

California Standards Practice for Earth Sciences



Glencoe



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Table of Contents

To the Student	iv
Test-Taking Tips: Student	v
California Standards for Earth Sciences	vi
Student Recording Chart	ix
Diagnostic Test	1
Standards Practice for Earth Sciences	7
Earth's Place in the Universe:	
Solar System	7
Stars, Galaxies, and the Universe	11
Dynamic Earth Processes	15
Energy in the Earth System:	
Solar Energy Enters, Heat Escapes	18
Ocean and Atmospheric Convection	20
Climate and Weather	24
Biogeochemical Cycles	26
Structure and Composition of the Atmosphere	28
California Geology	30
Sample Test	32

To the Student

Welcome to the Student Edition of *California Standards Practice for Earth Sciences*.

Task Regimen

Task	At-Home Assignment	In-Class Assignment
Task 1	Using an answer key from the teacher, locate and review any questions you missed. Place a question mark beside any question you do not understand, and bring it to class for discussion.	The teacher administers the test in a realistic test-taking environment.
Task 2	For each question you missed, find the pages in the textbook that cover the material and explain what specific information was needed to answer the question correctly. If you cannot find any helpful information in the textbook, write out three questions you have about the test question.	Work in a group to discuss any confusing questions and content areas. Then work through the confusing questions together.
Task 3	For every incorrect question, go through each answer choice and explain why it is correct or incorrect. Include any tips or hints you noticed that helped you eliminate choices. Place a question mark beside any question you do not understand, and bring it to class for discussion.	Your teacher will lead a discussion for each question. Share your ideas and observations with the class. Keep notes of the discussion to help you review.
Task 4	Your teacher will provide you with a list of questions to practice. For each question, make observations and write down all of the information given in the test in the form of a graphic, a passage, or otherwise. Write the information directly on the test.	Work in a group to discuss each question. Make sure to note the location in the textbook where helpful information was found.

Test-Taking Tips: Student

Before the Test

- Be sure to get plenty of sleep the week before the test. A healthy amount of sleep is eight to nine hours every night.
- On the night before the test, try to do something relaxing but stimulating, such as playing a board game, exercising, or reading an enjoyable book. Cramming the night before the test can often hamper your memory and make you tired.
- On the morning of the test, eat a healthy breakfast with fresh foods that are high in protein and carbohydrates.
- On the morning of the test, clear your mind of any outside distractions so that you will be better able to focus on the test. If breaks are given during the test, use that time to relax and clear your mind.

During the Test

- Listen to and read all directions.
- Be sure you understand the question before reading the answer choices. Then, make sure to read and consider **every** answer choice.
- Remember to carefully consider all the information presented in the test's graphics.
- If the test is timed, be sure to pace yourself.
- Always choose an answer. By eliminating as many incorrect choices as possible, you will have a good chance of guessing correctly and obtaining more points.

California Standards for Earth Sciences

Earth's Place in the Universe: Solar System

1. **Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:**
 - a. Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.
 - b. Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.
 - c. Students know the evidence from geological studies of Earth and other planets suggests that the early Earth was very different from Earth today.
 - d. Students know the evidence indicating that the planets are much closer to Earth than the stars are.
 - e. Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
 - f. Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.
 - g.* Students know the evidence for the existence of planets orbiting other stars.

Earth's Place in the Universe: Stars, Galaxies, and the Universe

2. **Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time. As a basis for understanding this concept:**
 - a. Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.
 - b. Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.
 - c. Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.
 - d. Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.
 - e.* Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.
 - f.* Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.
 - g.* Students know how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.

California Standards for Earth Sciences *continued*

Dynamic Earth Processes

3. **Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept:**
 - a. Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
 - b. Students know the principal structures that form at the three different kinds of plate boundaries.
 - c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
 - d. Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
 - e. Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.
 - f.* Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

Energy in the Earth System: Solar Energy Enters, Heat Escapes

4. **Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:**
 - a. Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.
 - b. Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
 - c. Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.
 - d.* Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

Energy in the Earth System: Ocean and Atmospheric Convection

5. **Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:**
 - a. Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
 - b. Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
 - c. Students know the origin and effects of temperature inversions.
 - d. Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.
 - e. Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.
 - f.* Students know the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.
 - g.* Students know features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.

California Standards for Earth Sciences *continued*

Energy in the Earth System: Climate and Weather

6. **Climate is the long-term average of a region’s weather and depends on many factors. As a basis for understanding this concept:**
 - a. Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
 - b. Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.
 - c. Students know how Earth’s climate has changed over time, corresponding to changes in Earth’s geography, atmospheric composition, and other factors, such as solar radiation and plate movement.
 - d.* Students know how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

Biogeochemical Cycles

7. **Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles. As a basis for understanding this concept:**
 - a. Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
 - b. Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.
 - c. Students know the movement of matter among reservoirs is driven by Earth’s internal and external sources of energy.
 - d.* Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.

Structure and Composition of the Atmosphere

8. **Life has changed Earth’s atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:**
 - a. Students know the thermal structure and chemical composition of the atmosphere.
 - b. Students know how the composition of the Earth’s atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.
 - c. Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

California Geology

9. **The geology of California underlies the state’s wealth of natural resources as well as its natural hazards. As a basis for understanding this concept:**
 - a. Students know the resources of major economic importance in California and their relation to California’s geology.
 - b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.
 - c. Students know the importance of water to society, the origins of California’s fresh water, and the relationship between supply and need.
 - d.* Students know how to analyze published geologic hazard maps of California and know how to use the map’s information to identify evidence of geologic events of the past and predict geologic changes in the future.

Name _____

Student Recording Chart

Directions: Circle each question from the Diagnostic Test that you answered *incorrectly*. If there are one or two circles marked for an indicator, write **Yes** in the **Need Practice?** box. Then complete the practice pages for that indicator.

Indicator	1. a.	1. b.	1. c.	1. d.	1. e.	1. f.	1. g.
Test Questions	38	9	46	39	29	24	44
Need Practice?							
Practice Pages	7	7	8	8	9	9	10

Indicator	2. a.	2. b.	2. c.	2. d.	2. e.	2. f.	2. g.
Test Questions	1	30	40	13	42	19	21
Need Practice?							
Practice Pages	11	11	12	12	13	13	14

Indicator	3. a.	3. b.	3. c.	3. d.	3. e.	3. f.
Test Questions	28	10	4	22	17	2
Need Practice?						
Practice Pages	15	15	16	16	17	17

Indicator	4. a.	4. b.	4. c.	4. d.
Test Questions	18	34	33	12
Need Practice?				
Practice Pages	18	18	19	19

Name _____

Student Recording Chart *continued*

Indicator	5. a.	5. b.	5. c.	5. d.	5. e.	5. f.	5. g.
Test Questions	43	20	25	6	16	35	3
Need Practice?							
Practice Pages	20	20	21	21	22	22	23

Indicator	6. a.	6. b.	6. c.	6. d.
Test Questions	11	23	45	32
Need Practice?				
Practice Pages	24	24	25	25

Indicator	7. a.	7. b.	7. c.	7. d.
Test Questions	14	8	27	37
Need Practice?				
Practice Pages	26	26	27	27

Indicator	8. a.	8. b.	8. c.
Test Questions	41	7	5
Need Practice?			
Practice Pages	28	28	29

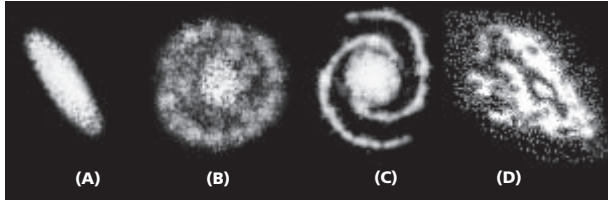
Indicator	9. a.	9. b.	9. c.	9. d.
Test Questions	31	15	36	26
Need Practice?				
Practice Pages	30	30	31	31

Diagnostic Test



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. Which drawing most accurately represents the shape of the Milky Way? **2. a.**



- A.** A
B. B
C. C
D. D
2. What happens as a lithospheric plate moves over a hot spot? **3. f.**
- A.** The plate descends into the mantle.
B. A chain of volcanoes forms.
C. The pressure of the plate keeps magma below Earth's surface.
D. The hot spot is pushed to the edge of the plate.
3. Which statement correctly describes sea surface temperatures along the South American coast and Pacific trade winds during El Niño conditions? **5. g.**
- A.** The sea surface temperatures are warmer than normal, and Pacific trade winds are from the west.
B. The sea surface temperatures are warmer than normal, and Pacific trade winds are from the east.
C. The sea surface temperatures are cooler than normal, and Pacific trade winds are from the west.
D. The sea surface temperatures are cooler than normal, and Pacific trade winds are from the east.
4. Rocks are classified as igneous, sedimentary, or metamorphic based primarily on their **3. c.**
- A.** texture.
B. crystal or grain size.
C. process of formation.
D. mineral composition.

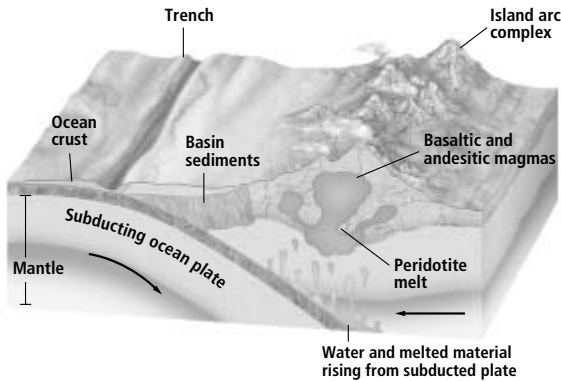
5. Scientists are concerned about the decrease in ozone in the upper atmosphere primarily because ozone protects life on Earth by absorbing certain wavelengths of **8. c.**
- A.** X-ray radiation.
B. ultraviolet radiation.
C. infrared radiation.
D. microwave radiation.
6. Currents in the oceans flow, at different depths, both toward and away from the tropics. What are the main causes of this layering of ocean currents? **5. d.**
- A.** the varying depths of the oceans
B. water temperature and salinity
C. the movement of tectonic plates on the seafloor
D. the rotation of the Earth
7. The Earth's atmosphere has changed greatly since the planet formed. What gas was probably rare or absent in the Earth's earliest atmosphere? **8. b.**
- A.** methane
B. ammonia
C. nitrogen
D. oxygen
8. The burning of fossil fuels has the greatest and most direct impact on the **7. b.**
- A.** rock cycle.
B. water cycle.
C. carbon cycle.
D. nitrogen cycle.
9. Our solar system formed about 4.6 billion years ago when **1. b.**
- A.** a large planet broke into many pieces.
B. a cloud of interstellar dust and gas began to condense.
C. stars collided with one another.
D. Jupiter formed as the largest planet.



