **5.** Precipitation is described by using
- **a.** monthly averages.
- **b.** monthly and yearly averages.
- **c.** yearly averages and ranges.
- **d.** monthly and yearly averages and ranges.

_____ **6.** In describing climate, what is important to consider in addition to averages in precipitation and temperature?
- **a.** extremes in temperature and precipitation
- **b.** local weather conditions
- **c.** seasonal averages
- **d.** yearly fluctuations in temperature and precipitation

_____ **7.** The factors that have the greatest influence on both temperature and precipitation are heat absorption and release,
- **a.** location, and latitude.
- **b.** season, and location.
- **c.** latitude, and topography.
- **d.** season, and topography.

LATITUDE

8. One of the most important factors that determines a region's climate is _____.

9. Temperature and wind patterns are determined by _____.

10. The higher the _____ of an area is, the smaller the amount of solar energy received by the area is.

11. The sun's rays hit Earth at a 90° angle at the _____, so temperatures are high.

12. The sun's rays hit Earth at a smaller angle at the _____, so temperatures are low.

13. In the Northern Hemisphere, the northern half of Earth is tilted away from the _____ during winter.

14. In the Northern Hemisphere, how does the tilt of Earth's axis and the way the sun's rays hit an area while Earth orbits the sun affect climate?

_____

_____

15. Because Earth receives different amounts of solar energy at different latitudes, belts of cool, dense air form near the _____, while belts of warm, less dense air form at the equator.

16. Because cool air is dense, it forms regions of _____ pressure.

17. Warm air forms regions of _____ pressure.

18. Differences is air pressure create _____.

19. In the equatorial belt of low pressure called the _____, air rises and cools, and water vapor condenses, creating precipitation.

20. In regions between 20° and 30° latitude, known as the _____, air sinks, warms, and dries, so little precipitation occurs.

21. In the middle latitudes, between 45° to 60°, warm tropical air meets cold polar air, which leads to belts of _____ precipitation.

22. In high-pressure areas, above 60° latitude, air masses are dry and cold, and average precipitation is _____.

HEAT ABSORPTION AND RELEASE

23. What two factors affect the amount of solar energy that an area receives?

24. Why does land heat faster than water?

25. What does the temperature of the land or water influence?

26. What does the temperature of the air affect?

27. Define the term *specific heat*.

28. In addition to specific heat, what causes the average temperatures of land and water at the same latitude to vary?

29. What influences the amount of heat absorbed or released by the air?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **30.** El Niño-Southern Oscillation (ENSO)

_____ **31.** El Niño

_____ **32.** La Niña

_____ **33.** monsoon

a. a seasonal wind that blows toward the land in the summer, bringing heavy rains, and that blows away from the land in the winter, bringing dry weather

b. a cool-water phase of ENSO that affects weather patterns

c. the warm-water phase of ENSO; a periodic occurrence in the eastern Pacific Ocean in which the surface-water temperature becomes unusually warm

d. a cycle of changing wind and water-current patterns in the Pacific Ocean

34. What may occur in the Pacific Ocean region and southeastern United States during El Niño?

35. What may occur in Indonesia and Australia during El Niño?

36. What causes monsoon climates such as that in southern Asia?

37. In what other areas do monsoon conditions occur?

_____

_____

TOPOGRAPHY

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **38.** topography

_____ **39.** rain shadow

_____ **40.** foehn

_____ **41.** chinook

a. a process that affects climate on both sides of a mountain

b. the surface features of the land

c. the warm, dry wind that forms as part of a rain shadow on the eastern slopes of the Rocky Mountains

d. a dry wind that flows down the slopes of the Alps

42. How does elevation affect temperature?

_____

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Climate Zones

1. Name Earth's three major types of climate zones.

_____

_____

_____

2. Why does each of these zones have several types of climates?

_____

_____

TROPICAL CLIMATES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **3.** tropical climate

_____ **4.** tropical rain-forest climate

_____ **5.** tropical desert climate

_____ **6.** savanna climate

a. characterized by warm and dry temperatures; annual rainfall of less than 25 cm

b. characterized by wet summers and dry winters; annual rainfall of 50 cm

c. characterized by high temperatures and heavy precipitation during at least part of the year; typical of equatorial regions

d. characterized by warm and humid temperatures; annual rainfall of 200 cm

7. What regions are characterized by tropical rain-forest climates?

_____

_____

8. What regions are characterized by savanna climates?

_____

_____

9. What regions are characterized by tropical desert climates?

_____

_____

MIDDLE-LATITUDE CLIMATES

_____ **10.** What climate does the Pacific Northwest of the United States have?
- **a.** marine west coast
- **b.** humid continental
- **c.** steppe
- **d.** Mediterranean

_____ **11.** What climate is found in the Great Plains of the United States?
- **a.** humid continental
- **b.** humid subtropical
- **c.** steppe
- **d.** mediterranean

_____ **12.** What climate is found in the southeastern United States?
- **a.** humid subtropical
- **b.** steppe
- **c.** humid continental
- **d.** mediterranean

_____ **13.** What climate is found in the northeastern United States?
- **a.** humid subtropical
- **b.** humid continental
- **c.** steppe
- **d.** marine west coast

_____ **14.** What climate is located along the coast of central and southern California?
- **a.** humid continental
- **b.** steppe
- **c.** mediterranean
- **d.** humid subtropical

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **15.** middle-latitude climate

_____ **16.** marine west coast climate

_____ **17.** steppe climate

_____ **18.** humid continental climate

_____ **19.** humid subtropical climate

_____ **20.** mediterranean climate

a. a dry climate with a large annual temperature range; annual precipitation of less than 40 cm

b. a mild climate with a low annual temperature range between summer and winter; annual precipitation of about 40 cm

c. a climate with a low annual temperature range; annual precipitation of 60 to 150 cm

d. a climate with a large annual temperature range; annual precipitation of 75 to 165 cm

e. a climate with a maximum average temperature of 8°C in the coldest month and a minimum average temperature of 10°C in the warmest month

f. a climate with a large annual temperature range; annual precipitation of greater than 75 cm

POLAR CLIMATES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **21.** polar climate

_____ **22.** subarctic climate

_____ **23.** tundra climate

_____ **24.** polar icecap climate

a. has average temperatures below 4°C; annual precipitation of 25 cm

b. has average temperatures that are near or below freezing; typical of polar regions

c. has average temperatures below 0°C; low annual precipitation

d. has the largest annual temperature range (63°C); annual precipitation of 25 to 50 cm

25. Treeless plains and nine months of temperatures below freezing characterize the _____ climate.

26. Little or no life, temperatures below freezing year-round, and high winds characterize the _____ climate.

27. Evergreen trees and brief, cool summers with long, cold winters characterize the _____ climate.

LOCAL CLIMATES

28. Define *microclimate*.

29. What influences microclimates?

30. Why might the average temperature of a city be a few degrees higher than that of the surrounding rural area?

31. How does elevation affect local climate?

32. Describe the *highland climate*.

33. Explain how large bodies of water, such as lakes, influence local temperatures.

34. What effect do large bodies of water have on precipitation?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Climate Change

1. What two questions do scientists work to answer?

_____

_____

_____

2. Define *climatologist*.

_____

_____

_____

STUDYING CLIMATE CHANGE

3. What practice helps climatologists make predictions about future climates?

_____

_____

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

sea-floor sediment	ice cores	general circulation models (GCMs)
fossils	tree rings	

4. When scientists find high ^{18}O levels in _____, they know that the water was cool in the past.

5. Thin _____ indicate cool weather and low precipitation in the past.

6. High levels of CO_2 found in _____ indicate warmer climate in the past, whereas ice ages follow decreases in CO_2.

7. By studying _____, scientists can learn how animals adapted to changing climates.

8. Computer-generated climate models that simulate changes in one variable when other variables remain unchanged are called _____.

9. What four climate conditions can computer models be used to predict?

10. Complex computer models can model interactions between what five elements?

POTENTIAL CAUSES OF CLIMATE CHANGE

11. What four factors might cause climate changes?

12. The movement of continents over millions of years caused by _____ may affect climate changes.

13. According to the Milankovitch theory, what three factors can lead to climate changes?

14. The shape of Earth's orbit changes from _____ to circular, affecting Earth's distance from the sun and therefore Earth's temperature and climate.

15. Decreasing _____ decreases temperature differences between seasons.

16. The wobble of Earth on its axis changes the direction of Earth's tilt and can reverse the _____.

17. What human activities are responsible for releasing carbon dioxide, CO_2, into the atmosphere?

_____

_____

18. What can increases in CO_2 levels lead to?

_____

_____

19. Sulfur and ash from _____ can decrease temperatures by reflecting sunlight back into space.

POTENTIAL IMPACTS OF CLIMATE CHANGE

20. Climate change can affect what three life-forms?

_____

_____

_____

21. What are three potential climate changes that could make survival of life on Earth more difficult for both humans and other species?

_____

_____

_____

22. Define *global warming*.

_____

_____

_____

_____

_____

23. How could global warming affect plants and animals?

24. How could the melting of polar icecaps affect the shoreline and its inhabitants?

WHAT HUMANS CAN DO

25. What actions have countries taken to reduce the potential effects of global warming?

26. List four actions individuals can take to reduce CO_2 concentrations in the atmosphere that are caused by pollution.

27. Name two ways that people can change their transportation habits to reduce the release of CO_2 into the atmosphere.

28. When driving, what are three things that can be done to make sure the car is burning fuel more efficiently?

_____

_____

_____

29. How can hybrid cars reduce the amount of carbon dioxide in the atmosphere?

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Viewing the Universe

1. How did observations of the sky help farmers in the past?

2. How did observations of the sky help sailors in the past?

3. What is the main reason people study the sky today?

4. What is astronomy?

THE VALUE OF ASTRONOMY

5. Name four exciting space discoveries astronomers have made.

6. What have astronomers learned from these discoveries?

7. What are the potential benefits to humans of studying the universe?

8. Name two federal agencies that support astronomical research.

CHARACTERISTICS OF THE UNIVERSE

_____ **9.** The study of the origin, properties, processes, and evolution of the universe is called
a. astronomy.
b. the big bang.
c. gravity.
d. cosmology.

_____ **10.** Most astronomers agree that the universe began with the big bang, which was
a. a gradual blooming of stars and planets.
b. a great dust swirl that appeared about 4 billion years ago.
c. a giant explosion that occurred about 14 billion years ago.
d. a black hole that turned inside out.

_____ **11.** In addition to telescopes, what do astronomers commonly use to study the universe?
a. computer models.
b. experiments.
c. microscopes.
d. computer games.

_____ **12.** What is the nearest part of the universe to Earth?
a. the Milky Way.
b. the solar system.
c. Mars.
d. a galaxy.

_____ **13.** A large collection of stars, dust, and gas bound together by gravity is called a
a. solar system.
b. Milky Way.
c. comet.
d. galaxy.

_____ **14.** The Milky Way is
a. Earth's solar system.
b. Earth's galaxy.
c. a star.
d. an asteroid.

_____ **15.** How many galaxies exist in the universe?
a. one
b. hundreds
c. millions
d. billions

16. What is the average distance between Earth and the sun? What is this distance called?

_____

17. How far does light travel in one year? What is this distance called?

_____

18. How far from Earth is the nearest star besides the sun?

_____

OBSERVING SPACE

_____ **19** Astronomers can see planets because planets
- **a.** reflect light.
- **b.** emit light.
- **c.** emit radio waves.
- **d.** emit X rays.

_____ **20.** What are all the frequencies or wavelengths of electromagnetic radiation called?
- **a.** visible light.
- **b.** the electric spectrum.
- **c.** the radiation frequencies.
- **d.** the electromagnetic spectrum

_____ **21.** Which is NOT an example of electromagnetic radiation?
- **a.** radio waves
- **b.** X rays
- **c.** gravity
- **d.** visible light

22. What is electromagnetic radiation composed of?

_____

_____

23. What happens when white light passes through a prism?

_____

24. What causes the different colors in the color spectrum?

_____

_____

25. Which colors of light have the shortest wavelengths? Which have the longest?

_____

Directed Reading *continued*

26. Describe the wavelengths of electromagnetic radiation that cannot be seen by humans.

27. Name six specific kinds of invisible wavelengths, which can only be detected by special instruments.

28. What happens if you place a thermometer in any wavelength of the visible spectrum?

29. How did Sir Frederick William Herschel discover infrared?

30. What does the word *infrared* mean?

31. How long are infrared waves compared with waves of visible light?

32. How long are radio waves compared with infrared waves?

33. What are the shortest wavelengths of visible light?

34. What does the word *ultraviolet* mean?

35. How long are X-ray wavelengths compared with ultraviolet wavelengths?

36. What are the shortest wavelengths?

TELESCOPES

_____ **37.** Galileo is known for
- **a.** discovering the moon.
- **b.** naming the Milky Way.
- **c.** using a telescope to study the sky.
- **d.** inventing the telescope.