Diagnostic Test *(continued)*

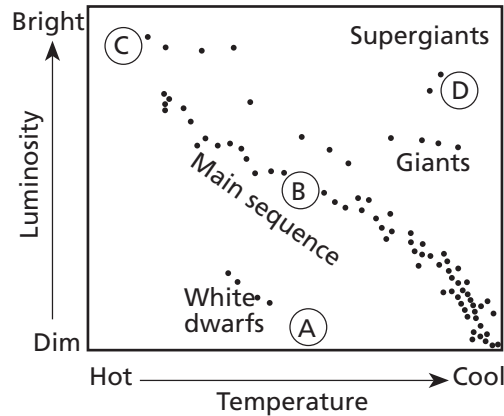


10. What type of orogeny (mountain building) is shown? **3. b.**



- A. oceanic-oceanic convergence
 B. oceanic-continental convergence
 C. continental-continental convergence
 D. divergence
11. What is the primary difference between weather and climate? **6. a.**
- A. Weather in an area can change, but the climate of an area never changes.
 B. Climate is controlled by solar energy, and weather is controlled by energy from the ground.
 C. Climate refers only to precipitation and wind, but weather also includes average temperatures.
 D. Weather refers to the short-term state of the atmosphere, and climate refers to the long-term conditions.
12. Which of the inner planets has the highest average surface temperature? **4. d.**
- A. Mercury
 B. Venus
 C. Earth
 D. Mars

13. The graph below represents the brightness and temperature of stars visible from Earth. Which location on the graph best represents a star with average brightness and temperature? **2. d.**



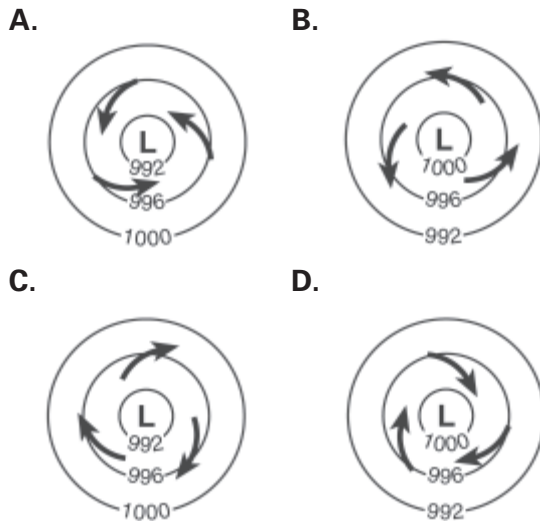
- A. A
 B. B
 C. C
 D. D
14. Carbon is used to make sugars in which step of the carbon cycle? **7. a.**
- A. photosynthesis
 B. respiration
 C. digestion
 D. transpiration
15. What type of fault is the San Andreas? **9. b.**
- A. reverse
 B. normal
 C. strike slip
 D. hanging
16. Which climate region is typically located between 20° N and S of the equator? **5. e.**
- A. rain forest
 B. tundra
 C. temperate continental
 D. desert



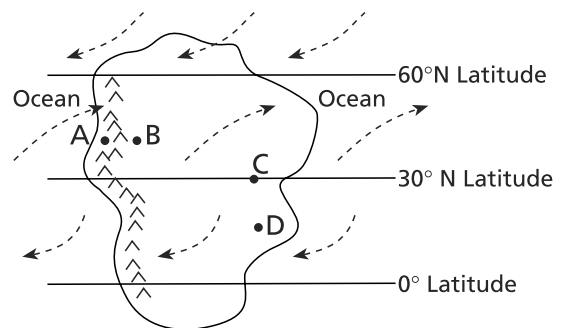
Diagnostic Test *(continued)*



17. Mount St. Helens erupted with a massive cloud of dust and ash. What type of volcano is Mount St. Helens? **3. e.**
- A. hot spot
 - B. shield
 - C. composite
 - D. cinder cone
18. Much of the Earth's internal heat comes from **4. a.**
- A. ultraviolet radiation absorbed by rocks.
 - B. the decay of radioactive elements.
 - C. lightning strikes.
 - D. rotation of the Earth's core.
19. A nuclear reaction that takes place in the cores of stars involves the fusion of protons to form an isotope of helium, helium-3. Then two helium-3 isotopes fuse, and two protons break away to leave behind a helium-4 nucleus. What happens as a result of this process? **2. f.**
- A. A nebula forms.
 - B. Mass is created.
 - C. The star collapses.
 - D. Energy is released.
20. Which map view best represents the pattern of isobar values, in millibars, and the pattern of wind flow, shown by arrows, at Earth's surface surrounding a northern hemisphere low-pressure center? **5. b.**



21. During red shift, the observed wavelengths of light from distant celestial objects appear closer to the red end of the spectrum than light from nearby celestial objects. The explanation for red shift is that the universe is presently **2. g.**
- A. contracting only.
 - B. expanding only.
 - C. remaining constant in size.
 - D. alternating between contracting and expanding.
22. An earthquake that registered high on the Richter scale and low on the Mercalli scale most likely occurred in which type of location? **3. d.**
- A. highly populated area
 - B. near a major body of water
 - C. area with few residents
 - D. mountainous area
23. Compared to location B, over the course of a year, location A will have **6. b.**



- A. less precipitation and a smaller temperature range.
 - B. less precipitation and a greater temperature range.
 - C. more precipitation and a smaller temperature range.
 - D. more precipitation and a greater temperature range.
24. The craters on the Moon were created by **1. f.**
- A. asteroid impacts.
 - B. comets.
 - C. meteors.
 - D. internal processes.



Diagnostic Test *(continued)*



25. Which occurs during a temperature inversion?
5. c.
A. Cold air rises, and warm air sinks.
B. Warm air rises, and cold air sinks.
C. A layer of cooler air lies over a relatively cool layer of air.
D. A layer of warmer air lies over a cool layer of air.
26. A geologic hazard map of California might include information about all of the following except **9. d.**
A. mudslides.
B. landslides.
C. earthquakes.
D. asteroid impacts.
27. Which is the major driving force behind the cycling of water through Earth's system?
7. c.
A. evaporation
B. precipitation
C. solar radiation
D. photosynthesis
28. Which mineral may preserve magnetic patterns on the ocean floor which would help support plate tectonics? **3. a.**
A. quartz
B. magnetite
C. feldspar
D. mica
29. The Sun is powered by nuclear reactions involving which of the following? **1. e.**
A. fusion of helium to form hydrogen
B. fission of helium to form hydrogen
C. fusion of hydrogen to form helium
D. fission of hydrogen to form helium
30. In which list are celestial features correctly shown in order of increasing size? **2. b.**
A. galaxy, solar system, universe, planet
B. solar system, galaxy, planet, universe
C. planet, solar system, galaxy, universe
D. universe, galaxy, solar system, planet

31. The discovery of which mineral had a significant impact on the early history of California? **9. a.**
A. gold
B. silver
C. copper
D. magnesium
32. What tools do scientists use to study the atmosphere and predict what effects greenhouse gases are having on Earth's climate? **6. d.**
A. Doppler radar
B. computer models
C. infrared cameras
D. barometers
33. Which statement best describes what is occurring in this figure? **4. c.**



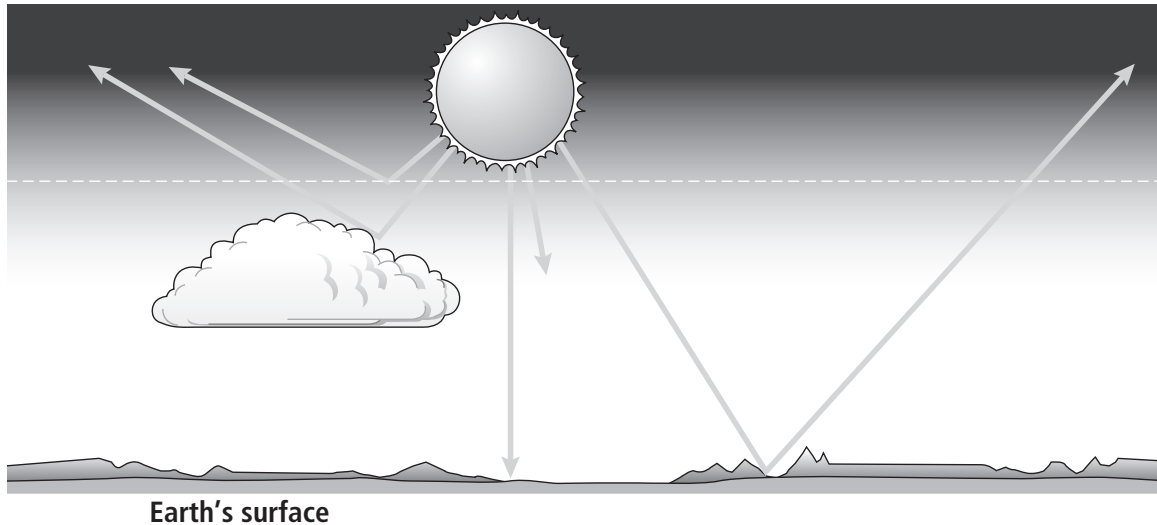
- A. Long wavelengths from the Sun reach Earth's surface and are reradiated as short wavelength radiation.
B. The upper atmosphere is heating up, while the lower atmosphere remains cooler.
C. Long wavelength radiation is trapped in Earth's lower atmosphere.
D. Energy from the Sun is absorbed by the clouds.



Diagnostic Test *(continued)*



34. Light from the Sun that reaches Earth's surface is either **4. b.**



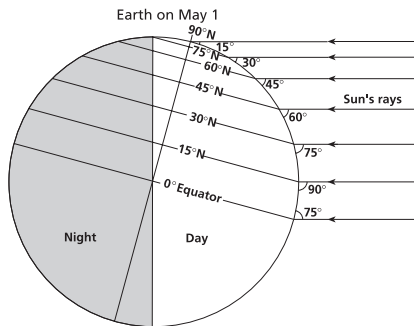
- A.** absorbed or refracted back into space.
B. reflected or converted into shorter wavelengths.
C. absorbed or reflected back into space.
D. absorbed or converted into shorter wavelengths.
35. Rain forests and deserts occur in belts around Earth because of which three factors? **5. f.**
A. gravity, Earth's rotation, temperature differences
B. sunlight, rainfall patterns, climate
C. seismic activity, elevation, humidity
D. wind patterns, ocean currents, mountain ranges
36. Most of the water used in southern California is **9. c.**
A. pumped from underground wells.
B. desalinated water from the Pacific Ocean.
C. transported from other states in pipes.
D. transported from northern California in canals.
37. Carbon is removed from the atmosphere through which process? **7. d.**
A. burning fossil fuels
B. deforestation
C. respiration
D. photosynthesis
38. Nearly 5 billion years ago, a rotating mass of dust and gas called the solar nebula gave rise to **1. a.**
A. the Sun and several other stars.
B. the solar system.
C. the Milky Way galaxy.
D. comets and meteors in the solar system.
39. When astronomers were first attempting to gauge the size of the universe, they used an observational effect known as parallax to show that **1. d.**
A. other stars are very far away from us.
B. Neptune is farther from Earth than Jupiter.
C. quasars are among the most distant objects in the universe.
D. the Andromeda galaxy is about 2 million light-years away.
40. Nuclear fusion in stars forms all elements with an atomic number greater than **2. c.**
A. hydrogen.
B. helium.
C. lithium.
D. beryllium.



Diagnostic Test *(continued)*



41. Seventy-eight percent of the atmosphere is composed of which gas? **8. a.**
- A. argon
 - B. nitrogen
 - C. oxygen
 - D. carbon dioxide
42. Origins of the early universe are studied by which group of scientists? **2. e.**
- A. structural geologists
 - B. evolutionary biologists
 - C. particle physicists
 - D. micropaleontologists
43. Which change can be expected to occur at 45° N over the next 30 days? **5. a.**



- A. The duration of insolation will decrease, and the temperature will decrease.
- B. The duration of insolation will decrease, and the temperature will increase.
- C. The duration of insolation will increase, and the temperature will decrease.
- D. The duration of insolation will increase, and the temperature will increase.

44. Scientists are convinced that other stars have planets in orbit about them. Without visiting these distant solar systems, how can they be sure? **1. g.**
- A. If our star has planets, then others must have them.
 - B. There is evidence of a weak gravitational pull working on other stars.
 - C. Other stars may have formed at the same time as the Sun.
 - D. Space probes have returned photographs of these planets.
45. During the time of Pangaea, what had the greatest impact on Earth's climate? **6. c.**
- A. All the continents were at the equator.
 - B. All the continents were near the poles.
 - C. It was a time of a giant global ocean.
 - D. Temperatures varied greatly from the coast of Pangaea to the inner regions.
46. How was early Earth different from Earth today? **1. c.**
- A. The Sun was dimmer.
 - B. There were more volcanic eruptions.
 - C. It was foggier.
 - D. It rained more.



Standards Practice

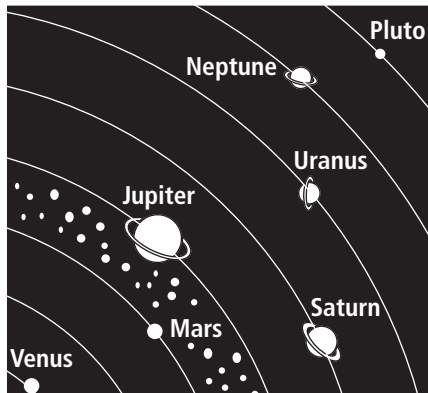
Earth's Place in the Universe: Solar System



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. a. Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.

1. How might the differences between the terrestrial planets and the gas planets have been established as the solar system formed?
 - A. Intense heat from the Sun caused materials to evaporate, producing the gas planets closest to the Sun.
 - B. Cold temperatures caused materials to freeze, producing the terrestrial planets farthest from the Sun.
 - C. Different elements and compounds were able to condense depending on their distance from the Sun.
 - D. The Sun's gravity captured small, terrestrial planets and pulled them close to the Sun, but was not strong enough to pull the large gas planets into closer orbits.
2. One characteristic all the gas planets share is



- A. solid surface.
 - B. presence of water and ice.
 - C. rings.
 - D. evidence of volcanic activity.
3. Which term can be used to describe the distribution of material in the solar system?
 - A. Big Bang
 - B. differentiation
 - C. convection
 - D. geocentric

1. b. Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.

4. Which evidence indicates that the solar system was formed approximately 4.6 billion years ago?
 - A. Zircon mineral grains found in metamorphic rocks on Earth have been dated at 4.2 billion years old.
 - B. Meteorites found on Earth have been radiometrically dated at between 4.5 and 4.7 billion years old.
 - C. The oldest rock samples from the Moon are approximately 4.6 billion years old.
 - D. Taking all of the evidence from above into consideration suggests that the solar system was formed approximately 4.6 billion years ago.
5. Scientists have estimated the date of Earth's formation to be approximately
 - A. 4.6×10^6 years ago.
 - B. 4.6×10^7 years ago.
 - C. 4.6×10^8 years ago.
 - D. 4.6×10^9 years ago.
6. What was in this part of the Milky Way prior to 4.6 billion years ago?
 - A. nothing
 - B. other planets
 - C. a cloud of dust and gas
 - D. a supernova star
7. Which theory do scientists think best accounts for the similarity of age and composition between the Moon and Earth?
 - A. Earth formed before the Moon.
 - B. The Moon formed before Earth.
 - C. Earth and the Moon formed at about the same time from dust and gas.
 - D. The Moon was once part of Earth and broke away as a result of a large impact.

Standards Practice

Earth's Place in the Universe: Solar System



1. c. Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.

8. What happened as Earth differentiated during its formative period?
 - A. Heavier materials sank toward the core, and lighter materials rose.
 - B. Widely separated land areas started looking different from one another.
 - C. The Atlantic and Pacific Oceans developed from the original global ocean.
 - D. Outgassing formed an oxygen atmosphere.
9. Earth's first atmosphere was probably similar to gases produced by
 - A. decaying vegetation.
 - B. photosynthesis.
 - C. volcanoes.
 - D. automobile engines.
10. Because early Earth had no ozone layer in its upper atmosphere, the surface of the planet was constantly scoured by
 - A. acid rain.
 - B. ultraviolet radiation.
 - C. tiny meteorites.
 - D. tornadoes and hailstorms.
11. Geological evidence suggests that early Earth was very different from Earth today in which way?
 - A. Earth's oceans probably formed long before Earth's atmosphere and covered most of Earth's surface.
 - B. Earth's earliest atmosphere was primarily composed of oxygen and contained very little water vapor, carbon dioxide, or nitrogen.
 - C. Earth's earliest oceans were much deeper than today, and the continents rose much higher in elevation.
 - D. Earth's earliest atmosphere probably contained large quantities of water vapor, carbon dioxide, and nitrogen, but contained very little oxygen gas.

1. d. Students know the evidence indicating that the planets are much closer to Earth than the stars are.

12. The inverse square law of light has been used to measure the distance to some stars. This law states that if Star A is twice as far away as Star B, but both have the same size and innate brightness, Star A will appear to be
 - A. one-half as bright as Star B.
 - B. one-fourth as bright as Star B.
 - C. one-eighth as bright as Star B.
 - D. one-sixteenth as bright as Star B.
13. The nearest star to us, Proxima Centauri, is about 00.3 light-years away. Approximately how far is that in kilometers?
 - A. 40 million
 - B. 40 billion
 - C. 40 trillion
 - D. 40 quadrillion
14. The parallax effect cannot be used to measure distances to other galaxies because they
 - A. are too dim to make a parallax measurement.
 - B. are too small to make an accurate parallax measurement.
 - C. are too far away to produce measurable parallax.
 - D. have red shifts that cancel out their parallax.
15. Planets sometimes seem to reverse direction in their course across the sky with respect to the distant stars. This effect, known as retrograde motion, is caused by
 - A. Earth's revolution around the Sun.
 - B. the rotation of the Milky Way.
 - C. the elliptical orbits of the planets.
 - D. the distortion of starlight by the atmosphere.
16. The bright celestial object that is often called both the morning star and the evening star is
 - A. Jupiter.
 - B. the Andromeda galaxy.
 - C. a large comet.
 - D. Venus.

Standards Practice

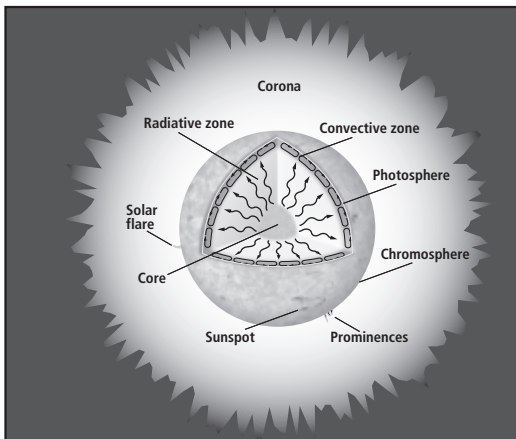
Earth's Place in the Universe: Solar System



1. e. Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.

17. What will happen to Earth when the Sun becomes a red giant?
- A. Earth will be pushed into a more distant orbit.
 - B. Earth will already be gone.
 - C. Earth will have a significant increase in volcanic activity.
 - D. Earth will get too hot to support life.

Use the graphic below to answer questions 18 and 19.



18. In which region is the Sun's energy created?

- A. photosphere
- B. chromosphere
- C. core
- D. radiative zone

19. Areas of cooler temperature on the Sun's surface appear as

- A. solar flares.
- B. sunspots.
- C. solar winds.
- D. prominences.

20. Nuclear fusion occurs when

- A. light nuclei combine to form heavier nuclei.
- B. heavier nuclei combine to form light nuclei.
- C. light nuclei split to form heavier nuclei.
- D. heavier nuclei split to form light nuclei.

1. f. Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.

21. What group of animals might have been driven to extinction by an asteroid impact 65 million years ago?

- A. trilobites
- B. woolly mammoths
- C. dinosaurs
- D. early amphibians

22. A huge meteorite crater exists in the state of

- A. Texas.
- B. Utah.
- C. Arizona.
- D. Missouri.

23. Most of the craters left by asteroid impacts on Earth have disappeared because of

- A. human activity.
- B. erosion.
- C. plate tectonics.
- D. Earth's gravity.

24. Craters on the Moon have remained intact because the Moon

- A. is not populated.
- B. has no atmosphere.
- C. has very hard rocks.
- D. has weak gravity.

25. Which evidence is often used to suggest that some mass extinctions of life on Earth were caused by asteroid impacts?

- A. abundance of iridium found in most rocks and minerals on Earth
- B. unusually high amounts of iridium found in clay layers that coincide with mass extinctions
- C. consistent and frequent volcanic eruptions throughout geologic time
- D. periodic episodes of intense volcanic activity on the surface of planets and moons similar to Earth

Standards Practice

Earth's Place in the Universe: Solar System



1. g. Students know the evidence for the existence of planets orbiting other stars.