_____ **38.** A telescope is an instrument that
- **a.** collects electromagnetic radiation from the sky and concentrates it.
- **b.** changes X rays from the sky to visible light.
- **c.** makes infrared waves visible to humans.
- **d.** reflects light from the craters on the moon.

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **39.** optical telescope

_____ **40.** lens

_____ **41.** refracting telescope

_____ **42.** reflecting telescope

_____ **43.** radio telescope

- **a.** an instrument that uses a set of lenses to gather and focus light from distant objects
- **b.** an instrument that uses a curved mirror to gather and focus light from distant objects
- **c.** an instrument that detects radio waves from space
- **d.** a telescope that collects only visible light
- **e.** a clear object shaped to bend light in special ways

44. What are two problems with refracting telescopes?

_____

_____

_____

_____

_____

45. What problem does a reflecting telescope solve?

_____

46. Describe what happens to light that enters a reflecting telescope.

_____

_____

47. In what way are the mirrors in reflecting telescopes better than the objective lenses in refracting telescopes?

48. What are the largest reflecting telescopes and how large are they?

49. Name four kinds of invisible radiation that telescopes have been developed to detect.

50. What effect does Earth's atmosphere have on many forms of electromagnetic radiation?

51. Why do ground-based telescopes that detect invisible radiation work best at high elevations?

SPACE-BASED ASTRONOMY

52. Why have spacecraft with instruments proved valuable in investigating planets, stars, and other distant objects?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **53.** *Hubble Space Telescope*

_____ **54.** *Chandra X-ray Observatory*

_____ **55.** *Compton Gamma Ray Observatory*

_____ **56.** *Spitzer Space Telescope*

_____ **57.** *James Webb Space Telescope*

a. was launched in 2003 to detect infrared radiation

b. orbits Earth to collect electromagnetic radiation from space objects

c. will be launched in 2011 to detect infrared radiation from objects in space

d. was used to detect gamma rays from objects such as black holes

e. makes clear images using X rays from objects in space

58. What planets were investigated by *Voyager 1* and *Voyager 2* spacecraft?

59. What information did the *Galileo* spacecraft gather about Jupiter?

60. What spacecraft began orbiting Saturn in 2004?

61. What will the *Huygens* probe do in December 2004?

62. Why are scientists interested in studying Titan?

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

Earth's moon	robotic spacecraft	space shuttle
crewed spacecraft	the solar system	space port

63. Spacecraft that carry only instruments and computers are called _____.

64. Spacecraft that do not carry humans can explore space and travel beyond the _____.

65. Spacecraft that carry humans are _____.

66. The humans have never traveled in space beyond _____.

67. An example of a crewed spacecraft that orbits Earth to repair satellites and perform experiments is the _____.

68. Why is it taking NASA a long time to launch a voyage to Mars?

_____

_____

69. What events focused public attention on the risks of human space exploration?

_____

_____

_____

70. How has space study helped make weather predictions more accurate?

_____

_____

71. What kind of help do satellites give car drivers and airplane pilots?

_____

_____

72. How has space exploration led to improved electronics?

_____

73. How has space exploration helped improve medical equipment?

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Movements of Earth

THE ROTATING EARTH

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

daylight	rotation	revolution
east	nighttime	year
day	west	night

1. The spinning of Earth on its axis is called _____.

2. A complete rotation of Earth takes about one _____.

3. As Earth rotates from west to east, the sun seems to rise in the _____.

4. The sun appears to set in the _____.

5. The side of Earth facing the sun at any given moment experiences _____.

6. The side of Earth facing away from the sun at any given moment experiences _____.

7. What did Foucault's pendulum provide in the 19th century?

_____

8. What happens to the path of a pendulum over the course of a day?

_____

9. What causes the apparent change in the path of a pendulum?

_____

10. What causes deflection of ocean currents and wind belts?

_____

11. In which direction are ocean currents and wind belts deflected in the Northern Hemisphere? In the Southern Hemisphere?

_____

12. What is the curving of the path of wind belts and ocean currents called?

_____

THE REVOLVING EARTH

13. What is the average speed of Earth as it travels around the sun?

_____

14. How long does each complete revolution of Earth around the sun take?

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **15.** revolution

_____ **16.** orbit

_____ **17.** ellipse

_____ **18.** perihelion

_____ **19.** aphelion

a. a closed curve whose shape is determined by two points within the curve

b. the point in a planet's orbit at which the planet is closest to the sun

c. the motion of a body that travels around another body in space

d. the point in a planet's orbit at which the planet is farthest from the sun

e. the path that a body follows as it travels around another body in space

20. What is the shape of Earth's orbit around the sun?

_____

21. What is Earth's aphelion distance? Earth's perihelion distance?

_____

CONSTELLATIONS AND EARTH'S MOTION

22. What is a constellation?

_____

23. What did the International Astronomical Union do in 1930?

_____

24. Where did many of the names for the constellations come from?

_____

25. What causes the position of a constellation to appear to change over a period of several hours?

_____

26. What causes the position of a constellation to appear to change, at the same time of the evening, over a period of several weeks?

_____

MEASURING TIME

_____ **27.** The basis for the measurement of time is
- **a.** the sun's motion.
- **b.** the moon's motion.
- **c.** Earth's motion.
- **d.** the galaxy's motion.

_____ **28.** The measurement of a day is determined by
- **a.** the rotation of Earth on its axis.
- **b.** Earth's revolution around the sun.
- **c.** the moon's motion around Earth.
- **d.** the period between successive full moons.

_____ **29.** The measurement of a year is determined by
- **a.** the rotation of Earth on its axis.
- **b.** Earth's revolution around the sun.
- **c.** the moon's motion around Earth.
- **d.** the period between successive full moons.

_____ **30.** The measurement of a month is based on
- **a.** the rotation of Earth on its axis.
- **b.** Earth's revolution around the sun.
- **c.** the moon's motion around Earth.
- **d.** Earth's motion around the moon.

_____ **31.** Each rotation of Earth on its axis takes
- **a.** 24 hours.
- **b.** 29.5 days.
- **c.** 365 days.
- **d.** 365 1/4 days.

_____ **32.** Each complete revolution of Earth around the sun takes
- **a.** 24 hours.
- **b.** 29.5 days.
- **c.** 365 days.
- **d.** 365 1/4 days.

_____ **33.** Today, a month is determined as roughly
- **a.** 29.5 days.
- **b.** one-twelfth of a year.
- **c.** 28 days.
- **d.** 365 days.

_____ **34.** Who were the first people to use a calendar based on a solar year?
- **a.** the Aztecs
- **b.** the Romans
- **c.** the Babylonians
- **d.** the Egyptians

_____ **35.** What civilization created a calendar based on a 12-month lunar year?
- **a.** the Roman
- **b.** the Babylonian
- **c.** the Egyptian
- **d.** the Aztec

36. What is a calendar?

37. Why is the extra 1/4 day of the year usually ignored?

38. What is a leap year? Explain why it is necessary.

39. What two Roman rulers were responsible for creating the yearly calendar as we know it?

40. What calendar problem did Pope Gregory XIII address and how did his committee solve it?

41. What is the definition of noon?

42. Is it noon at the same time all over the world? Explain your answer.

43. How many degrees does each of Earth's 24 standard time zones cover? Explain your answer.

44. How is the time in one zone different from the time in the zone east of it?

45. What is the International Date Line ? What does it mark?

46. Why is daylight time shorter in the winter months than in the summer months?

47. Why does the United States use daylight savings time from April to October?

48. According to daylight savings time, what do we do to clocks in April and October?

49. Why do equatorial countries not observe daylight savings time?

THE SEASONS

_____ **50.** Earth's axis is
- **a.** vertical.
- **b.** tilted at 12°.
- **c.** tilted at 23.5°.
- **d.** 90°.

_____ **51.** During each revolution of Earth, the North Pole
- **a.** sometimes tilts toward the sun and sometimes tilts away.
- **b.** is always vertical.
- **c.** always tilts toward the sun.
- **d.** always tilts away from the sun.

_____ **52.** When the North Pole tilts toward the sun, the Northern Hemisphere has
- **a.** the same amount of daylight as the Southern Hemisphere.
- **b.** longer periods of daylight than the Southern Hemisphere.
- **c.** shorter periods of daylight than the Southern Hemisphere.
- **d.** varying periods of daylight compared to the Southern Hemisphere.

_____ **53.** When the North Pole tilts away from the sun, the sun's rays strike the Northern Hemisphere
- **a.** vertically.
- **b.** at a high angle.
- **c.** at a low angle.
- **d.** horizontally.

_____ **54.** Seasons are caused by
- **a.** Earth's rotation on its axis.
- **b.** changes in the angle at which the sun's rays strike Earth.
- **c.** the distance of a place from the equator.
- **d.** differences in Earth's time zones.

_____ **55.** Winter occurs in the Northern Hemisphere when
- **a.** the North Pole tilts away from the sun.
- **b.** the North Pole tilts toward the sun.
- **c.** the sun's rays strike the Northern Hemisphere at a high angle.
- **d.** the sun's rays creates more daylight hours.

_____ **56.** A result of fewer daylight hours is
- **a.** less solar energy.
- **b.** more solar energy.
- **c.** higher temperatures.
- **d.** a longer season.

_____ **57.** When it is winter in the Northern Hemisphere, the Southern Hemisphere experiences
- **a.** winter.
- **b.** summer.
- **c.** spring.
- **d.** fall.

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

autumnal equinox	hemisphere	equator
equinox	vernal equinox	celestial equator

58. A line drawn on the sky directly overhead from the equator on Earth is called the _____.

59. The moment when the sun appears to cross the celestial equator is a(an) _____.

60. At an equinox, the angle of the sun's rays along the _____ is 90°.

61. The beginning of fall in the Northern Hemisphere is marked by the _____, occurring on September 22 or 23.

62. The beginning of spring in the Northern Hemisphere is marked by the _____, falling on March 21 or 22.

63. What is true of the hours of daylight and darkness everywhere on Earth at an equinox?

_____

64. What is a solstice?

_____

_____

65. What begins on the soltices each year?

_____

66. Along what line do the sun's rays strike Earth at a 90° angle at the summer solstice? Where is this line located?

_____

67. What happens to the sun in the Northern Hemisphere at the summer solstice?

_____

68. How does the period of daylight change depending on your location on Earth at the summer solstice?

69. Along what line do the sun's rays strike Earth at a 90° angle at the winter solstice? Where is this line located?

70. Describe the hours of daylight in the Northern Hemisphere at the winter solstice.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Formation of the Solar System

1. The sun and all of the planets and other bodies that revolve around it make up the _____.

2. Celestial bodies that orbit the sun, such as Earth and Jupiter, are called _____.

3. In 1796, the French mathematician Pierre-Simon, marquis de Laplace, advanced the _____ to explain the origins of the solar system.

THE NEBULAR HYPOTHESIS

_____ **4.** Laplace's hypothesis states that the sun and the planets condensed at about the same time out of a rotating cloud of dust and gas called a
- **a.** planet.
- **b.** nebula.
- **c.** supernova.
- **d.** solar system.

_____ **5.** The rotating cloud of dust and gas from which our solar system is thought to have formed is called the
- **a.** solar nebula.
- **b.** gas giant.
- **c.** sun.
- **d.** nova

_____ **6.** Energy from collisions and pressure from gravity caused the center of the solar nebula to become
- **a.** hotter and less dense.
- **b.** cooler and denser.
- **c.** cooler and less dense.
- **d.** hotter and denser.

_____ **7.** Which of the following formed when the temperature at the center of the nebula reached about 10,000,000°C and hydrogen fusion began?
- **a.** Mars
- **b.** Earth
- **c.** the sun
- d. the moon

_____ **8.** How much of the matter that was contained in the solar nebula makes up the sun?
- **a.** 5%
- **b.** about 99%
- **c.** 25%
- **d.** about 75%

FORMATION OF THE PLANETS

_____ **9.** Small bodies from which a planet originated in the early development of the solar system are called
- **a.** atmospheres.
- **b.** planetesimals.
- **c.** suns.
- **d.** moons.

_____ **10.** Some planetesimals joined together through collision and through the force of gravity to form larger bodies called
- **a.** protoplanets.
- **b.** sunspots.
- **c.** protons.
- **d.** nebulas.

_____ **11.** The smaller bodies that orbit the planets are called
- **a.** solar nebulas.
- **b.** moons.
- **c.** planetesimals.
- **d.** suns.

12. Why are Mercury, Venus, Earth, and Mars called the *inner* planets?

13. Why did the inner planets, which contained large percentages of heavy elements such as iron and nickel, lose their less dense gases?

14. How do the surfaces of the inner planets compare with that of Earth today?

15. How do the inner planets differ from the outer planets?

16. Jupiter, Saturn, Uranus, and Neptune are referred to as

_____ planets.

17. How did distance from the sun affect the formation of the outer planets?

18. Name the three reasons why the outer planets are referred to as *gas giants*.

19. Which gas giant is farthest from the sun?

20. In what way does Saturn differ from the other outer planets?

21. In what way is Pluto similar to other Kuiper Belt objects?

22. How is Pluto more like Quaoar and Sedna that it is like Neptune?

FORMATION OF SOLID EARTH

_____ **23.** When Earth formed, its high temperature was NOT due to

- **a.** heat produced when planetesimals collided with one another.
- **b.** heat generated when the increasing weight of its outer layers compressed its inner layers.
- **c.** the conversion of moving radioactive particles into heat energy.
- **d.** an irregular orbit that brought it closer to the sun.

_____ **24.** Dense materials such as molten iron sank to Earth's center and less dense materials were forced to the outer layers in a process called
a. distinction.
b. differentiation.
c. distribution.
d. delineation.

_____ **25.** Which of the following did NOT form as one of Earth's layers when differentiation occurred?
a. core
b. mantle
c. atmosphere
d. crust

_____ **26.** Which of the following elements is NOT present in large amounts in Earth's three layers ?
a. gold
b. iron
c. silica
d. magnesium

_____ **27.** Earth's surface continued to change as a result of
a. increasing radiation.
b. colliding planetesimals.
c. the heat in Earth's interior.
d. hydrogen fusion.

FORMATION OF EARTH'S ATMOSPHERE

_____ **28.** The original atmosphere of Earth consisted of
a. oxygen and nitrogen.
b. hydrogen and helium.
c. nitrogen and helium.
d. hydrogen and oxygen.

_____ **29.** Today, hydrogen and helium occur mainly in the
a. oceans.
b. middle atmosphere.
c. lower atmosphere.
d. upper atmosphere.

_____ **30.** Earth's early atmosphere formed when volcanic eruptions released gases in a process called
a. outgassing.
b. atmospheric composition.
c. air generation.
d. layering.

_____ **31.** What is the molecule that contains three oxygen atoms and collects in Earth's upper atmosphere called?

a. oxygen
b. argon
c. ozone
d. carbon dioxide

32. Some of Earth's early organisms, such as cyanobacteria and early green plants, used _____ during photosynthesis.

33. Which byproduct of photosynthesis was released into the atmosphere?

_____

_____

34. When did the chemical composition of Earth's atmosphere reach that of today?

_____

_____

35. What is the present chemical composition of Earth's atmosphere?

_____

_____

36. How did Earth's first oceans form?

_____

_____

37. Comet collisions may have contributed a significant amount of _____ to Earth's surface.

38. The first ocean was probably made of _____ water.

39. The concentration of certain _____ in the oceans increased as rainwater dissolved rocks on land and carried these dissolved solids into the oceans.

40. When ocean water evaporated, chemicals in the ocean combined to form _____.

41. Earth's atmosphere and surface cooled because ocean water also dissolved much of the _____ in the atmosphere.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Models of the Solar System

_____ **1.** The first astronomers thought that the stars, planets, and sun revolved around
- **a.** the sun.
- **b.** the Milky Way.
- **c.** Earth.
- **d.** the moon.

EARLY MODELS OF THE SOLAR SYSTEM

_____ **2.** More than 2,000 years ago, the Greek philosopher Aristotle suggested a model of the solar system that was Earth-centered, or
- **a.** geocentric.
- **b.** geometric.
- **c.** geologic.
- **d.** geothermal.

_____ **3.** The pattern by which planets appear to move backward in the sky relative to the stars is called
- **a.** reverse motion.
- **b.** restrained motion.
- **c.** retrograde motion.
- **d.** revolving motion.

_____ **4.** The Greek astronomer Claudius Ptolemy proposed that planets moved in small circles, or epicycles, as they
- **a.** revolved in larger circles around the moon.
- **b.** revolved in larger circles around the sun.
- **c.** revolved in even smaller circles around Earth.
- **d.** revolved in larger circles around Earth.

_____ **5.** The Polish astronomer Nicolaus Copernicus proposed a model of the solar system that was sun-centered, or
- **a.** lunacentric.
- **b.** astrocentric.
- **c.** heliocentric.
- **d.** celestracentric.

_____ **6.** According to Copernicus, all the planets revolved around
- **a.** the sun in the same direction but at different speeds and distances.
- **b.** the moon in the same direction but at different speeds and distances.
- **c.** the sun in different directions but at the same speeds and distances.
- **d.** the sun in different directions and different speeds and distances.

KEPLER'S LAWS

7. Upon whose observations did Johannes Kepler base his three laws of planetary motion?

_____

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **8.** eccentricity

_____ **9.** ellipse

_____ **10.** orbital period

a. a closed curve whose shape is determined by two points, or foci

b. the time required for a body to complete a single orbit

c. the degree of elongation of an elliptical orbit

11. What does the *law of ellipses* state?

_____

_____

_____

12. In planetary orbits, one focus is located within the _____, and no object is located at the other focus.

13. How is eccentricity determined?

_____

_____

_____

14. What did Kepler discover about the orbit of Mars?

_____

_____

_____

15. The law of equal areas states that equal areas are covered in equal amounts of time as an object orbits the _____.

16. Kepler's third law, the law of periods, describes the relationship between the average distance of a planet from the sun and the _____ of the planet.

17. According to the law of periods, the cube of the average _____ of a planet from the sun is always proportional to the square of the period.

18. What mathematical formula is used to explain the law of periods?

_____

_____

_____

NEWTON'S EXPLANATION OF KEPLER'S LAWS

Use the terms from the list below to complete the sentences that follow. Each term may be used only once.

revolution gravity inertia

19. The tendency of a stationary body to remain at rest or of a moving body to remain in motion until an outside force acts upon it is called _____.

20. Newton discovered that an outside force called _____ causes the orbit of a planet to curve.

21. The outer planets have longer periods of _____ than the inner planets because the outer planets are less affected by the sun's gravitational pull.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Inner Planets

1. The planets closest to the sun are called the _____

2. Name the four inner planets.

_____

_____

_____

_____

3. The inner planets are also called _____ because they are like Earth.

4. Describe the composition of the inner planets.

_____

_____

_____

5. Bowl-shaped depressions called _____ formed on the surfaces of inner planets when the planets collided with other objects in space.

MERCURY

_____ **6.** Mercury, the closest planet to the sun, circles the sun every
- **a.** 44 days.
- **b.** 88 days.
- **c.** four years.
- **d.** 80 hours.

_____ **7.** Mercury rotates on its axis once every
- **a.** 95 days.
- **b.** 45 days.
- **c.** 59 days.
- **d.** five years.

_____ **8.** Mercury's surface features a long line of cliffs and
- **a.** dry ocean beds.
- **b.** a large number of craters.
- **c.** shallow fresh-water springs.
- **d.** lava plains.

_____ **9.** The absence of a dense atmosphere and Mercury's slow rotation contribute to
- **a.** long days and short nights.
- **b.** short days and long nights.
- **c.** steady temperatures.
- **d.** a large daily temperature range.

VENUS

10. How long is the orbital period of Venus, the second planet from the sun?

_____

11. How often does Venus rotate?

_____

12. The planet that Venus most resembles in mass, size, and density is

_____.

13. Venus's atmospheric pressure is about _____ times the pressure on Earth.

14. What two factors cause the high temperatures on Venus?

_____

_____

15. What percentage of the atmosphere on Venus is composed of carbon dioxide?

_____

16. What phenomenon occurs when solar energy heats Venus's surface and the high concentration of carbon dioxide in the atmosphere blocks most of the infrared radiation from escaping?

_____

_____

17. Venus appears to be very bright in the night sky because drops of

_____ form a cloud layer that reflects sunlight.

18. Why is Venus commonly referred to as the *evening star* or *morning star?*

_____

_____

_____

19. The surface of Venus is composed of which two types of rock?

_____

_____

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **20.** *Magellan*

_____ **21.** volcano

_____ **22.** Maat Mons

a. the highest volcano on Venus

b. a U.S. satellite that collected data about Venus

c. a landform commonly found on Venus

23. How could the craters on Venus be described?

_____

24. What evidence indicates that Venus undergoes a periodic resurfacing?

_____

_____

EARTH

25. Earth is the _____ planet from the sun.

26. The orbital period of Earth is _____ days.

27. Earth completes one _____ on its axis every day.

28. How many moons does Earth have?

_____

29. Over the last _____ years, Earth's continents separated from a single landmass and drifted to their present positions.

30. What two factors have caused the surface of Earth to keep changing?

_____

_____

31. Why is Earth the only planet on which water exists in a liquid state?

_____

_____

32. How was Earth able to maintain the moderate temperatures that were necessary to support life?

_____

_____

33. What three elements does Earth have in the proper combination necessary to support life?

_____

_____

_____

MARS

34. Mars is the _____ planet from the sun.

35. How long is Mars's orbital period?

_____

36. How often does Mars rotate on its axis?

_____

37. Why are Mars's seasons similar to Earth's?

_____

_____

38. Mars is believed to have been geologically active because of its massive volcanoes and a system of deep _____ on its surface.

39. One of the many major volcanic regions on Mars is called _____.

40. The largest volcano on Mars is _____, which is many times the height of Mount Everest and has a base about the size of Nebraska.

41. Why do scientists think that Martian volcanoes have grown so large?

_____

_____

42. Two seismic wave-producing geological events called _____ indicate that volcanoes on Mars may still be active.

Directed Reading *continued*

43. Why can water not exist as a liquid on Mars?

44. Which two spacecraft found evidence that liquid water once did exist on Mars's surface?

45. Mars has many surface features that are characteristic of

_____ by water.

46. Where might water exist as permanent frost or as a liquid on Mars?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Outer Planets

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **1.** outer planets

_____ **2.** asteroid belt

_____ **3.** gas giant

_____ **4.** Pluto

a. a planet with a deep and massive gaseous atmosphere

b. planets farthest from the sun; include Jupiter, Saturn, Uranus, and Neptune

c. a celestial body usually located outside the orbit of Neptune

d. a ring of debris that separates the inner planets from the outer planets

GAS GIANTS

_____ **5.** How do the gas giants compare with the terrestrial planets?
- **a.** Gas giants are larger and more dense.
- **b.** Gas giants are larger and less dense.
- **c.** Gas giants are smaller and more dense.
- **d.** Gas giants are smaller and less dense.

_____ **6.** Compared with the terrestrial planets, the gas giants
- **a.** have more gravity, which helps them retain gases.
- **b.** have less gravity, which helps them retain gases.
- **c.** have the same amount of gravity, which helps them retain gases.
- **d.** have no gravity, which helps them retain gases.

_____ **7.** The thick atmosphere of the gas giants is made up of
- **a.** oxygen and hydrogen.
- **b.** helium and carbon dioxide.
- **c.** hydrogen and helium.
- **d.** carbon dioxide and oxygen.

_____ **8.** The gas giants have ring systems that are made up of
- **a.** orbiting moons.
- **b.** dust and icy debris.
- **c.** comets.
- **d.** asteroids and gases.

JUPITER

9. Jupiter is the _____ planet from the sun.

10. Jupiter's mass is more than _____ times that of Earth.

11. How long is Jupiter's orbital period?

_____

12. How often does Jupiter rotates on its axis?

_____

13. Jupiter has dozens of _____, four of which are the size of small planets.

14. How much of Jupiter's atmosphere is composed of hydrogen and helium?

_____

15. Jupiter's atmosphere is much like the atmosphere of the

_____.

16. Why didn't Jupiter become a star?

_____

_____

_____

17. What do Jupiter's unique bands of orange, gray, blue, and white indicate?

_____

_____

_____

18. How do the bands form?

_____

_____

_____

19. Describe Jupiter's Great Red Spot.

_____

_____

_____

20. What do Jupiter's high wind speeds tell scientists about the planet's weather?

_____

_____

21. How does Jupiter's large mass affect its interior temperature and pressure?

_____

_____

_____

SATURN

_____ **22.** How far is Saturn from the sun?
- **a.** It is the fourth planet from the sun.
- **b.** It is the sixth planet from the sun.
- **c.** It is the closest planet to the sun.
- **d.** It is the farthest planet from the sun.