- 26.** Why have planets orbiting other stars not been observed directly?
- A.** They are too small.
 - B.** They are too far away.
 - C.** They are too dim.
 - D.** all of the above
- 27.** Astronomers hope to observe planets around other stars directly. What instruments would most likely enable them to do this?
- A.** large optical telescopes
 - B.** very sensitive space probes
 - C.** infrared telescopes on Pluto
 - D.** video cameras attached to comets
- 28.** Planets around other stars are easiest to detect with present techniques when they have
- A.** a reflective surface.
 - B.** a large amount of mass.
 - C.** a short rotational period.
 - D.** several moons.
- 29.** In order to see the periodic dimming of a distant star caused by a planet moving in front of it, Earth must be in line with the
- A.** planet's axis of rotation.
 - B.** star's axis of rotation.
 - C.** planet's orbital plane around the star.
 - D.** star's orbital plane around the Milky Way.
- 30.** Which has been used as evidence for the existence of planets orbiting other stars?
- A.** small movement of a star around a center of mass that is shared with a planetary system
 - B.** distinct and periodic dimming of the light from a star
 - C.** both A and B
 - D.** neither A nor B

Standards Practice

Earth's Place in the Universe: Stars, Galaxies, and the Universe



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

- 2. a.** Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.
1. Approximately how many stars are there in the Milky Way?
A. 100–400 million
B. 10–40 billion
C. 100–400 billion
D. 1–4 trillion
 2. The Milky Way and the Andromeda galaxy are sometimes called sister galaxies because they are
A. relatively close together.
B. both large elliptical galaxies.
C. about the same age.
D. both large spiral galaxies.
 3. The Milky Way contains a large central bulge made up mostly of
A. young stars.
B. old stars.
C. remnants of supernovas.
D. dust and gas.
 4. About how long does it take the solar system to make one revolution around the Milky Way?
A. 25,000 years
B. 250,000 years
C. 25 million years
D. 250 million years
 5. The Milky Way and Andromeda galaxy belong to a collection of galaxies called the
A. Local Group.
B. Andromeda Cluster.
C. Milky Way Cluster.
D. Proximal Group.
 6. Which is the approximate diameter of the Milky Way galaxy?
A. 100 light-years
B. 1000 light-years
C. 100,000 light-years
D. 1,000,000 light-years

- 2. b.** Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.
7. The light from most distant galaxies is
A. shifted toward the red end of the spectrum.
B. shifted toward the blue end of the spectrum.
C. always ultraviolet.
D. always infrared.
 8. From their motion, astronomers have inferred that galaxies contain not just stars but also
A. many planets larger than Earth.
B. a great amount of unseen, or dark, matter.
C. billions of enormous black holes.
D. many elements unknown to us.
 9. The largest groupings of galaxies are called
A. multiclusters.
B. hyperclusters.
C. omniclusters.
D. superclusters.
 10. Everything that astronomers can see with their telescopes makes up
A. the observable universe.
B. the space-time continuum.
C. infinity.
D. multiple universes.
 11. Which best describes the shapes and masses of galaxies?
A. range from dwarf ovals, having masses of ten Suns, to giant spirals, having masses of 1000 Suns
B. range from dwarf spirals, having masses of 100 Suns, to giant ovals, having masses of 100 million Suns
C. range from dwarf spirals, having masses of 100,000 Suns, to giant spirals, having masses of 100 billion Suns
D. range from dwarf ellipticals, having masses of one million Suns, to giant ellipticals, having masses of 100 trillion Suns

Standards Practice

Earth's Place in the Universe: Stars, Galaxies, and the Universe



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

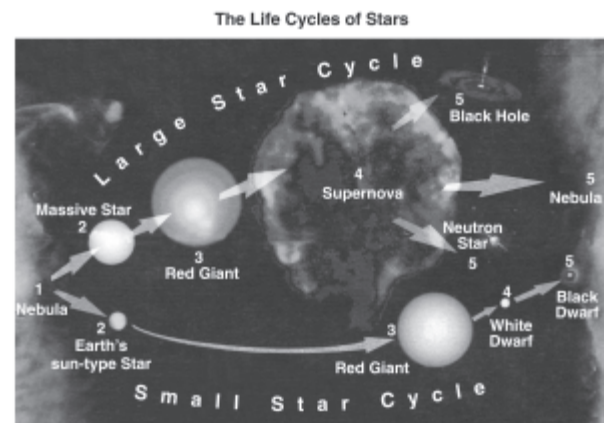
2. c. Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.

12. All of the universe's original supply of hydrogen came from
- A. a parallel universe.
 - B. the space-time continuum.
 - C. black holes.
 - D. the Big Bang.
13. The first stars in the universe probably could not have had planets because
- A. it was still too hot for planets to exist.
 - B. most of the elements necessary for forming planets had not yet been created.
 - C. remaining shock waves from the Big Bang prevented the formation of planets.
 - D. the first stars were too small to support planets.
14. The heaviest natural elements in the solar system were created by
- A. the Sun.
 - B. Jupiter.
 - C. asteroid impacts.
 - D. exploding stars.
15. The creation of elements in stars is called
- A. nuclear fabrication.
 - B. nuclear assembly.
 - C. nucleosynthesis.
 - D. thermosynthesis.
16. Stars like the Sun cannot create elements any heavier than
- A. carbon.
 - B. sodium.
 - C. iron.
 - D. gold.

2. d. Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

17. A star emits light with many different wavelengths. This energy is called
- A. relativistic radiation.
 - B. cosmic radiation.
 - C. nuclear radiation.
 - D. electromagnetic radiation.
18. A star the size of the Sun can produce energy from normal fusion reactions for about
- A. 1 billion years.
 - B. 5 billion years.
 - C. 10 billion years.
 - D. 50 billion years.

Use the diagram below to answer questions 19 and 20.



19. The life-cycle path followed by a star is determined by the star's initial
- A. mass and volume.
 - B. temperature and origin.
 - C. luminosity and color.
 - D. luminosity and structure.
20. Stars like the Sun most likely formed directly from a
- A. nebula.
 - B. supernova.
 - C. red giant.
 - D. black dwarf.

Standards Practice

Earth's Place in the Universe: Stars, Galaxies, and the Universe



2. e. Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.

21. Albert Einstein's famous equation, $E=mc^2$, means that
- A. matter and energy are interchangeable.
 - B. even a small amount of matter contains a large amount of energy.
 - C. energy equals mass times the square of the speed of light.
 - D. all of the above
22. Why can normal particle accelerators not accelerate neutrons?
- A. They are too heavy.
 - B. They are too large.
 - C. They have no electric charge.
 - D. They sometimes emit an electron.
23. A positron is
- A. a neutron with a temporary positive charge.
 - B. an antimatter electron.
 - C. an antimatter proton.
 - D. a subatomic particle whose position has been established with certainty.
24. Modern particle accelerators can accelerate subatomic particles to nearly the speed of
- A. sound.
 - B. light.
 - C. a comet.
 - D. the solar wind.
25. What is produced when a particle of matter and a particle of antimatter collide?
- A. a burst of energy
 - B. a shower of new matter particles
 - C. both A and B
 - D. neither A nor B
26. Where was the first particle accelerator built?
- A. Chicago, Illinois
 - B. Geneva, Switzerland
 - C. Berkeley, California
 - D. Berlin, Germany

2. f. Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.

27. A forming star needs a critical minimum amount of mass to enable
- A. fusion reactions to begin.
 - B. planets to form.
 - C. fission reactions to begin.
 - D. atoms of hydrogen to form.
28. How does a blue star differ from a yellow star?
- A. It is brighter.
 - B. It is hotter.
 - C. It has a shorter life.
 - D. all of the above
29. The hydrogen in a star is in a form known as
- A. quark soup.
 - B. an energy cloud.
 - C. a maelstrom.
 - D. plasma.
30. Fusion reactions could not occur in a star without the pressure created by
- A. electrons.
 - B. gravity.
 - C. antimatter.
 - D. rotational energy.
31. The amount of helium in the Sun is
- A. increasing.
 - B. decreasing.
 - C. fluctuating.
 - D. staying about the same.
32. Hydrostatic equilibrium within a star refers to a balance between
- A. gravitational collapse and nuclear fission.
 - B. gravitational collapse and nuclear fusion.
 - C. nuclear fission and a supernova explosion.
 - D. nuclear fusion and a supernova explosion.

Standards Practice

Earth's Place in the Universe: Stars, Galaxies, and the Universe



- 2. g.** Students know how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the “big bang” model that suggests that the universe has been expanding for 10 to 20 billion years.
- 33.** What caused the universe to begin expanding?
A. supernova explosions
B. the Big Bang
C. black holes
D. repulsive electromagnetic forces
- 34.** Evidence indicates that the expansion of the universe is
A. slowing down.
B. settling into a constant rate.
C. accelerating.
D. reversing.
- 35.** How does light from most distant galaxies differ from light from closer galaxies?
A. It is dimmer.
B. It is more red-shifted.
C. It is more likely to have been altered by gravitational effects.
D. all of the above
- 36.** Which scientist was the first to find evidence that the universe is expanding?
A. Galileo Galilei
B. Albert Einstein
C. Edwin Hubble
D. Stephen Hawking
- 37.** What theory was bolstered by the discovery of the microwave background radiation?
A. the Big Bang theory
B. the Steady State theory
C. the general theory of relativity
D. all of the above
- 38.** Which shift in the electromagnetic spectrum received from distant galaxies suggests that the universe is expanding?
A. blue-shift
B. green-shift
C. red-shift
D. violet-shift

Standards Practice

Dynamic Earth Processes

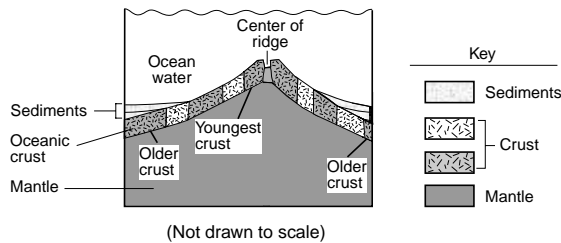


Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

3. a. Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.

- The primary evidence for plate tectonics is based on what two phenomena?
 - mountain building and volcanic eruptions
 - hydrothermal venting and continental drift
 - ocean currents and undersea landslides
 - seismic data and magnetic banding
- Where are the youngest rocks on the seafloor located?
 - at the mid-ocean ridges
 - along the continental shelves
 - in the Mariana Trench
 - near the Hawaiian Islands

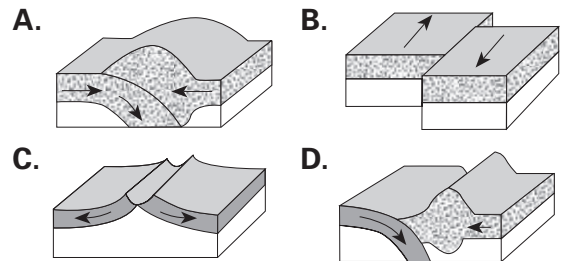
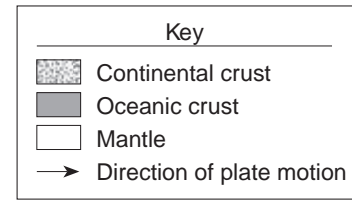
Use the graphic below to answer questions 3 and 4.



- If the crust symbol represents basalt with normal magnetic polarity, what does the crust symbol most likely represent?
 - igneous rock with normal magnetic polarity
 - igneous rock with reversed magnetic polarity
 - sedimentary rock with normal magnetic polarity
 - sedimentary rock with reversed magnetic polarity
- The geologic features on the ocean floor in this region resulted from
 - colliding plates in the lithosphere.
 - sinking iron and magnesium in the lithosphere.
 - cooler temperatures in the mantle.
 - rising convection currents in the magma.

3. b. Students know the principal structures that form at the three different kinds of plate boundaries.

- Which cross-section below best represents the crustal plate movement that is the primary cause of the volcanoes and deep rift valleys at mid-ocean ridges?