_____ **23.** How long is Saturn's orbital period?
- **a.** 100 years
- **b.** 2,950 years
- **c.** three years
- **d.** 29.5 years

_____ **24.** How many moons does Saturn have?
- **a.** at least 30
- **b.** at least 60
- **c.** at least 75
- **d.** at least 125

_____ **25.** How large is Titan, Saturn's largest moon?
- **a.** half the size of Earth
- **b.** twice the size of Earth
- **c.** half the size of the sun
- **d.** twice the size of Venus

26. Saturn, like the planet _____, is made up almost entirely of hydrogen and helium and has a rocky, iron core.

27. Saturn is the least _____ planet in the solar system.

28. Saturn is known for its _____, which are two times the planet's diameter.

29. Like Jupiter, Saturn has _____ of colored clouds.

30. How often does Saturn rotate on its axis?

_____

31. NASA's _____ spacecraft will orbit Saturn for many years to gather information about the planet and its moon Titan.

URANUS

32. Uranus is the _____ planet from the sun and the third largest planet in the solar system.

33. Why is Uranus a difficult planet to study?

_____

_____

34. Uranus has at least _____ moons and at least 11 small rings.

35. The orbital period for Uranus is almost _____ years.

36. Although most planets rotate with their axis perpendicular to their orbital planes, Uranus's axis is almost _____ to the plane of its orbit.

37. How often does Uranus rotate?

_____

38. The planet's blue-green color indicates that the atmosphere may contain significant amounts of _____, in addition to hydrogen and helium.

NEPTUNE

39. Neptune is the _____ planet from the sun and is similar to Uranus in size and mass.

40. Neptune's orbital period is nearly 164 years, and the planet rotates about every _____ h.

41. Neptune's existence was _____ before Neptune was actually discovered.

42. How was Neptune's existence predicted before the planet was actually discovered?

43. Neptune's atmosphere is made up of which gases?

44. What have images taken by *Voyager 2* and the *Hubble Space Telescope* told us about Neptune's weather?

PLUTO

45. Pluto is usually _____ than any planet is from the sun.

46. Pluto's orbit is an unusually elongated and tilted _____.

47. How does Pluto compare with other objects in the solar system in terms of its size and distance from the sun?

48. What is Pluto made of?

OBJECTS BEYOND PLUTO

49. Describe the Kuiper Belt.

50. Name two objects that have been found beyond Pluto.

EXOPLANETS

51. Define *exoplanet*.

52. Because exoplanets cannot be directly observed through telescopes or satellites, how do scientists know they exist?

53. Where are large exoplanets located with respect to their stars?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Earth's Moon

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **1.** satellite

_____ **2.** moon

_____ **3.** *Sputnik I*

_____ **4.** *Explorer I*

_____ **5.** *Hubble Space Telescope*

a. a natural body that revolves around another body and has a smaller mass than that body

b. the first artificial satellite launched by the United States, in 1958

c. a natural or artificial body that orbits around a planet

d. an important information-gathering satellite now in orbit around Earth

e. the first artificial satellite, launched by the Soviet Union in exploring the moon

_____ **6.** Between 1969 and 1972, the United States sent six spacecraft to the moon as part of what space program?
- **a.** Gemini
- **b.** Apollo
- **c.** Hubble
- **d.** Explorer

_____ **7.** Why is the gravity experienced on the moon's surface so much less than the gravity experienced on Earth?
- **a.** because Earth has much less mass than the moon
- **b.** because the moon has much more weight than Earth
- **c.** because Earth has much more weight than the moon
- **d.** because the moon has much less mass than Earth

_____ **8.** A person who exerts 600 newtons of force on Earth exerts how many newtons on the moon?
- **a.** 100
- **b.** 600
- **c.** 800
- **d.** 1,200

_____ **9.** Why doesn't the moon have an atmosphere?
- **a.** because the air is too thin for gases
- **b.** because the cold temperature freezes gases
- **c.** because the gravity is too weak to hold gases.
- **d.** because the ground is too dry to hold gases.

_____ **10.** How does the absence of an atmosphere affect the moon's surface temperature?
- **a.** It is always cold.
- **b.** It is always hot.
- **c.** It varies greatly with the time of year.
- **d.** It varies widely with the time of day.

THE LUNAR SURFACE

_____ **11.** What word comes from the Latin word luna and refers to any feature of the moon?
- **a.** lunar.
- **b.** moony.
- **c.** marine.
- **d.** loony.

_____ **12.** A dark, smooth area of the moon that reflects less light than other areas is called a(n)
- **a.** luna.
- **b.** anothosite.
- **c.** mare.
- **d.** crater.

_____ **13.** Most of the moon's craters formed about 4 billion years ago when the moon was struck by
- **a.** pieces left over from Earth.
- **b.** rocks from volcanic eruptions.
- **c.** another moon.
- **d.** debris from the formation of the solar system.

_____ **14.** Rilles, or long, deep channels running through the maria, are thought to be left over from
- **a.** heavy rainstorms.
- **b.** the formation of lava plains.
- **c.** the Apollo space spacecraft.
- **d.** asteroids striking the moon's surface.

_____ **15.** How are lunar rocks similar to rocks on Earth?
- **a.** They are metamorphic.
- **b.** They contain many of the same elements.
- **c.** They are sedimentary.
- **d.** They contain fossils.

_____ **16.** Where on the moon do light-colored, coarse-grained anorthosites rich in calcium and aluminum come from?
a. rilles
b. maria
c. lunar highlands
d. lava plains

_____ **17.** Fine-grained rocks from the maria that contain titanium, magnesium, and iron are
a. rilles.
b. basalts.
c. anorthosites.
d. regolith.

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

craters	water	anorthosites
rilles	asteroids	breccia
regolith	ridges	

18. Rough highlands composed of rocks called _____ form light patches on the moon.

19. Maria are plains of dark, solidified lava that formed when the lava filled basins created by impacts of massive _____.

20. Many bowl-shaped depressions called _____ cover the surface of the moon.

21. Long, narrow elevations of rock called _____ rise out of the surface of the moon and criss-cross the maria.

22. Over billions of years, meteorites have crushed the surface of the moon into _____, or dust and small fragments of rock.

23. The substance _____ is missing from the minerals in lunar rocks.

24. One type of rock found both in the highlands and maria is _____, which formed when meteorites struck the moon.

THE INTERIOR OF THE MOON

_____ **25.** How do the rocks on the lunar surface compare with those on Earth?
- **a.** They are lighter in color.
- **b.** They are less dense.
- **c.** They are darker.
- **d.** They are equal in density.

_____ **26.** How does the overall density of the moon compare with the density of Earth?
- **a.** The moon's density is three times that of Earth.
- **b.** The moon's density is three-fifths that of Earth.
- **c.** The moon's density is five times that of Earth.
- **d.** The moon's density is one fifth that of Earth.

_____ **27.** Compared with Earth's interior, the interior of the moon is
- **a.** more dense.
- **b.** equal in density.
- **c.** less dense.
- **d.** without density.

_____ **28.** Where do most moonquakes occur?
- **a.** on the crust
- **b.** in the mantle
- **c.** under the crust
- **d.** in the core

_____ **29.** From moonquakes, scientists learned that the moon's interior
- **a.** is made up of water.
- **b.** has only one compositional layer.
- **c.** has three compositional layers.
- **d.** is frozen.

_____ **30.** The side of the moon that always faces Earth and the side that always faces away from Earth are called the
- **a.** close side and distant side.
- **b.** light side and dark side.
- **c.** near side and far side.
- **d.** hot side and cold side.

_____ **31.** What caused the crust on the side of the moon facing away from Earth to be thicker than that of the crust facing Earth?
- **a.** the pull of Earth's gravity
- **b.** the rotation of the moon on its axis
- **c.** heat from the sun
- **d.** the moon's unbalanced core

_____ **32.** The surface of the far side of the moon is mountainous and has
- **a.** many large maria.
- **b.** only a few small maria.
- **c.** only a few ridges.
- **d.** no ridges.

_____ **33.** The thickest layer of the moon is the
- **a.** maria.
- **b.** crust.
- **c.** mantle.
- **d.** core.

_____ **34.** The moon's non-uniform rotation indicates that the core is
- **a.** neither completely solid nor completely liquid.
- **b.** completely liquid.
- **c.** completely solid.
- **d.** completely magnetic.

THE FORMATION OF THE MOON

_____ **35.** The theory that a Mars-sized body struck Earth and began the development of the moon is called the
- **a.** giant impact hypothesis.
- **b.** big bang theory.
- **c.** theory of relativity.
- **d.** huge explosion hypothesis.

_____ **36.** The collision with a Mars-sized body ejected chunks of Earth's
- **a.** liquid crust into orbit.
- **b.** molten mantle out of orbit.
- **c.** frozen core into orbit.
- **d.** molten mantle into orbit.

_____ **37.** The material ejected from Earth by its collision with a huge body eventually
- **a.** flew out of the solar system.
- **b.** clumped together to form the moon.
- **c.** formed asteroids.
- **d.** was absorbed by the sun.

_____ **38.** Why did the material from the collision that clumped together continue to revolve around Earth?
- **a.** because of the moon's density
- **b.** because of Earth's density
- **c.** because of the moon's gravitational pull
- **d.** because of Earth's gravitational pull

39. How did the lunar interior change over time?

40. What happened when the outer surface of the moon cooled to form a crust over the molten interior?

41. What developments took place on the moon about 3 billion years ago?

42. Why is the moon a valuable source of information about the conditions that existed in the solar system long ago?

43. After impacts on the moon's surface formed deep basins, what do scientists think happened?

44. Why did more lava flow into the craters on the near side of the moon than into those on the far side?

45. Because there is no evidence of plate tectonics or convection currents in the moon's mantle to supply energy, how do scientists think that magma might have reached the moon's surface?

46. When and why did lava flows end?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Movements of the Moon

1. Why is there a discrepancy between the lunar day as measured by the rotation of the moon on its axis and the time between lunar sunrises?

THE EARTH-MOON SYSTEM

2. If you could observe Earth and the moon from space, what would you see?

3. What do Earth and the moon form together?

4. Where is the balance point of the Earth-moon system located?

5. Why is the balance point of the Earth-moon system located where it is?

6. What is the balance point called?

7. Describe how the barycenter orbits the sun.

8. Why does Earth's distance from the moon vary over the course of a month?

Directed Reading *continued*

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

moon	apogee	revolution
axis	rotation	perigee

9. The moon is at_____ when it is farthest from Earth,.

10. The moon is at_____ when it is closest to Earth,

11. The moon appears to rise and set at Earth's horizon because of Earth's rotation on its _____.

12. Because of Earth's rotation and the moon's _____, the moon actually rises or sets about 50 minutes later each night

13. The moon completes a _____on its axis only once during each orbit around Earth.

14. How often does the moon revolve around Earth relative to the stars?

_____

15. Why do observers on Earth always see the same side of the moon?

_____

_____

16. As the moon orbits Earth, what part of the moon's surface changes?

_____

_____

17. What happens when the near side of the moon is NOT fully illuminated by the sun?

_____

_____

_____

ECLIPSES

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **18.** eclipse

_____ **19.** umbra

_____ **20.** penumbra

_____ **21.** solar eclipse

_____ **22.** diamond-ring effect

_____ **23.** annular eclipse

a. the outer part of the shadow in an eclipse, where sunlight is partially blocked

b. an event in which the moon passes between Earth and the sun and the moon's shadow falls on Earth

c. the inner, cone-shaped part of the shadow in an eclipse, where sunlight is completely blocked

d. an event in which the shadow of one celestial body falls on another

e. the last bits of the sun's light visible before a total eclipse

f. an eclipse in which a thin ring of sunlight is visible around the outer edge of the moon

24. What occurs during a total solar eclipse?

25. What do observers who are located outside the umbra, but inside the penumbra see during a solar eclipse?

26. Describe the area of Earth covered by a total solar eclipse.

27. What are some effects of a total solar eclipse visible on Earth?

Directed Reading *continued*

28. What causes an annular eclipse?

29. When does a lunar eclipse occur?

30. What must happen for a total lunar eclipse to occur?

31. Why is a totally eclipsed moon reddish in color?

32. About how many of each kind of eclipse occur during the calendar year?

33. Why don't solar and lunar eclipses occur during every lunar orbit?

34. Under what two conditions do solar eclipses occur?

35. Under what two conditions do lunar eclipses occur?

36. Where are lunar eclipses visible?

PHASES OF THE MOON

_____ **37.** Why does the moon shine?
- **a.** because it reflects light from Earth
- **b.** because its surface is molten
- **c.** because it reflects light from the sun
- **d.** because it reflects light from all the planets

_____ **38.** In astronomy, a phase is the change in the illuminated area
- **a.** of the sun as seen from Earth.
- **b.** of the solar system as seen from outside it.
- **c.** of Earth as it rotates on its axis.
- **d.** of one celestial body as seen from another body.

_____ **39.** Phases of the moon are caused by the
- **a.** change in seasons.
- **b.** revolution of Earth on its axis.
- **c.** revolution of the moon on its axis.
- **d.** changing positions of the sun, moon, and Earth.

_____ **40.** During this phase of the moon, the near side is dark, and no lighted area of the moon is visible on Earth.
- **a.** dark moon
- **b.** new moon
- **c.** near moon
- **d.** full moon

_____ **41.** As the moon continues in its orbit around Earth, part of the near side becomes illuminated. The moon is said to be
- **a.** waxing.
- **b.** revolving.
- **c.** waning.
- **d.** spinning.

_____ **42.** The waxing phases of the moon are
- **a.** waxing, growing, completing.
- **b.** crescent, half, whole.
- **c.** first quarter, second quarter, third quarter.
- **d.** waxing crescent, first quarter, waxing gibbous.

_____ **43.** At what stage is the entire near side of the moon illuminated by the sun, because Earth is between the sun and moon?
- **a.** whole moon
- **b.** luminous moon
- **c.** new moon
- **d.** full moon

_____ **44.** When the lighted part of the near side of the moon appears to decrease in size, the moon is
- **a.** waxing.
- **b.** shrinking.
- **c.** waning.
- **d.** decreasing.

_____ **45.** The waning phases of the moon are
- **a.** waning gibbous, last quarter, waning crescent.
- **b.** waning crescent, last quarter, waning gibbous.
- **c.** second quarter, third quarter, fourth quarter.
- **d.** waning, last quarter, invisible.

_____ **46.** What is sunlight that is reflected off Earth and then off the moon called?
- **a.** moonshine
- **b.** sunshine
- **c.** earthshine
- **d.** moonlight

_____ **47.** The period from one new moon to the next is
- **a.** 27.3 days.
- **b.** 30 days.
- **c.** 29.5 days.
- **d.** 31 days.

_____ **48.** The position of the moon in each new moon phase is
- **a.** behind the sun.
- **b.** directly between Earth and the sun.
- **c.** in line with, and behind Earth.
- **d.** directly in front of the sun.

TIDES ON EARTH

Use terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

tides	gravity	rotation
bulge	phases	inertia

49. The forces of gravity and _____ together cause tides on Earth.

50. The _____ of Earth causes inertia, which in turn causes water on Earth's surface to move away from Earth's center.

51. At the same time, the _____ of the moon pulls all of the water on Earth toward the moon.

52. On the side of Earth closest to the moon, the combination of the gravitational pull of the moon and inertial force causes a(n)

_____ in the water toward the moon.

53. Why does water on the side of Earth farthest from the moon bulge away from Earth in the opposite direction?

_____

_____

_____

_____

54. What is the result of these forces on Earth's oceans?

_____

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Satellites of Other Planets

1. What did Galileo discover in 1610?

2. Which two planets do not have moons?

3. What do Saturn, Jupiter, Uranus, and Neptune have in addition to moons?

MOONS OF MARS

4. Name the moons of Mars and describe their orbits.

5. Describe the physical appearance of Mars's moons.

6. Explain why astronomers think that the moons of Mars are fairly old.

MOONS OF JUPITER

_____ **7.** What are the four largest moons of Jupiter known as?
- **a.** Galilean moons
- **b.** Jovian satellites
- **c.** gas-giant moons
- **d.** king's satellites

_____ **8.** How do Jupiter's four largest moons compare to Earth's moon?
- **a.** Two are larger.
- **b.** One is smaller.
- **c.** They all are larger.
- **d.** They all are smaller.

_____ **9.** The innermost of Jupiter's four large moons is
- **a.** Ganymede.
- **b.** Io.
- **c.** Callisto.
- **d.** Europa.

_____ **10.** An engineer examining images from the Voyager spacecraft discovered
- **a.** another large moon.
- **b.** a crust of ice on Io.
- **c.** volcanoes on our moon.
- **d.** volcanoes on Io.

_____ **11.** The lava on Io is much hotter than that on Earth because the lava there has more
- **a.** hydrogen and iron.
- **b.** magnesium and magma.
- **c.** nickel and sulfur.
- **d.** magnesium and iron.

_____ **12.** Why do scientists think Io's volcanic material is mostly sulfur and sulfur dioxide?
- **a.** because parts of its surface are dark and smooth
- **b.** because most of its surface is covered by craters
- **c.** because parts of its surface are yellow-red
- **d.** because most of its surface is covered by ice

_____ **13.** Io moves inward and outward in its orbit around Jupiter because of
- **a.** the gravitational pull of Jupiter's other moons.
- **b.** the force of its own inertia.
- **c.** Jupiter's gravitational pull.
- **d.** Jupiter's magnetic field.

_____ **14.** The in and out movements, caused by the difference between the force on one side of Io and that on the other side, are called
a. ionic forces.
b. gravitational forces.
c. tidal forces.
d. magnetic forces.

_____ **15.** The forces that pull Io back and forth cause its surface to also
a. develop craters.
b. move in and out.
c. revolve more slowly.
d. attract other moons.

_____ **16.** The flexing of Io's surface causes friction that heats and melts Io's interior, leading to
a. inertia.
b. volcanism.
c. tidal forces.
d. magnetism.

_____ **17.** Data from the *Galileo* spacecraft show that Io has a(n)
a. iron core and a polar ice cap.
b. magnetic field and an icy crust.
c. iron core and perhaps a magnetic field.
d. magnetic field and perhaps a rock core.

_____ **18.** What is Europa?
a. the moon closest to Jupiter
b. the second closest Galilean moon to Jupiter
c. the third closest Galilean moon to Jupiter
d. the fourth closest Galilean moon to Jupiter

_____ **19.** How does this moon compare with Earth's moon?
a. It is about the same size but much more dense.
b. It is smaller and much less dense.
c. It is bigger and much more dense.
d. It is about the same size, but much less dense.

_____ **20.** Scientists think Europa has a rock core that is covered with
a. a thick layer of ice.
b. oceans and seas.
c. a thick crust of rock.
d. rivers of lava.

_____ **21.** What do scientists think might exist under Europa's surface layer?

a. petroleum and perhaps coal
b. liquid water and perhaps petroleum
c. coal and perhaps simple forms of life
d. liquid water and perhaps simple forms of life

22. The third Galilean moon from Jupiter is _____.

23. Why does the third Galilean moon have a relatively small mass although it is the largest moon in the solar system?

_____

24. What are three features that appear on images of Ganymede's surface?

_____

_____

_____

25. What do Io and Ganymede possess, that the other two Galilean moons do not?

_____

26. The farthest Galilean moon from Jupiter is _____.

27. In what ways is the farthest Galilean moon similar to Ganymede?

_____

_____

28. Callisto has a surface covered with _____ that are the result of collisions that occurred early in the history of the solar system.

MOONS OF SATURN

_____ **29.** How many moons does Saturn have?

a. 15
b. more than 75
c. at least 30
d. less than 100

_____ **30.** Only Jupiter's moon Ganymede is larger than Saturn's largest moon, which is

a. Olympus.
b. Janus.
c. Titan.
d. Io.

_____ **31.** Unlike any other moon in our solar system, Titan has
- **a.** an atmosphere made of nitrogen.
- **b.** an atmosphere made of oxygen.
- **c.** oceans filled with water.
- d. a core made of water.

_____ **32.** Titan's surface may contain lakes or oceans of
- **a.** liquid water.
- **b.** solid lava.
- **c.** liquid methane.
- **d.** frozen gases.

_____ **33.** In 2005, what space probe gathered information about Titan's atmosphere?
- **a.** *Galileo*
- **b.** *Apollo*
- **c.** *Cassini*
- **d.** *Huygens*

_____ **34.** What shape characterizes Saturn's smaller moons?
- **a.** round
- **b.** elliptical
- **c.** irregular
- **d.** elongated

MOONS OF URANUS AND NEPTUNE

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **35.** Triton

_____ **36.** Miranda

_____ **37.** Uranus

_____ **38.** Oberon

_____ **39.** Neptune

- **a.** the fifth of Uranus's moons to be discovered
- **b.** one of Uranus's largest moons
- **c.** planet with a moon named Triton
- **d.** Neptune's icy moon, which travels in a retrograde orbit
- **e.** planet with at least 24 moons

PLUTO'S MOONS

40. How does Pluto differ from other planets?

41. How is Pluto's relationship with its moon Charon unlike the relationships between other planets and their moons?

42. Why does one side of Pluto always face Charon?

RINGS OF THE GAS GIANTS

43. When was Saturn's set of rings discovered?

44. Describe Saturn's rings. What are they composed of?

45. What was the early theory about the origin of Saturn's rings?

46. What is the current theory about the origin of Saturn's rings?

Directed Reading *continued*

47. Describe Jupiter's single ring.

48. How many rings does Uranus have?

49. Describe Neptune's rings.

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Asteroids, Comets, and Meteoroids

1. In addition to the sun, planets, and their moons, what occupies the space in our solar system?

_____

_____

_____

_____

ASTEROIDS

_____ **2.** What are asteroids?
- **a.** small stars outside the solar system
- **b.** rocky bodies that orbit the planets
- **c.** fragments of rock that orbit the sun
- **d.** small bodies of rock and ice with tails

_____ **3.** Most asteroids are found in the asteroid belt located
- **a.** between the orbits of Mars and Jupiter.
- **b.** beyond the orbit of Neptune.
- **c.** in orbit around Earth.
- **d.** between the orbits of Mercury and Venus.

_____ **4.** Concentrated in groups just ahead of and just behind Jupiter as it orbits the sun are the
- **a.** Martian asteroids.
- **b.** Roman asteroids.
- **c.** Turkish asteroids.
- **d.** Trojan asteroids.

_____ **5.** The composition of asteroids is similar to that of the
- **a.** inner planets.
- **b.** gas giants.
- **c.** comets.
- **d.** outer planets.

_____ **6.** For what reason do many astronomers think that asteroids in the asteroid belt were not able to form a planet?
- **a.** because of the strong gravitational force of Mars
- **b.** because of the strong gravitational force of Jupiter
- **c.** because of the tidal forces of the outer planets
- **d.** because of the inertia of the inner planets

_____ **7.** The total mass of all asteroids, including that of the largest, is less than the mass of
- **a.** both of Mars's moons.
- **b.** Earth's moon.
- **c.** the head of a comet.
- **d.** the *Voyager* spacecraft.

Use the terms from the list below to complete the sentences that follow. Each term may be used only once. Some terms may not be used.

Mars	ellipses	carbon
iron	planets	asteroids
composition	Ceres	Earth

8. The largest of the smaller bodies in the solar system are _____.

9. The orbits of asteroids, like those of the planets, are _____.

10. The largest known asteroid, _____, is about 1,000 km.

11. The closest asteroids to the sun are inside the orbit of _____.

12. Asteroids are classified according to their _____.

13. One type of asteroid is composed of nickel and _____, making them appear shiny and metallic.

14. Another group of asteroids is made mostly of _____, which gives them a dark color.

15. What are near-Earth asteroids?

_____

_____

_____

16. Why has interest in near-Earth asteroids increased in recent years?

_____

_____

_____

17. What do scientists hope to accomplish by identifying and monitoring near-Earth asteroids?

_____

_____

_____

COMETS

_____ **18.** What is a comet?
- **a.** a natural body that revolves around a planet
- **b.** a ring of pieces of rock and ice around a planet
- **c.** the largest of the smaller bodies in the solar system
- **d.** a small body of ice, rock, and cosmic dust that orbits the sun

_____ **19.** What kind of orbit do comets follow?.
- **a.** fast
- **b.** slow
- **c.** circular
- **d.** elliptical

_____ **20.** Halley's comet passes by Earth in its orbit every
- **a.** month.
- **b.** year.
- **c.** 76 years.
- **d.** 67 years.

_____ **21.** A comet's spectacular tails form when
- **a.** sunlight changes the comet's ice to gas.
- **b.** sunlight is reflected from the coma.
- **c.** moonlight is reflected from the comet.
- **d.** gravity pulls gas from the comet.