- The subduction of an oceanic plate beneath a continental plate produces a(n)
 - chain of volcanic mountains.
 - chain of non-volcanic mountains.
 - inland sea.
 - rift valley.
- A transform boundary is also called a
 - convergent boundary.
 - divergent boundary.
 - parallel slip boundary.
 - perpendicular slip boundary.
- Which relationship between geologic structures and plate boundaries is most accurate?
 - Explosive volcanoes most often occur near convergent boundaries.
 - Folded mountains commonly develop at divergent boundaries.
 - Rift valleys are usually produced at convergent boundaries.
 - Volcanic arcs are usually found along transform boundaries.

Standards Practice

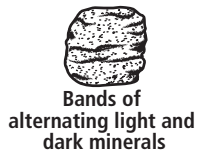
Dynamic Earth Processes



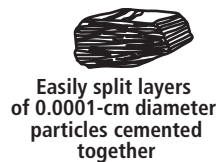
3. c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.

9. Rock J represents molten rock that has cooled rapidly at the surface of Earth. Of the diagrams and descriptions below, which best represents rock J?

A.



B.



C.



D.



10. Limestone that is exposed to enough heat and pressure is transformed into

- A. marble.
- B. slate.
- C. quartzite.
- D. gneiss.

11. Which type of metamorphism is most likely to be caused by a small intrusion of magma into dry rock material?

- A. contact metamorphism
- B. hydrothermal metamorphism
- C. regional metamorphism
- D. dynamothermal metamorphism

12. Which observation about a rock could lead you to identify it as igneous? The rock

- A. has well-defined layers.
- B. has a glassy texture.
- C. contains pebbles.
- D. is made of calcite.

13. Most sedimentary rocks are formed by

- A. uplifting and melting.
- B. compaction and cementation.
- C. eruption of volcanoes.
- D. changes deep within Earth.

3. d. Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.

14. Fractures in rock where sections of rock might suddenly move to create an earthquake are called

- A. rifts.
- B. faults.
- C. fissures.
- D. crevices.

15. The most destructive waves produced by an earthquake are

- A. body waves.
- B. transverse waves.
- C. latitudinal waves.
- D. channel waves.

16. Most of the world's major earthquakes occur in areas bordering the

- A. Atlantic Ocean.
- B. Pacific Ocean.
- C. Indian Ocean.
- D. Mediterranean Sea.

17. An earthquake on the ocean floor can produce a(n)

- A. waterspout.
- B. undersea volcano.
- C. tsunami.
- D. hydrothermal vent.

18. Which scale measures the damage done by an earthquake to determine an earthquake's intensity?

- A. modified Mercalli scale
- B. moment magnitude scale
- C. Richter scale
- D. seismic magnitude scale

Standards Practice

Dynamic Earth Processes

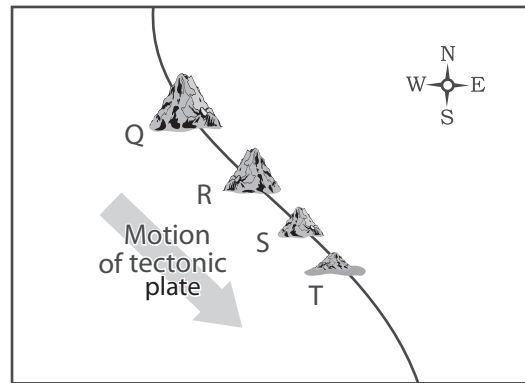


3. e. Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.

19. When magma emerges explosively from a volcano, it often forms rocky fragments called tephra. The largest pieces of tephra are called
- A. lava chunks.
 - B. magma rocks.
 - C. tephra balls.
 - D. volcanic bombs.
20. What is the name for a large crater formed when a magma chamber collapses?
- A. volcanic canyon
 - B. depression
 - C. caldera
 - D. sinkhole
21. What determines the viscosity of magma?
- A. its temperature and composition
 - B. its age and composition
 - C. its temperature and age
 - D. all of the above
22. A huge cloud of hot gases, dust, and ash that sometimes pours down the slopes of a volcano is called a
- A. thermic landslide.
 - B. volcanic surge.
 - C. incendiary blast.
 - D. pyroclastic flow.
23. The most violent volcanic eruptions are termed
- A. Plinian eruptions.
 - B. Vesuvian eruptions.
 - C. Tamboran eruptions.
 - D. Theran eruptions.
24. Which best characterizes a composite volcano?
- A. violent eruptions producing gentle slopes
 - B. violent eruptions producing steep slopes
 - C. voluminous lava flows producing gentle slopes
 - D. voluminous lava flows producing steep slopes

3. f. Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

25. Where are most of Earth's explosive volcanoes located?
- A. in rift valleys
 - B. in subduction zones
 - C. along mid-ocean ridges
 - D. at the poles
26. Which is the order of volcanoes, from the youngest to the oldest, that were formed by the motion of this tectonic plate?



- A. Q, R, S, T
 - B. T, S, Q, R
 - C. Q, T, S, R
 - D. T, S, R, Q
27. Hawaii, which sits over a hot spot located near the center of the Pacific plate, is which type of volcano?
- A. cinder cone volcano
 - B. composite volcano
 - C. lava dome volcano
 - D. shield volcano
28. A wide, dome-shaped volcano built from thin, freely flowing lava is called a(n)
- A. composite volcano.
 - B. umbrella volcano.
 - C. shield volcano.
 - D. drumlin volcano.

Standards Practice

Energy in the Earth System: Solar Energy Enters, Heat Escapes



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

4. a. Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.

- Which was not a significant source of heat during Earth's early formation?
 - asteroid and meteoroid impacts
 - gravitational contraction
 - isostasy
 - radioactive decay
- The most damaging forms of ultraviolet radiation are
 - absorbed by the oceans.
 - blocked by the upper atmosphere.
 - melting the icecaps.
 - weakened in the lower atmosphere.
- How many joules of energy does the average American household use in one second?
 - 10
 - 100
 - 1000
 - 10,000
- The tremendous amount of heat within Earth powers
 - plate tectonics.
 - ocean currents.
 - weather patterns.
 - all of the above
- The energy stored in fossil fuels originally came from
 - Earth's core.
 - gravity.
 - fusion reactions in the Sun.
 - fission reactions in the Sun.
- What fraction of the energy produced by the Sun does Earth receive?
 - one two-thousandth
 - one two-millionth
 - one two-billionth
 - one two-trillionth

4. b. Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.

- Plants remove which gases from the atmosphere?
 - nitrogen and hydrogen
 - oxygen and methane
 - carbon dioxide and oxygen
 - hydrogen and oxygen
- Photosynthesis releases which gas into the air?
 - nitrogen
 - oxygen
 - carbon dioxide
 - hydrogen
- Photosynthesizing plants are green because they contain
 - chlorophyll.
 - carbon dioxide.
 - free radicals.
 - oxygen.
- The solar energy stored in green plants is the primary energy source for
 - chemical reactions in the soil.
 - animal life.
 - carnivorous plants.
 - all of the above
- In which season does the amount of carbon dioxide in the atmosphere decrease slightly?
 - winter
 - spring
 - summer
 - fall
- What percentage of the incoming solar radiation that reaches Earth is reflected back into space?
 - 15%
 - 25%
 - 35%
 - 50%

Standards Practice

Energy in the Earth System: Solar Energy Enters, Heat Escapes



4. c. Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.

- 13.** What would be Earth's approximate average temperature without the greenhouse effect?
- A. 10°C
 - B. -1°C
 - C. -9°C
 - D. -17°C
- 14.** Most of the energy radiated back into space from Earth is which part of the electromagnetic spectrum?
- A. ultraviolet
 - B. infrared
 - C. violet
 - D. red
- 15.** What are the main greenhouse gases?
- A. carbon dioxide, water vapor, and methane
 - B. oxygen, carbon dioxide, and methane
 - C. carbon dioxide, nitrogen, and water vapor
 - D. water vapor, nitrogen, and methane
- 16.** Greenhouse gases in the atmosphere
- A. transmit most visible light but absorb infrared light.
 - B. absorb most visible and infrared light.
 - C. absorb ultraviolet light but transmit only infrared light.
 - D. absorb all visible light but transmit infrared light.
- 17.** Which gas in the atmosphere has been increasing significantly because of human burning of fossil fuels?
- A. oxygen
 - B. nitrogen
 - C. carbon dioxide
 - D. methane

4. d. Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

- 18.** Without the greenhouse effect, Earth would be most similar to
- A. the Moon.
 - B. Mercury.
 - C. Neptune.
 - D. Mars.
- 19.** A critical elevation in a planet's surface temperature caused by a high level of greenhouse gases in its atmosphere is called a(n)
- A. boiling cauldron effect.
 - B. runaway greenhouse effect.
 - C. steambath effect.
 - D. explosive greenhouse effect.
- 20.** On what planet have concentrations of greenhouse gases caused extremely high surface temperatures?
- A. Saturn
 - B. Mercury
 - C. Neptune
 - D. Venus
- 21.** Scientists warn that elevated levels of greenhouse gases in Earth's atmosphere are causing global warming. One consequence of this problem that can already be seen is
- A. the retreat of many glaciers.
 - B. increased extinctions in the oceans.
 - C. deserts encroaching on North American farmlands.
 - D. warm weather in Antarctica in the summer.
- 22.** By causing changes in ocean currents, global warming could possibly lead to
- A. worsening erosion of the continental shelves.
 - B. colder weather in some areas.
 - C. increased fish populations in polar waters.
 - D. fewer seafloor earthquakes.

Standards Practice

Energy in the Earth System: Ocean and Atmospheric Convection



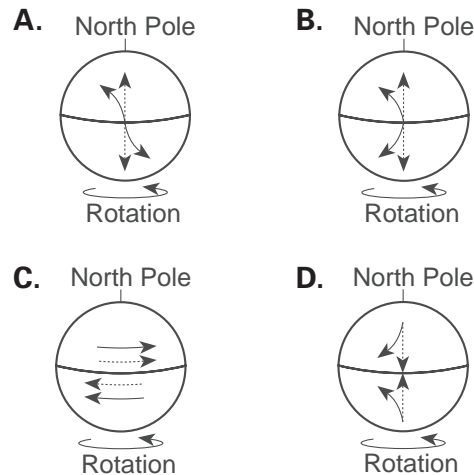
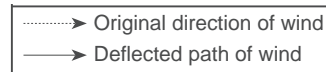
Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

5. a. Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.

1. Why is Earth's surface warmer at the equator than at the poles?
 - A. The Sun is closer to the equator than the poles.
 - B. The equator receives more direct sunlight than the poles.
 - C. There is more water at the equator, which absorbs more heat.
 - D. Ice at the poles keeps the surface colder than the surface at the equator.
2. What causes circulation cells to develop in the atmosphere?
 - A. Warm air sinks in clouds as cold air rises.
 - B. Higher pressure in the upper atmosphere forces warm air to the surface.
 - C. The Sun's rays heat the upper atmosphere most, and the heat transfers to the surface.
 - D. Heat at the surface transfers to the atmosphere.
3. In what way are ocean currents and air currents the same?
 - A. Cool air sinks, just as cool or more saline water sinks, and warm air, like warm water, rises.
 - B. Both form currents that flow mostly from cool areas to warm areas.
 - C. Cool water evaporates and rises into the atmosphere, just as cool air expands in areas of low pressure.
 - D. Warm water flows more swiftly than cool water, just as warm winds are stronger than cool winds.
4. A tropical depression is the first stage in the development of
 - A. gyres.
 - B. hurricanes.
 - C. El Niño.
 - D. tornadoes.