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ **22.** nucleus

_____ **23.** coma

_____ **24.** head

_____ **25.** ion tail

_____ **26.** dust tail

- **a.** streams from the comet's head and always points away from the sun
- **b.** is composed of rock, ice, and metals
- **c.** is made up of the nucleus and coma
- **d.** curves backward along the comet's orbit
- **e.** surrounds the nucleus in a spherical cloud of gas dust and reflects sunlight

Directed Reading *continued*

27. Describe the Oort cloud.

28. Where is the Oort cloud located?

29. The gravity of a star that passes near the solar system may cause a comet to fall into a more elliptical _____ around the sun.

30. Name the flat region beyond Neptune's orbit that contains leftover planetesimals.

31. What are the many thousands of bodies located within this belt, including Pluto, called?

32. What is the difference between long-period and short-period comets?

33. What has forced some comets that originated in the Kuiper Belt outward into the Oort cloud?

34. Give an example of a short-period comet.

METEOROIDS

35. What are meteoroids?

36. How do scientists think that most meteoroids originate?

37. What happens when a meteoroid enters Earth's atmosphere?

38. Why do meteor showers occur at about the same time each year?

In the space provided, write the letter of the description that best matches the term or phrase.

_____ **39.** meteor

_____ **40.** shooting star

_____ **41.** fireball

_____ **42.** meteor shower

_____ **43.** meteorite

_____ **44.** stony meteorite

_____ **45.** iron meteorite

_____ **46.** stony-iron meteorite

a. a meteoroid that vaporizes very quickly in a brilliant flash of light

b. a bright streak of light that results when a meteoroid burns up in Earth's atmosphere

c. a meteorite similar in composition to rocks on Earth that may contain carbon compounds

d. the rarest type of meteorite

e. a meteoroid or any part of a meteoroid that is left when it hits Earth

f. a meteorite with a distinctive metallic appearance

g. a common name for a meteor

h. a large number of meteoroids entering Earth's atmosphere in a short period of time

47. Where do astronomers think that most meteorites come from?

_____

48. Why are the oldest meteorites important?

_____

_____

_____

49. Where do some rare meteorites originate?

_____

50. According to computer simulations, how do these rare meteorites reach Earth?

_____

_____

_____

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Structure of the Sun

1. From what did people once believe the sun's energy comes?

_____

_____

2. About how long ago did scientists discover that the sun's energy is quite different from fire?

_____

_____

THE SUN'S ENERGY

_____ **3.** What does the sun look like to the unaided eye?
- **a.** a dazzling, brilliant ball that has no distinct features
- **b.** a bright disc with ridges and valleys
- **c.** a dazzling ball with seas and dark areas
- **d.** a softly glowing sphere with flaming edges

_____ **4.** Why do astronomers use special filters to look at the sun?
- **a.** The sun seems only one color otherwise.
- **b.** No telescope can view the sun otherwise.
- **c.** The sun's brightness can damage your eyes.
- **d.** They view the sun only at night.

_____ **5.** What do scientists use to break up the sun's light into a spectrum?
- **a.** a spectrometer
- **b.** a spectrograph
- **c.** a spectra-reader
- **d.** a light graphometer

_____ **6.** What causes dark lines to form in the spectra of stars?
- **a.** Gases in the stars' interiors emit specific wavelengths of light.
- **b.** Gases in the stars' outer layers absorb specific wavelengths of light.
- **c.** Magnetic currents in the stars' outer layers distort wavelengths of light.
- **d.** Gases in the stars' outer layers emit specific wavelengths of light.

_____ **7.** What factors determine which gases produce visible spectral lines?
- **a.** the size of the star
- **b.** the elements in a star
- **c.** the type of spectrograph that is used
- **d.** the temperature of a star's outer layers

_____ **8.** What important factor can be determined by studying the spectrum a star?
- **a.** the amounts of elements that are not contained in the star
- **b.** the rate at which gases are released into a star's atmosphere
- **c.** the numbers of gases that are present in a star's atmosphere
- **d.** the amounts of elements that are present in a star's atmosphere

_____ **9.** How can scientists deduce the temperature, density, and pressure of a gas in a star's surface?
- **a.** by studying the spectrum of the star
- **b.** by studying the spectrum of nearby stars
- **c.** by studying the brightness of the star
- **d.** by calculating the size of the star

_____ **10.** To identify the elements in a star's atmosphere, scientists
- **a.** match the spectral lines of starlight against the spectra from known stars.
- **b.** match the spectral lines of starlight to those of Earth's elements.
- **c.** match the spectral lines of starlight against the spectra of gases in Earth's atmosphere.
- **d.** match the spectral lines of starlight to one another.

_____ **11.** Why does matching the spectral lines of starlight to those of Earth's elements enable scientists to identify the elements in a star's atmosphere?
- **a.** Groups of elements have the same spectral lines.
- **b.** Individual elements may have the same spectral lines.
- **c.** Each element has a unique pattern of spectral lines.
- **d.** Each group of elements has unique spectral lines.

_____ **12.** What element makes up about 75% of the sun's mass?
- **a.** helium
- **b.** iron
- **c.** hydrogen
- **d.** radium

_____ **13.** How much of the sun's total mass is composed of hydrogen and helium?
- **a.** about 75%
- **b.** about 85%
- **c.** about 90%
- **d.** about 99%

_____ **14.** The sun's spectrum reveals that it contains
- **a.** almost nothing besides hydrogen.
- **b.** almost all chemical elements.
- **c.** only hydrogen and helium.
- **d.** hydrogen, helium, oxygen, and carbon.

_____ **15.** What atomic process combines nuclei of small atoms to form more-massive nuclei?
- **a.** nuclear fission
- **b.** nuclear fusion
- **c.** nuclear half-life
- **d.** nuclear decay

_____ **16.** Nuclei of which atoms are the primary fuel for the sun?
- **a.** hydrogen
- **b.** helium
- **c.** protons
- **d.** electrons

17. What is the common makeup of a hydrogen atom?

_____

18. What happens inside the sun to the electrons in hydrogen atoms?

_____

19. How many steps occur in nuclear fusion inside the sun?

_____

20. Describe the first step of nuclear fusion.

_____

21. What happens to the charge of one hydrogen proton?

_____

22. What is a particle that is emitted by one proton?

_____

23. What is the result of the first step of fusion?

_____

_____

24. Describe the second step of nuclear fusion.

_____

_____

25. Describe the third step of nuclear fusion.

26. What is released in the fusion of two two-proton-one-neutron nuclei?

27. What particles are fused together to form a helium nucleus?

28. How often is energy released during nuclear fusion?

29. When hydrogen fusion occurs in the sun, what is always one of the final products?

30. How does the mass of a helium nucleus compare with the mass of the hydrogen nuclei that fused to form it?

31. What is converted into energy during the series of fusion reactions that form helium nuclei inside the sun?

32. What causes the sun to shine and gives the sun its high temperature?

MASS CHANGING INTO ENERGY

_____**33.** In 1905, Albert Einstein proposed that a

- **a.** small amount of matter yields a large amount of energy.
- **b.** large amount of matter was equal to a large amount of energy.
- **c.** large amount of matter yields a small amount of energy.
- **d.** small amount of matter was equal to a small amount of energy.

_____**34.** At the time of Einstein's 1905 proposal, what two factors were unknown?
- **a.** nuclear fission and electrons
- **b.** energy and an atom's nucleus
- **c.** energy and matter
- **d.** nuclear fusion and the nucleus of the atom

_____**35.** Einstein's proposal was
- **a.** part of his special theory of relativity.
- **b.** part of his general theory of physics.
- **c.** his basic theory about the makeup of atoms.
- **d.** part of his special theory of energy.

_____**36.** What equation is part of Einstein's theory?
- **a.** $E=mc$
- **b.** $E^2=mc$
- **c.** $E=mc^2$
- **d.** $E=m^2c$

_____**37.** In the equation $E = mc^2$, "E" represents
- **a.** mass, or the amount of matter.
- **b.** a constant.
- **c.** matter.
- **d.** energy produced.

_____**38.** In the equation $E=mc^2$, "m" represents
- **a.** the total mass in the universe.
- **b.** the mass of one ounce of lead.
- **c.** mass, or the amount of matter that is changed.
- **d.** the amount of matter that remains.

_____**39.** In the equation $E=mc^2$, "c" represents
- **a.** energy.
- **b.** matter.
- **c.** the diameter of the sun.
- **d.** the speed of light.

_____**40.** What is the speed of light?
- **a.** 300,000 km/hr
- **b.** 300,000 km/s
- **c.** 300,000 m/hr
- **d.** 300,000 m/s

41. What can Einstein's equation be used to calculate?

_____

_____

42. How much hydrogen is changed into helium in the sun every second?

_____

43. What subatomic particle is given off during fusion?

_____

44. How long does it take neutrinos that escape from the sun to reach Earth?

_____

45. What does the study of neutrinos indicate?

_____

_____

THE SUN'S INTERIOR

In the space provided, write the letter of the temperature that matches the part of the sun.

_____ **46.** core

_____ **47.** chromosphere

_____ **48.** sunspot

_____ **49.** radiative zone

_____ **50.** corona

_____ **51.** photosphere

_____ **52.** convective zone

a. 3,800°C
b. 6,000°C
c. 4,000°C to 50,000°C
d. 1,000,000°C
e. 2,000,000° C
f. 2,000,000° C to 7,000,000°C
g. 15,000,000°C

_____ **53.** What has revealed what the invisible layers of the sun may be like?
- **a.** the solar wind
- **b.** neutrinos
- **c.** computer models
- **d.** the sun's corona

_____ **54.** In recent years, more detail has been learned about what is happening inside the sun by careful studies of
- **a.** motions in the sun's corona.
- **b.** motions on the sun's surface.
- **c.** movement of sunspots.
- **d.** changes in energy from the sun.

_____ **55.** What is the size of the sun's core?

a. 25% of 1,390 km
b. 25% of 13,900 km
c. 25% of 139,000 km
d. 25% of 1,390,000 km

56. What is the sun's core made up of?

57. How does the mass of the sun compare with the mass of Earth?

58. What effect does the sun's large mass have on the density of the sun's core?

59. Compare the nuclei of atoms on Earth and in the sun's core.

60. What factors in the sun's core force nuclei close enough to fuse?

61. What is the most common nuclear reaction inside the sun?

62. What zone in the sun's interior surrounds the core, and what is its temperature?

63. In the radiative zone, in what form does energy move outward?

64. What zone surrounds the radiative zone, and what is its temperature?

65. Describe how energy produced in the sun's core moves through the convective zone. Compare the movement to an example on Earth.

66. What causes the movement of gases in the convective zone?

THE SUN'S ATMOSPHERE

_____ **67.** To what does the word atmosphere refer, when applied to the sun?
- **a.** the sheath of air surrounding the sun
- **b.** all of the gases that make up the sun
- **c.** the uppermost region of solar gases
- **d.** the regions of gases above the sun's core

_____ **68.** What are the three layers of the sun's atmosphere?
- **a.** ionosphere, troposphere, stratosphere
- **b.** photosphere, chromosphere, convection zone
- **c.** photosphere, chromosphere, corona
- **d.** core, corona, photosphere

_____ **69.** What is the innermost layer of the solar atmosphere called?
- **a.** photosphere
- **b.** chromosphere
- **c.** corona
- **d.** solar wind

70. What is the sun's photosphere?

71. Why are we able to see the photosphere from Earth?

72. What are sunspots?

73. What layer lies above the photosphere? How did this layer get its name?

Directed Reading *continued*

74. How do gases move in the chromosphere?

75. Describe the upward movement of gas in the chromosphere.

76. How do spacecraft study the sun?

77. What is the outermost layer of the sun's atmosphere called?

78. Describe the size and temperature of the corona.

79. How can the corona stop most subatomic particles from escaping into space, even though it is not very dense?

80. Under what condition may the corona be visible during the day?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Solar Activity

1. How do the gases that make up the sun's interior and atmosphere behave?

_____

2. What causes the continuous rising and sinking of the sun's gases?

_____

_____

_____

3. What else keeps the sun's gases in motion?

_____

_____

4. Why don't all locations on the sun rotate at the same speed?

_____

_____

5. On average, how long does it take the sun to rotate once?

_____

_____

SUNSPOTS

_____ **6.** What do the movements of gases in the sun's convective zone and the movements caused by the sun's rotation produce?

a. solar wind
b. convection currents
c. charged ions
d. magnetic fields

_____ **7.** Why are some regions of the photosphere so much cooler than others?

a. The sun's surface temperatures vary wildly.
b. Less energy is being transferred to the regions.
c. Changes in the magnetic fields reduce heat.
d. More energy is being transferred to the regions.

_____ **8.** How much cooler are the cool regions than the surrounding photosphere?
- **a.** up to 3,000,000°C
- **b.** up to 300,000°C
- **c.** up to 30,000°C
- **d.** up to 3,000°C

9. What is a sunspot?

_____

_____

10. What is granulation?

_____

_____

11. How might the diameter of a large sunspot compare to the size of Earth?

_____

_____

THE SUNSPOT CYCLE

_____ **12.** What did sunspots first reveal about the sun?
- **a.** The sun rotates.
- **b.** The sun is not made of fire.
- **c.** The sun is fueled by nuclear fusion.
- **d.** The sun has a core.

_____ **13.** Later, astronomers learned that the numbers and positions of sunspots vary in a cycle that lasts about
- **a.** 75 years.
- **b.** 50 years.
- **c.** 27 years.
- **d.** 11 years.

_____ **14.** A sunspot cycle begins when
- **a.** there is a sudden increase in the number of sunspots all across the sun.
- **b.** the number of sunspots is very high but begins to decrease.
- **c.** the number of sunspots is very low but begins to increase.
- **d.** the location of sunspots on the sun suddenly changes.

_____ **15.** Where do groups of sunspots initially appear?
- **a.** at the sun's poles
- **b.** at the sun's equator
- **c.** all across the sun's surface
- **d.** about midway between the sun's equator and poles

_____ **16.** Over the next few years after they appear, the number of sunspots
- **a.** increases until they reach a peak of 10 to 20 sunspots.
- **b.** increases until they reach a peak of more than 100 sunspots.
- **c.** decreases steadily until there are no sunspots at all.
- **d.** stabilizes between 40 and 50 sunspots.

17. What happens after the number of sunspots reaches its peak?

_____

_____

_____

_____

18. At what point does the sunspot cycle end and begin again?

_____

_____

_____

SOLAR EJECTIONS

_____ **19.** The solar-activity cycle is caused by
- **a.** the alignment of solar system planets.
- **b.** the changing solar magnetic field.
- **c.** the rate at which fusion occurs in the solar core.
- **d.** the changing pattern of currents in the convective layer.

_____ **20.** The solar-activity cycle is characterized by
- **a.** decreases in solar surface events.
- **b.** increases in solar surface events.
- **c.** increases and decreases in sunspot activity.
- **d.** increases and decreases in various types of solar activities.

_____ **21.** What are events in which the sun emits atomic particles called?
- **a.** solar cycles
- **b.** solar eruptions
- **c.** solar ejections
- **d.** solar events

_____**22.** One form of atmospheric disturbance on the sun is called a prominence, which can be described as
- **a.** whirlpools in the photosphere.
- **b.** huge clouds of glowing gases.
- **c.** rivers of gas that look like streams.
- **d.** dark regions in the photosphere.

_____**23.** What shape do prominences take?
- **a.** huge arches that reach high above the sun's surface
- **b.** huge circular storms on the sun's surface
- **c.** massive waves that cross the sun's surface
- **d.** giant masses of gas that resemble mountains

_____**24.** How does each solar prominence get its shape?
- **a.** It follows curved lines of magnetic force from a region of one magnetic polarity to a field of the same polarity.
- **b.** It erupts from the sun's surface but is pulled back down by the sun's gravity, forming a curve.
- **c.** It follows the curved shape of the sun's surface.
- **d.** It follows curved lines of magnetic force from a region of one magnetic polarity to a field of the opposite polarity.

_____**25.** What are the most violent of all solar disturbances?
- **a.** prominences
- **b.** sunspots
- **c.** solar flares
- **d.** coronal mass ejections

_____ **26.** A solar flare is a
- **a.** sudden outward eruption of electrically charged particles, such as electrons and protons.
- **b.** brief outward eruption of atomic particles, such as protons and neutrinos.
- **c.** gradual increase in the stream of charged particles that make up the solar wind.
- **d.** huge, arched prominence that breaks its magnetic field and streams outward.

_____ **27.** Although the trigger for a solar flare is unknown, scientists know that
- **a.** solar flares occur on a regular cycle that lasts about two years.
- **b.** solar flares release the energy stored in the strong magnetic fields of sunspots.
- **c.** solar flares are closely associated with the alignment of the planets in the solar system.
- **d.** solar flares are so powerful that they can be seen clearly in daytime.

_____**28.** What can be formed by the release of energy in a solar flare?
- **a.** prominences
- **b.** coronal streams
- **c.** coronal loops
- **d.** waves in the solar wind

_____**29.** How long do most solar flares last?
- **a.** Few eruptions last more than an hour.
- **b.** Most eruptions last for two or three hours.
- **c.** Few eruptions last more than a minute.
- **d.** Most eruptions last for a week.

_____**30.** A coronal mass ejection is
- **a.** a part of the corona that is thrown off from the sun.
- **b.** a part of a coronal loop that does not curve back to the sun.
- **c.** a prominence that breaks away from its magnetic field.
- **d.** another name for a certain type of solar flare.

_____**31.** What is the space around Earth that contains a magnetic field?
- **a.** the magnetometer
- **b.** the magnetic corona
- **c.** the magnetosphere
- **d.** the magnet band

32. What are geomagnetic storms? What are they caused by?

_____

_____

33. With what frequency do geomagnetic storms occur?

_____

_____

_____

AURORAS

_____**34.** What are auroras?
- **a.** halos of light around stars and the moon
- **b.** long arches of gas on the sun's surface
- **c.** electromagnetic sparks in the sun's atmosphere
- **d.** bands of light in the sky

_____**35.** How are auroras caused?
- **a.** They are caused by the interaction of solar wind and Earth's magnetosphere.
- **b.** They are caused by the interaction of solar wind and Earth's atmosphere.
- **c.** The solar wind bends around Earth.
- **d.** The solar wind changes as it gets farther from the sun.

_____**36.** Where on Earth are auroras usually seen?
- **a.** near Earth's equator
- **b.** everywhere in Earth's atmosphere
- **c.** close to Earth's magnetic poles
- **d.** only in Earth's northern hemisphere

_____**37.** Why are auroras usually seen close to Earth's magnetic poles?
- **a.** Electrically charged particles reach only Earth's magnetic poles.
- **b.** Electrically charged particles are guided toward the poles by the planet's rotation.
- **c.** Electrically charged particles are guided toward Earth's magnetic poles by Earth's magnetosphere.
- **d.** Electrically charged particles are more easily seen through the thin air near the poles.

_____**38.** How does the solar wind produce the colorful sheets of light?
- **a.** Electrically charged particles heat up in Earth's atmosphere and begin to glow.
- **b.** Electrically charged particles strike the atoms and gas molecules in the upper atmosphere.
- **c.** Electrically charged particles enter the magnetosphere and begin to glow.
- **d.** Electrically charged particles explode once they are in contact with the atoms and gases of the atmosphere.

_____**39.** What are auroras near the north pole called?
- **a.** aurora borealis (eastern lights)
- **b.** aurora australis (aurora occidentalis)
- **c.** aurora borealis (northern lights)
- **d.** aurora australis (southern lights)

_____**40.** What are auroras near the south pole called?
- **a.** aurora borealis (eastern lights)
- **b.** aurora australis (aurora occidentalis)
- **c.** aurora borealis (northern lights)
- **d.** aurora australis (southern lights)

Directed Reading *continued*

41. How far above Earth's surface do auroras normally occur?

42. When are auroras most frequent?

43. How often are auroras visible across the northern contiguous United States?

44. Where in the United States are auroras visible almost every clear, dark night?

45. In addition to Earth, where else have auroras been recorded?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Characteristics of Stars

1. What is a star?

_____

_____

2. How does the color of stars seen from Earth differ from their actual color?

_____

_____

ANALYZING STARLIGHT

_____ **3.** How do astronomers learn about stars?
- **a.** by analyzing the sounds that stars absorb
- **b.** by analyzing the light that stars emit
- **c.** by analyzing the sounds that stars emit
- **d.** by analyzing the light that stars absorb

_____ **4.** What are spectrographs?
- **a.** devices that separate light into different colors
- **b.** devices that separate light into different gases
- **c.** graphs that separate light into different spectra
- **d.** devices that gather light into different spectra

_____ **5.** What are the three types of spectra?
- **a.** remission, bright-line, and contiguous
- **b.** emission, absorption, and composite
- **c.** emission, absorption, and continuous
- **d.** transmission, abduction, and continuous

_____ **6.** What does a star's dark-line spectrum reveal?
- **a.** the star's distance and size
- **b.** the star's composition and magnitude
- **c.** the star's texture and temperature
- **d.** the star's composition and temperature

_____ **7.** What is true of the layers of a star?
- **a.** the inner layers are very cool, the outer layers are somewhat cool
- **b.** the outer layers are very hot, the inner layers are somewhat cooler
- **c.** the inner layers are very hot, the outer layers are somewhat cooler
- **d.** the outer layers are very hot, the inner layers are somewhat hot

_____ **8.** Elements in the outer layers of a star absorb
- **a.** some of the light radiating from within the star.
- **b.** some of the light radiating from outside the star.
- **c.** none of the light radiating from outside the star.
- **d.** none of the light radiating from inside the star.

THE COMPOSITIONS OF STARS

9. What do the colors and lines in the spectrum of a star indicate?

_____

_____

10. What is the most common element in stars? What is the second most common element?

_____

THE TEMPERATURES OF STARS

In the space provided, write the letter of the color that best matches the surface temperature of a star.

_____ **11.** less than 3,500°C

_____ **12.** 10,000–30,000°C

_____ **13.** 3,500–5,000°C

_____ **14.** 5,000–6,000°C

_____ **15.** 7,500–10,000°C

- **a.** orange
- **b.** red
- **c.** yellow
- **d.** blue-white
- **e.** white

16. What is indicated by a star's color?

_____

17. What color are the coolest stars?

_____

THE SIZES AND MASSES OF STARS

_____ **18.** What is the diameter of the sun?
- **a.** 1,390,000 km
- **b.** 11,390,000 km
- **c.** 1,390,000 miles
- **d.** 390,000 km

_____ **19.** Stars that are very dense may have
- **a.** greater temperature than the sun and still be much larger.
- **b.** less mass than the sun and still be much smaller than the sun.
- **c.** more mass than the sun and still be much smaller than the sun.
- **d.** lower temperature than the sun and still be much larger.

STELLAR MOTION

_____ **20.** What two kinds of motion are associated with stars?
- **a.** inferred motion and actual motion
- **b.** actual motion and apparent motion
- **c.** actual motion and imagined motion
- **d.** inferred motion and apparent motion

_____ **21.** What causes the apparent motion of the stars, which we can see with the unaided eye?
- **a.** the actual movement of the stars
- **b.** the movement of the skies
- **c.** the movement of the sun
- **d.** the movement of the Earth

_____ **22.** What causes the circular trails of light seen in long-exposure photographs of the stars?
- **a.** the revolution of the stars around the North Pole
- **b.** the rotation of Earth on its axis
- **c.** the revolution of Earth around the sun
- **d.** the rotation of the stars on their axes

_____ **23.** In the Northern Hemisphere, the movement of stars called circumpolar stars makes them appear
- **a.** to be extremely distant.
- **b.** to circle the sun.
- **c.** to circle Polaris, the North Star.
- **d.** to circle Mars and Venus.

_____ **24.** What is true of all visible stars at the North Pole?
- **a.** They are visible at the South Pole.
- **b.** They are circumpolar.
- **c.** They are perpendicular.
- **d.** They are brighter than the sun.