5. b. Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.

5. In which direction is an ocean current's path of motion deflected by the Coriolis effect?
 - A. to the left in the northern hemisphere and to the right in the southern hemisphere
 - B. to the right in the northern hemisphere and to the left in the southern hemisphere
 - C. to the left in both the northern and southern hemispheres
 - D. to the right in both the northern and southern hemispheres
6. Which illustration shows the Coriolis effect?



7. Which is NOT significantly influenced by the Coriolis force?
 - A. winds in Earth's atmosphere
 - B. currents in Earth's oceans
 - C. water in a bathtub
 - D. the flow of magma beneath Earth's surface
8. What causes the Coriolis force?
 - A. Earth's shape
 - B. Earth's rotation
 - C. Earth's revolution around the Sun
 - D. Earth's energy flows from the equator to the poles

Standards Practice

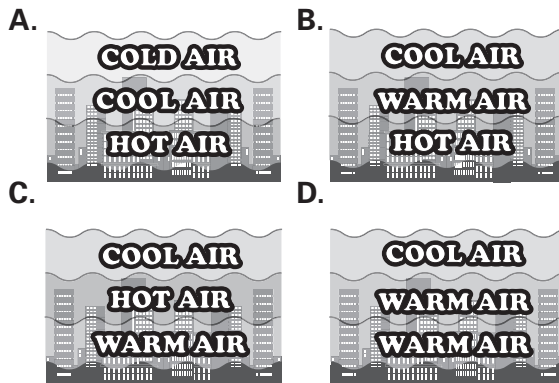
Energy in the Earth System: Ocean and Atmospheric Convection



5. c. Students know the origin and effects of temperature inversions.

9. In what way is the atmosphere most often heated?
- It is heated from above by the transfer of energy from the Sun's rays.
 - It is heated from below by the transfer of energy from Earth's surface.
 - It is heated from the sides as warm air moves into areas of cool air.
 - It is heated from below as a result of volcanic activity.
10. What is the transfer of heat by vertical movements of air masses called?
- conduction
 - radiation
 - subduction
 - convection

11. Which shows an example of temperature inversion?

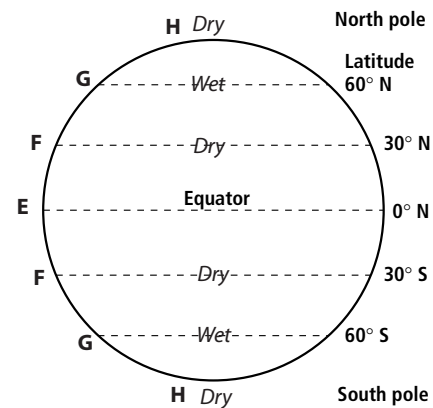


12. Which describes an atmospheric temperature inversion?

- Air temperature decreases with altitude, producing sunny skies and fair weather.
- Air temperature decreases with altitude, producing strong updrafts and thunderstorms.
- Air temperature increases with altitude, trapping air pollutants near Earth's surface.
- Air temperature increases with altitude, producing strong surface winds and dust storms.

5. d. Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.

13. At what latitudes is ocean water most warmed by the Sun?
- at low latitudes
 - at the poles
 - at high latitudes
 - at temperate latitudes
14. What forces water to flow horizontally from low latitudes to high latitudes?
- differences in thermal energy
 - differences in amounts of sunlight
 - differences in prevailing winds
 - differences in water density
15. At what level is the water density highest?
- right above the surface
 - just below the ocean surface
 - between the surface and seafloor
 - at the bottom, where water is in contact with the seafloor
16. At what latitude region would ocean water have the lowest salinity?



- E
- F
- G
- H

Standards Practice

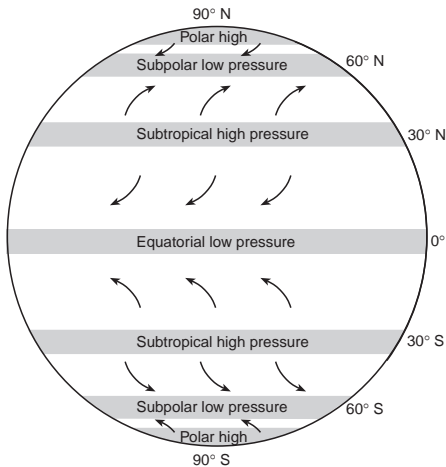
Energy in the Earth System: Ocean and Atmospheric Convection



5. e. Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.

17. Large bands, or zones, of similar climates circle Earth. What causes these bands?
- strong winds that flow from west to east
 - large-scale convection patterns in the atmosphere
 - small-scale variations in surface temperatures
 - large-scale variances between surface and air temperatures

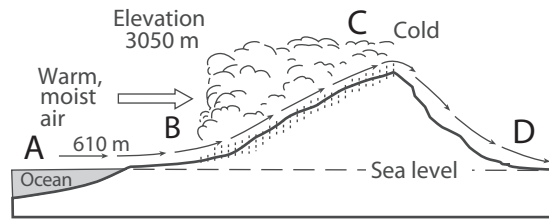
Use the illustration below to answer questions 18 and 19.



18. Not including the equator, how many cells exist between the equator and each pole?
- 1
 - 2
 - 3
 - 4
19. In general terms, how does air circulate through the cells?
- Wind flows from east to west in some cells and from west to east in others.
 - Wind flows to the east in the northern hemisphere and to the west in the southern hemisphere.
 - Air rises at the equator and sinks in the other cells.
 - Air rises in two regions and sinks in two others.

5. f. Students know the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.

20. In which area on this drawing does a rain shadow occur?



- A
 - B
 - C
 - D
21. What happens to air in the tropics as it is warmed and water evaporates?
- It is cooled again by falling rain.
 - The resulting warm, moist air rises and cools.
 - It spreads out horizontally near the ground.
 - It becomes saturated with water, causing fog.
22. What causes air from the tropics to move toward the poles?
- The spinning of Earth forces the warm air away from the equator.
 - The warm air cools quickly and spreads away from the equator near the surface.
 - The warm air cools and loses its moisture as rain, which is pushed away by rising warmer air.
 - Cool air sinks, pushing the warm air below to the north and south.
23. What happens as air sinks to the surface, is compressed, and warms up over a long period of time?
- It evaporates water from the ground, causing a desert to form.
 - It causes large windstorms to form.
 - It evaporates water from the ground, causing rain forests to form.
 - It causes clouds to form, but no rain falls.

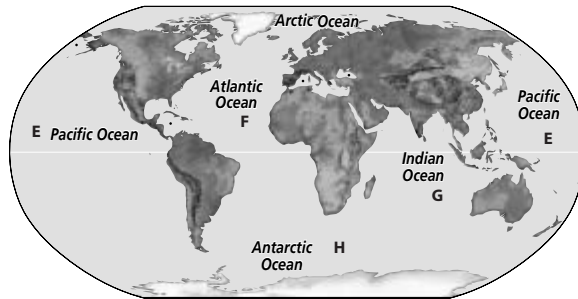
Standards Practice

Energy in the Earth System: Ocean and Atmospheric Convection



5. g. Students know features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climactic results of this cycle.

24. In which location does the El Niño southern oscillation (ENSO) cycle begin?



- A. E
- B. F
- C. G
- D. H

25. The ENSO cycle refers to the observed relationship between what periodic changes?

- A. patterns of temperature changes in the deep waters of the Pacific Ocean
- B. patterns of surface temperatures in the Pacific Ocean and Atlantic Ocean
- C. patterns of temperature and air pressure of the surface of the Pacific Ocean and the air above it at the equator
- D. patterns of water and air temperatures in the Arctic Ocean and Indian Ocean

26. Over what time scale are the changes in the ENSO cycle measured?

- A. days
- B. months
- C. years
- D. centuries

27. What changes relate most directly to the ENSO cycle?

- A. global ice ages
- B. variations in global weather
- C. populations of insects worldwide
- D. types of crops developed worldwide

28. Which event would most likely occur during an El Niño?

- A. Much of the northwestern coast of South America experiences a cool, dry climate.
- B. Frequent and intense hurricanes develop in the Atlantic Ocean.
- C. Strong trade winds move water westward across the Pacific Ocean.
- D. Warm ocean current develops off the western coast of South America

Standards Practice

Energy in the Earth System: Climate and Weather



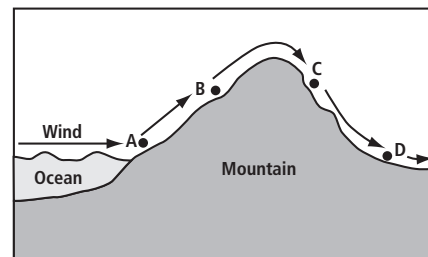
Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

6. a. Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.

1. Unequal transmission and absorption of solar energy on Earth can cause
 - A. differences in sunlight reaching Earth's surface.
 - B. differences in air temperature and thus air pressure.
 - C. global warming in some parts of the Earth system, but not all.
 - D. the air to reach an average temperature worldwide.
2. What is caused by differences in air pressure?
 - A. wind
 - B. clouds
 - C. rain
 - D. thunder
3. What determines atmospheric humidity?
 - A. daily cloud cover
 - B. amounts of groundwater
 - C. solar evaporation and precipitation of water
 - D. solar intensity and amounts of groundwater
4. How do evaporation and precipitation transfer heat between the atmosphere and the oceans?
 - A. Heat is absorbed when water condenses and released when water evaporates.
 - B. Heat is absorbed when water evaporates and released when water condenses.
 - C. All the water in the atmosphere comes from the oceans, which release heat when they release water vapor.
 - D. Warm oceans evaporate more quickly, warming the atmosphere by conduction.
5. What is affected by the transfer of energy in and out of the atmosphere?
 - A. weather alone
 - B. climate alone
 - C. neither weather nor climate
 - D. both weather and climate

6. b. Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.

6. Where would deserts most likely be found?
 - A. along the equator
 - B. along the eastern coasts of continents
 - C. on the leeward side of mountains
 - D. on the windward side of mountains
7. What is one factor that affects the location of deserts and rain forests?
 - A. time of year
 - B. today's weather
 - C. latitude
 - D. longitude
8. Why are temperatures generally cooler at high elevations than at low elevations?
 - A. Air is less dense at higher altitudes.
 - B. Clouds form at high elevations.
 - C. Winds are stronger at high elevations.
 - D. All low elevations experience thermal inversions.
9. Which factors directly influence local weather and climate?
 - A. common plants in the region
 - B. mountains and prevailing winds
 - C. wildlife populations
 - D. human settlements
10. Which location is likely to receive the most precipitation?