25. What are three types of actual motion that stars may have?

_____

_____

_____

26. What is the Doppler effect?

27. What does the fact that most distant galaxies have red-shifted spectra indicate?

DISTANCES TO STARS

_____ **28.** What is a light-year?
- **a.** the distance that light travels in one year
- **b.** the same as the speed of light
- **c.** the amount of time it takes light to travel one mile
- **d.** the distance that light travels in one second

_____ **29.** How many kilometers does light travel in one year?
- **a.** 300,000 km
- **b.** 9.46 billion km
- **c.** 700 trillion km
- **d.** 9.46 trillion km

_____ **30.** When we witness an event on the sun, when did it actually take place?
- **a.** about 8 minutes before we saw it
- **b.** about 80 years ago
- **c.** about 8 light-years before we saw it
- **d.** about 8 years before we saw it

_____ **31.** Except for the sun, what star is nearest to Earth?
- **a.** Polaris
- **b.** Proxima Centauri
- **c.** Alpha Centauri
- **d.** Jupiter

32. What is parallax and how do scientists use it?

33. How close must a star be in order for scientists to calculate its distance by measuring parallax?

STELLAR BRIGHTNESS

_____ **34.** How many stars can be seen without a telescope on Earth?

a. about 6,000
b. more than 3 billion
c. less than 1,000
d. more than 3 trillion

_____ **35.** What is the Hubble Space Telescope?

a. a sun-orbiting telescope
b. an Earth-orbiting telescope
c. a land-based telescope
d. a telescope on a rocket

36. What is a star's apparent magnitude?

37. What is a star's absolute magnitude?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Stellar Evolution

_____ **1.** Why are astronomers not able to observe the entire life of any star?
- **a.** because of the movement of stars
- **b.** because a star typically exists for billions of years
- **c.** because the light of stars reaches Earth millions of years later
- **d.** because a star typically does not exist long enough to be observed

CLASSIFYING STARS

2. What is luminosity?

_____

_____

3. What is the Hertzsprung-Russell diagram?

_____

_____

_____

4. What is plotted on the horizontal axis and the vertical axis of the H-R diagram?

_____

_____

5. What is the main sequence?

_____

_____

_____

_____

STAR FORMATION

_____ **6.** What is a nebula?
- **a.** a cloud of gas and dust where a star begins
- **b.** an explosion where dust collects
- **c.** a false image of a star
- **d.** a group of planets where a star begins

_____ **7.** What is Newton's law of universal gravitation?

a. None of the objects in the universe attract each other through gravitational force.

b. All objects in the universe attract each other through magnetic force.

c. None of the objects in the universe attract each other through magnetic force.

d. All objects in the universe attract each other through gravitational force.

_____ **8.** Gravitational force increases as the mass of an object

a. decreases or as the distance between two objects decreases.

b. increases or as the distance between two objects increases.

c. increases or as the distance between two objects decreases.

d. decreases or as the distance between two objects increases.

9. What is a protostar?

10. What happens as more matter is pulled into a protostar?

11. What is important about the onset of fusion?

12. What happens as gravity increases the pressure on the matter within a star?

13. What does the equilibrium between the outward pressures of radiation and the force of gravity do?

14. How long does a main sequence star maintain a stable size?

THE MAIN-SEQUENCE STAGE

_____ **15.** What is the second and longest stage in the life of a star?

a. the fusion stage
b. the stellar equilibrium stage
c. the main-sequence stage
d. the nebula stage

_____ **16.** A star that has the same mass as the sun's mass

a. stays on the main sequence for about 10 million years.
b. stays on the main sequence for about 10 billion years.
c. stays on the main sequence for about 14 billion years.
d. stays on the main sequence for about 100 billion years.

LEAVING THE MAIN SEQUENCE

17. When does a star enter its third stage?

18. What does increased temperature from contraction in the core cause the helium core to do?

19. Describe the stars known as giants and their place on the H-R diagram.

20. What are supergiants?

THE FINAL STAGES OF A SUNLIKE STAR

_____ **21.** What is a planetary nebula?

a. a cloud of gas that forms around a sunlike star that is dying
b. a cloud of gas that forms as a star is born
c. a cloud of energy that is hard to identify
d. a cloud of helium that forms around a star that is starting to fuse

_____ **22.** What is a white dwarf?
- **a.** a cool, extremely scattered core of matter leftover from an old star
- **b.** a hot, extremely scattered core of matter leftover from a red giant
- **c.** a hot, extremely dense core of matter leftover from an old star
- **d.** a cool, extremely dense core of matter leftover from a red giant

_____ **23.** What is a black dwarf?
- **a.** a white dwarf that no longer gives off light
- **b.** a white dwarf that starts to give off more light
- **c.** a black star that becomes a white dwarf
- **d.** a star that is dying

_____ **24.** An explosion on a white dwarf caused by a pressure build-up is a
- **a.** red giant.
- **b.** black dwarf.
- **c.** supergiant.
- **d.** nova.

_____ **25.** What effect may a nova have on a star?
- **a.** It may cause it to become many thousands of times brighter.
- **b.** It may destroy the star.
- **c.** It may cause it to turn into a giant.
- **d.** It may cause it to become many thousands of times dimmer.

26. Describe a supernova and how it differs from a nova.

_____

_____

_____

_____

_____

THE FINAL STAGES OF MASSIVE STARS

_____ **27.** Stars that have masses of more than 8 times the sun's mass produce supernovas
- **a.** with the help of a secondary star.
- **b.** rarely.
- **c.** without needing a secondary star to fuel them.
- **d.** on a regular basis.

_____ **28.** After the supergiant stage, massive stars contract with a gravitational force that is
- **a.** a much less than that of small-mass stars.
- **b.** much greater than that of large-mass stars.
- **c.** much less than that of white dwarf stars.
- **d.** much greater than that of small mass stars.

29. What happens when the core uses up its fuel?

30. What is a neutron star?

31. What is a pulsar?

32. Describe how a black hole forms.

33. Why is locating black holes difficult?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: Star Groups

_____ **1.** How many stars make up the universe?
- **a.** hundreds
- **b.** thousands
- **c.** millions
- **d.** trillions

CONSTELLATIONS

_____ **2.** Although the stars that make up a pattern appear to be close together,
- **a.** they are not all the same distance from Earth.
- **b.** they are not all stars.
- **c.** they are all the same distance from Earth.
- **d.** they are not all visible from Earth.

_____ **3.** If you look at the same region of the sky for several nights, the positions of the stars
- **a.** appear to change in relation to one another.
- **b.** appear to change some in relation to the sun.
- **c.** do not appear to change in relation to one another.
- **d.** appear to change in relation to the universe.

_____ **4.** Why do the stars appear to be fixed in their patterns?
- **a.** because Earth revolves around the stars
- **b.** because they are actually not moving
- **c.** because of the small distance from which the stars are viewed
- **d.** because of the tremendous distance from which the stars are viewed

_____ **5.** What are the patterns of stars and the region of space around them?
- **a.** consternations
- **b.** consultations
- **c.** constellations
- **d.** galaxies

6. Why are constellations useful?

MULTIPLE-STAR SYSTEMS

_____ **7.** What are binary stars?
- **a.** pairs of stars that revolve around each other and are held together by gravity
- **b.** multiple-star systems that revolve around each other and are held together by gravity
- **c.** pairs of stars that do not revolve around each other but are held together by gravity
- **d.** pairs of stars that revolve around each other and are held together by magnetism

_____ **8.** What is a barycenter?
- **a.** the center of pressure in a star
- **b.** the center of mass in systems of stars
- **c.** the place where a star is hottest
- **d.** the place toward which stars travel

_____ **9.** Where is the barycenter located when binary stars have similar masses?
- **a.** in one of the stars
- **b.** outside both stars
- **c.** in the center of each star
- **d.** somewhere between the stars

10. How many observed stars do astronomers estimate are part of multiple star systems?

_____

STAR CLUSTERS

11. What are clusters?

_____

_____

12. Name and describe two kinds of clusters.

_____

_____

_____

_____

GALAXIES

_____ **13.** What is a galaxy?
- **a.** a large-scale group of planets, stars, and moons bound together by gravity
- **b.** a large-scale group of stars, gas, and dust bound together by gravity
- **c.** a large-scale group of stars, rocks, and dirt bound together by gravity
- **d.** a large-scale group of gas, elements, and atoms bound together by gravity

_____ **14.** What is the diameter of the Milky Way?
- **a.** about 100,000 years
- **b.** about 200 billion miles
- **c.** about 200 billion light-years
- **d.** about 100,000 light-years

_____ **15.** What are Cepheid variables?
- **a.** small stars that fade in a regular pattern
- **b.** giant stars that brighten and fade in an irregular pattern
- **c.** giant stars that brighten and fade in a regular pattern
- **d.** dwarf stars that brighten and fade in a regular pattern

_____ **16.** The longer a Cepheid's cycle,
- **a.** the dimmer the star's visual absolute magnitude.
- **b.** the brighter the star's visual absolute magnitude.
- **c.** the dimmer the star's telescopic magnitude.
- **d.** the brighter the star's apparent non-visual magnitude.

In the space provided, write the letter of the definition that best matches the term or phrase.

_____ **17.** elliptical galaxy

_____ **18.** barred spiral galaxy

_____ **19.** irregular galaxy

_____ **20.** spiral galaxy

- **a.** varies from almost spherical to a stretched out football in shape and has a bright center
- **b.** has a nucleus of bright stars and flattened arms that circle around the nucleus
- **c.** has no particular shape and may have a low total mass
- **d.** has a straight bar of stars that runs through the center

THE MILKY WAY

_____ **21.** What does the Milky Way look like in the night sky?
- **a.** a cloudlike band that stretches across the sky
- **b.** a cloudy mass in the center of the sky
- **c.** a cloudlike elliptical mass
- **d.** a cloudy mass with spiral arms

22. How is the sun related to the Milky Way?

_____

_____

23. How long does it take the sun to orbit around the Milky Way?

_____

24. What are the closest neighbors to the Milky Way?

_____

25. How far from Earth are the Milky Way's closest neighbors?

_____

QUASARS

_____ **26.** When were quasars first discovered?
- **a.** 1663
- **b.** 1963
- **c.** 1863
- **d.** 1763

_____ **27.** What does a quasar look like when viewed through an optical telescope?
- **a.** It appears as a point of light, almost like a small, faint star.
- **b.** It appears as a mass of light, almost like a large, faint star
- **c.** It appears as a point of light, almost like a small, bright star
- **d.** It appears as a mass of light, almost like a large, bright star

_____ **28.** The word quasar is a shortened term for
- **a.** quasi-singular radioactive source.
- **b.** quasi-stellar radio star.
- **c.** quarter-stellar radio star.
- **d.** quasi-stellar radio source.

29. What do some quasars project?

_____

_____

30. Where are quasars located?

31. What could explain the large amount of energy emitted from a quasar?

Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading

Section: The Big Bang Theory

_____ **1.** What is cosmology?
- **a.** the study of the distance, mass, and time of the universe
- **b.** the study of the origin, structure, and future of the universe
- **c.** the study of the stars, planets, and people of the universe
- **d.** the study of how the stars affect Earth and the universe

_____ **2.** Like all scientific theories, the theories about the origin and evolution of the universe
- **a.** are well-established.
- **b.** must constantly be tested against new observations and experiments.
- **c.** are occasionally tested against old observations and experiments.
- **d.** are considered to be true.

_____ **3.** Many current theories of the universe began with observations made
- **a.** more than 300 years ago.
- **b.** more than 100 years ago.
- **c.** less than 100 years ago.
- **d.** less than 10 years ago.

HUBBLE'S OBSERVATIONS

4. What did Hubble discover near the end of the 1920s?

_____

_____

5. What did Hubble find out about the most distant galaxies?

_____

_____

6. What do the spectra of distant galaxies collected today say about Hubble's original findings?

_____

THE BIG BANG THEORY EMERGES

7. Define the big bang theory.

_____

_____

Directed Reading *continued*

8. If you trace the expanding universe back in time, what would you find?

9. In terms of expansion, what is true of the universe today?

10. What is cosmic background radiation?

11. When do astronomers think cosmic background radiation formed?

12. What would the universe have been like soon after the big bang compared with now?

13. What is the temperature of the energy of the background radiation from the big bang?

14. What are the ripples in the cosmic background radiation, and what caused them?

15. What may the ripples in the cosmic background radiation indicate about the early universe?

_____

_____

_____

A UNIVERSE OF SURPRISES

_____ **16.** Analyzing the ripples in cosmic background radiation tells us that the kinds of matter that humans, the planets, the stars, and matter between stars are made of
- **a.** makes up only 73% of the universe.
- **b.** makes up only 23% of the universe.
- **c.** makes up only 4% of the universe.
- **d.** makes up only 32% of the universe.

_____ **17.** What is the type of matter called that does not give off light?
- **a.** dark energy
- **b.** darkness
- **c.** dark matter
- **d.** dark elements

_____ **18.** What is dark energy?
- **a.** Scientists think that it acts as a force that opposes gravity.
- **b.** Scientists think that it is matter that does not give off any light.
- **c.** Scientists think that it acts as a dark force that opposes reality.
- **d.** Scientists think that it acts as a force that opposes magnetism.

_____ **19.** Recent evidence suggests that distant galaxies are
- **a.** closer to Earth than current theory would indicate.
- **b.** moving faster than current theory would indicate.
- **c.** farther from Earth any theory is able to describe.
- **d.** farther from Earth than current theory would indicate.

_____ **20.** Because of dark energy, the universe's rate of expansion
- **a.** seems to be slowing.
- **b.** seems to be undetectable.
- **c.** seems to have stopped.
- **d.** seems to be accelerating.