- A. A
- B. B
- C. C
- D. D

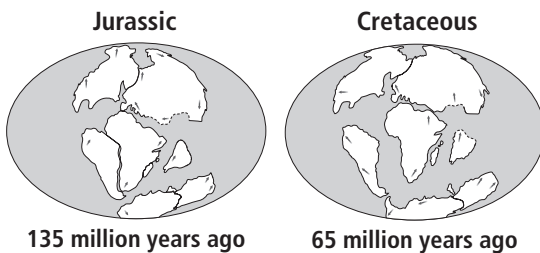
Standards Practice

Energy in the Earth System: Climate and Weather



6. c. Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.

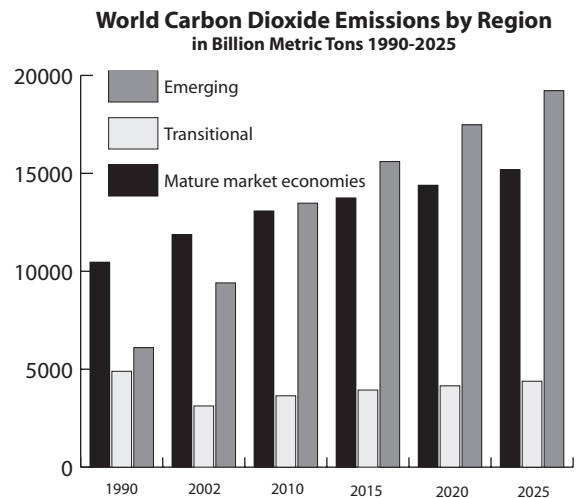
11. Which natural event does NOT cause long-term climatic changes?
- A. variation in solar radiation
 - B. changes in Earth's tilt and orbit
 - C. high-altitude ozone depletion
 - D. volcanic eruptions
12. Which statement about the illustrated geologic periods on Earth is definitely true?



- A. It rains more now than it did in the earlier geologic periods.
 - B. Earth's oceans were saltier in the earlier geologic period than they are today.
 - C. Changes in ocean currents played a major role in climate change.
 - D. Earth's rivers were larger in the earlier periods than they are today.
13. Which factor could give scientists a clue about changes in Earth's atmosphere over time?
- A. The carbon content of fossil sea shells.
 - B. The amount of water in aquifers.
 - C. Signs of wind erosion on cliffs.
 - D. The depth of sedimentary rock layers beneath the seas.
14. What happened after the last ice age ended about 12,000 years ago?
- A. Earth's climate got generally colder.
 - B. Earth's oceans got generally smaller.
 - C. Earth's climate got generally warmer.
 - D. Earth's orbit changed its size.

6. d. Students know how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

15. By using computer models, what do scientists predict will happen to Earth's climate if greenhouse gases continue to increase?
- A. Temperatures will decrease first, then increase.
 - B. Average global temperatures will increase.
 - C. Temperatures will remain consistent.
 - D. The ozone layer will deteriorate.
16. The table below shows the amount of carbon dioxide emissions in different regions of the world through the year 2025. What tool was probably used to make the projections into the future?



(Source: International Energy Outlook 2005, Energy Information Administration)

- A. adding machine
 - B. hand calculator
 - C. emissions spectrometer
 - D. computer model
17. To create your own computer model of the effects of greenhouse gases, which data set would you most need?
- A. historical temperature extremes
 - B. historical agriculture production
 - C. historical weather information
 - D. historical population figures

Standards Practice

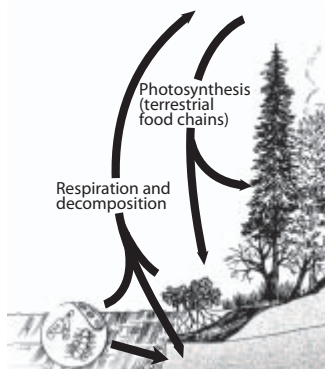
Biogeochemical Cycles



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

7. a. Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.

1. Which statement best describes the part of the carbon cycle shown below?



- A. long-term process
B. short-term process
C. decomposition
D. combustion
2. Which is NOT part of carbon's biogeochemical cycle?
A. Marine animals use carbonate and bicarbonate ions in their shells.
B. Carbon dioxide in the atmosphere is used by animals in photosynthesis.
C. Carbon is stored in the solid earth as coal, petroleum, or graphite.
D. Limestone can dissolve in acidic rain, releasing carbon dioxide into the air or water.
3. Which is a possible path of the movements of nitrogen in the nitrogen cycle?
A. soil → air → plants → air → animals → soil
B. soil → animals → plants → air → soil
C. air → animals → soil → plants → air
D. air → soil → plants → animals → soil → air
4. Which of these nitrogen-producing processes is most harmful to vegetation?
A. nitrogen fixation
B. atmospheric nitrogen
C. ammonia fertilizers
D. acid rain

7. b. Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.

5. Scientists believe the concentration of carbon in the atmosphere is currently
A. rising due to the release of fossil fuels.
B. falling because more organisms are dying off.
C. rising due to increasing plant populations.
D. falling because Earth's total biomass is increasing.
6. Where is carbon stored in the largest amounts on Earth?
A. atmosphere
B. oceans
C. lithosphere
D. ice caps
7. Most carbonates held in the geosphere take which form?
A. carbon monoxide
B. carbon dioxide
C. methane
D. limestone
8. In which reservoir is dissolved CO₂ most abundant?
A. oceans
B. fossil fuels
C. organic wastes
D. carbohydrates

Standards Practice

Biogeochemical Cycles

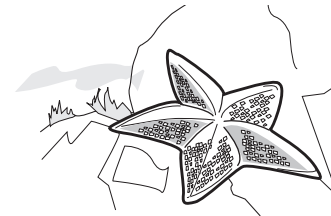


7. c. Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.

9. What are the primary sources of the energy that drive the movement of matter among reservoirs?
 - A. solar and geothermal energy
 - B. the Sun and plants
 - C. animals and the solid earth
 - D. plants and animals
10. Which is the primary source of energy that drives the water cycle?
 - A. carbon dioxide in Earth's atmosphere
 - B. Earth's gravity
 - C. heat radiating from Earth's interior
 - D. the Sun
11. Of these, which force is most directly responsible for the creation of fossil fuels?
 - A. displacement
 - B. erosion
 - C. pressure
 - D. tectonic activity
12. Movement of carbon from the geosphere to the atmosphere can be accomplished by
 - A. combustion.
 - B. photosynthesis.
 - C. respiration.
 - D. all of the above
13. Carbon dioxide exchange in the oceans is least affected by
 - A. circulating currents.
 - B. photosynthesis and respiration.
 - C. sea surface temperatures.
 - D. undersea volcanic activity.

7. d. Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.

14. Which type of flow within the carbon cycle happens most slowly?
 - A. Carbon flows from animals to the atmosphere by respiration.
 - B. Carbon flows from plants to animals by consumption.
 - C. Carbon flows from animals to the atmosphere by decay.
 - D. Carbon flows from the geosphere to the oceans by erosion.
15. What is the annual approximate ratio of carbon exchange into and out of the atmosphere by the biological cycle versus the geological cycle?
 - A. 1:1
 - B. 100:1
 - C. 1000:1
 - D. 10,000:1
16. In which form is carbon cycling most quickly?
 - A. animal tissue
 - B. atmospheric carbon dioxide
 - C. carbohydrates
 - D. carbonate rocks
17. For organism X shown below, which is the likely sequence of flow of its carbon into and out of carbon reservoirs?



- A. $X \rightarrow \text{coal} \rightarrow \text{combustion} \rightarrow \text{atmospheric CO}_2$
 - B. $\text{CO}_2 \rightarrow \text{water} \rightarrow X \rightarrow \text{sediment} \rightarrow \text{limestone}$
 - C. $\text{plant matter} \rightarrow \text{decomposition} \rightarrow X \rightarrow \text{CO}_2 \rightarrow \text{water}$
 - D. $\text{limestone} \rightarrow \text{natural gas} \rightarrow X \rightarrow \text{combustion}$
18. In which form is carbon cycling most slowly?
 - A. animal tissue
 - B. atmospheric carbon dioxide
 - C. carbohydrates
 - D. carbonate

Standards Practice

Structure and Composition of the Atmosphere



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

8. a. Students know the thermal structure and chemical composition of the atmosphere.

- Which group below lists three of the gases in Earth's atmosphere in order of frequency?
 - argon, nitrogen, oxygen
 - oxygen, nitrogen, argon
 - nitrogen, oxygen, argon
 - oxygen, argon, nitrogen
- Which statement is true about the layers of the atmosphere?
 - Each one gets colder as altitude increases.
 - Only the troposphere can support human life.
 - They are defined by their differences in density.
 - Their chemical compositions have no notable variations.
- Which is NOT one of the four main layers of the atmosphere?
 - troposphere
 - thermosphere
 - lithosphere
 - mesosphere
- Which layer of the atmosphere includes the ozone layer?
 - thermosphere
 - ionosphere
 - exosphere
 - stratosphere
- Which best describes the chemical composition of Earth's atmosphere?
 - 78% oxygen, 21% nitrogen, and 1% other gases
 - 87% oxygen, 12% nitrogen, and 1% other gases
 - 78% nitrogen, 21% oxygen, and 1% other gases
 - 87% nitrogen, 12% oxygen, and 1% other gases

8. b. Students know how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.

- The balance of gases in the atmosphere
 - was established at least 10,000 years ago.
 - was established at least 600 million years ago.
 - has been continually varying throughout Earth's existence.
 - has not changed since the formation of Earth.
- How is human activity affecting the composition of Earth's atmosphere?
 - It appears to be increasing the amount of atmospheric carbon dioxide present today, due to the releasing of fossil fuels.
 - It appears to be increasing the amount of atmospheric carbon dioxide throughout human existence, because overpopulation means more people are exhaling.
 - Scientists generally have no data indicating that human activity is affecting Earth's atmosphere.
 - Human agriculture appears to be increasing oxygen and nitrogen levels in Earth's atmosphere.
- Which process did NOT contribute to the formation of Earth's atmosphere?
 - outgassing
 - photosynthesis
 - gravity
 - wind
- Which explanation do most scientists use to explain the origin of atmospheric oxygen?
 - Acid rain dissolved rocks on Earth's surface, releasing oxygen into the atmosphere.
 - Bombardment from comets released large quantities of oxygen into the atmosphere.
 - Cyanobacteria photosynthesized carbon dioxide and water, giving off oxygen.
 - Volcanic outgassing produced large quantities of atmospheric oxygen.

Standards Practice

Structure and Composition of the Atmosphere



8. c. Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

- 10.** How does the ozone layer protect life on Earth's surface?
- A.** It acts as a catalyst to eliminate CFCs.
 - B.** It absorbs UV radiation and limits the amount that reaches the troposphere.
 - C.** It mitigates global warming by acting like a beach umbrella to keep Earth cool.
 - D.** It pulls ozones and other pollutants from the lower atmosphere and absorbs them.
- 11.** Ozone is
- A.** particulate matter that benefits life in the lower atmosphere, but endangers it by polluting the upper atmosphere.
 - B.** organic material that benefits life in the lower atmosphere.
 - C.** a gas that pollutes the lower atmosphere, but is vital to life when found in the upper atmosphere.
 - D.** a highly charged ion that pollutes every layer of the atmosphere.
- 12.** Which best describes the ozone layer?
- A.** It has not changed in size or shape in human history.
 - B.** Human activity seems to have reduced its size irreversibly.
 - C.** It appears to change in size and shape naturally, but not due to human activity.
 - D.** Both human activity and natural influences appear to affect its size and shape.
- 13.** Where is Earth's ozone layer located, and what is its role in protecting life on Earth?
- A.** It is high in the thermosphere and screens Earth from harmful gamma radiation.
 - B.** It is within the stratosphere and screens Earth from harmful ultraviolet radiation.
 - C.** It is low in the troposphere and screens Earth from harmful infrared radiation.
 - D.** It is deep in the asthenosphere and screens Earth from harmful microwave radiation.

Standards Practice

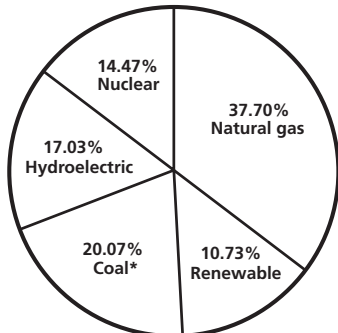
California Geology



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

9. a. Students know the resources of major economic importance in California and their relation to California's geology.

1. Of the power sources found in California, which two provide the greatest amount of electric power?



* Intermountain and Mohave coal plants are considered in-state, since they are in California control areas.

- A. nuclear and geothermal
B. natural gas and coal
C. natural gas and hydroelectric
D. coal and nuclear
2. What caused the sediments in California's Central Valley that have made it a major agricultural area?
- A. faults that occurred as the Sierra Nevada rose and eroded
B. faults that developed as the Sierra Nevada sank
C. ancient volcanic activity that buried the state in extrusive igneous rock
D. ancient volcanic activity that formed large igneous intrusions
3. What geologic process provides California's access to geothermal energy, which accounts for around 6 percent of California's electricity needs?
- A. fault-line erosion
B. plate tectonic subduction
C. plate tectonic spreading, or rifting
D. uplift deposition

9. b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.

4. What might cause a tsunami to strike the coast of California?
- A. volcanic activity within California
B. any earthquake along the Pacific Rim
C. high tides along the Pacific Rim
D. an earthquake in the Sierra Nevada
5. In which area would a landslide be most likely to occur as a result of an earthquake in California?
- A. an uplifted area with weak underlying rock and sediments
B. an uplifted area with exposed igneous rock
C. a valley floor composed of sediments
D. the interior of a dormant volcano's crater
6. In which California area is an earthquake most likely to occur?
- A. Central Valley
B. Sierra Nevada
C. San Andreas Fault
D. Sacramento
7. What is the primary cause of erosion of California's coastal cliffs?
- A. energy of waves striking their bases
B. energy of waves striking their rims
C. force of rivers flowing across them
D. force of earthquakes striking the coast
8. How many active volcanoes can be found in California?
- A. 0
B. 4
C. 6
D. 12

Standards Practice

California Geology



9. c. Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

9. Why is water more important in California than in many other states?
- A. California has less water than any other state.
 - B. California's water is polluted by the Pacific Ocean.
 - C. More people live in California than in any other state.
 - D. California's economy is based on industry and agriculture, which require a lot of water.

10. What is the source of most of California's water?
- A. coastal rain from Pacific Ocean winds
 - B. underground aquifers throughout the state
 - C. rain and snow in mountain watersheds
 - D. canals running from the Colorado River

11. California's mountains receive the greatest total precipitation in the state, but the majority of people in the state live along the coast. What is the relationship between degrees north latitude and average annual rainfall in California?

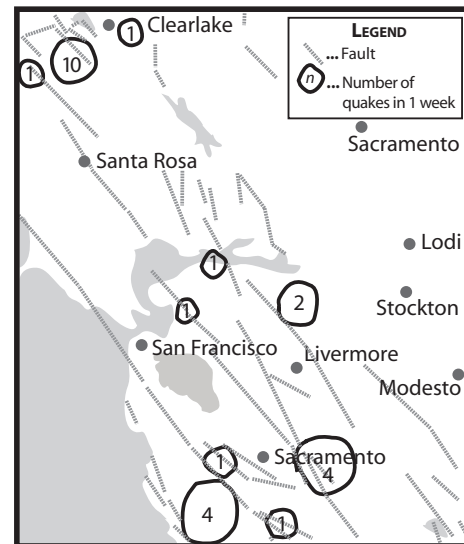
Average Annual Rainfall (cm)				
34°N	36°N	38°N	40°N	42°N
less than 50	50	75	100	200

- A. Average rainfall increases and decreases randomly with degrees of latitude from Mexico to Oregon.
- B. Average rainfall increases on a regular curve with each degree of latitude from Mexico to Oregon.
- C. Average rainfall decreases on a regular curve with each degree of latitude from Mexico to Oregon.
- D. There is no statistical relationship between rainfall and degrees of latitude from Mexico to Oregon.

9. d. Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

12. Suppose you are planning to build an underground system of pipes to deliver water to a development of new houses. The best source of information about potential earthquake hazards affecting your project would be the
- A. Federal Emergency Management Agency.
 - B. U.S. Army Corps of Engineers.
 - C. California Division of Mines and Geology.
 - D. local water reclamation district.

Use the map below to answer question 13.



13. Which community seems to have the greatest risk of an earthquake?
- A. Sacramento
 - B. Lodi
 - C. Clearlake
 - D. Stockton
14. In which location is the probability of future earthquakes much greater than elsewhere around the globe?
- A. batholith
 - B. craton
 - C. seismic belt
 - D. seismic gap

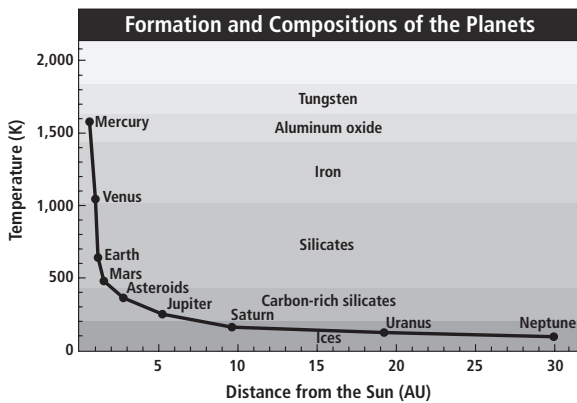
Sample Test



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

1. Compared to continental crust, oceanic crust is **3. a.**
A. less dense and thinner.
B. less dense and thicker.
C. denser and thinner.
D. denser and thicker.

2. How are the inner planets different from the outer planets? **1. a.**



- A.** The outer planets contain iron.
B. The inner planets are warmer.
C. The outer planets contain heavier elements.
D. The inner planets are rich in carbon silicates.
3. What shape is the Milky Way galaxy? **2. a.**
A. elliptical
B. spiral
C. globular
D. SO galaxy
4. El Niño is a(n) **5. g.**
A. annual event.
B. seasonal event.
C. cold ocean current.
D. warm ocean current.
5. Which greenhouse gas has increased as a direct result of burning fossil fuels and deforestation? **4. c.**
A. carbon dioxide
B. water vapor
C. methane
D. nitrous oxide

6. What happens to air temperature through the thermosphere? **8. a.**
A. Temperature decreases with altitude.
B. Temperature increases with altitude.
C. Temperature remains constant throughout the thermosphere.
D. Temperatures change randomly throughout the thermosphere.

7. People living along the coast of California are primarily concerned with which natural disaster? **9. b.**
A. tsunamis
B. forest fires
C. earthquakes
D. volcanic eruptions

8. The rotation of Earth on its axis creates **5. b.**
A. the seasons.
B. a year.
C. the Coriolis Effect.
D. a heat imbalance.

9. The diagram below represents a sample of rock. This rock is clearly metamorphic because it shows **3. c.**



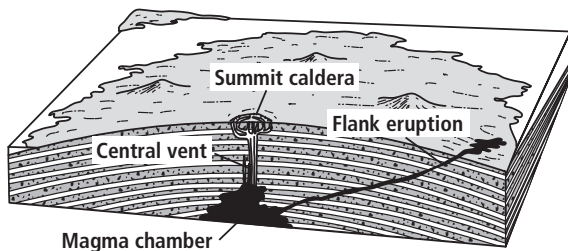
- A.** distorted banding.
B. organic composition.
C. a mixture of minerals.
D. crystals from precipitation.
10. What is the role of bacteria in the nitrogen cycle? **7. a.**
A. They fix free nitrogen.
B. They break down wastes.
C. They release nitrogen compounds in plants.
D. They release fixed nitrogen into the soil.



Sample Test *(continued)*



11. Most stars begin their life cycles as **2. d.**
A. supernovae.
B. red giants.
C. white dwarfs.
D. nebulas.
12. What evidence suggests that the universe has been expanding for 10 to 20 million years? **2. g.**
A. evidence of gravitational collapse
B. evidence of redshift from distant galaxies
C. evidence from the early atmosphere on Earth
D. evidence from rocks from the Moon and asteroid belt
13. What was the primary source of atmospheric oxygen on Earth? **8. b.**
A. volcanic eruptions
B. outgassing
C. photosynthesis by land plants
D. the ocean
14. What is the average salinity of salt water? **5. d.**
A. 10 ppt
B. 35 ppt
C. 50 ppt
D. 200 ppt
15. Which type of volcano is shown in this diagram? **3. e.**



- A. cinder cone
B. composite
C. shield
D. pyroclastic

16. Coal beds have been found in the rocks of Antarctica. This suggests that the climate in Antarctic was once **6. c.**
A. cold and snowy.
B. warm and moist.
C. windy.
D. a desert.
17. The ozone layer is located in the **8. c.**
A. troposphere.
B. stratosphere.
C. mesosphere.
D. thermosphere.
18. What type of star is Earth's Sun? **1. e.**
A. super giant
B. red dwarf
C. white dwarf
D. main sequence
19. What does the ozone layer do to much of the incoming solar radiation? **4. b.**
A. absorb it
B. reflect it
C. deflect it
D. allow it to pass into the atmosphere
20. Which statement is true of deserts? **5. f.**
A. They are only in warm climates.
B. They occur where the potential for precipitation is greater than evaporation.
C. They are often found inland, far from the coast.
D. They are areas that receive no precipitation.
21. Which of the following is used to measure the magnitude of an earthquake? **3. d.**
A. Fujita scale
B. Beaufort scale
C. Hertzprung-Russell diagram
D. Richter scale
22. How can an increase in greenhouse gases be predicted? **6. d.**
A. by studying satellite photos
B. by studying computer models
C. by studying temperature data
D. by studying emissions control



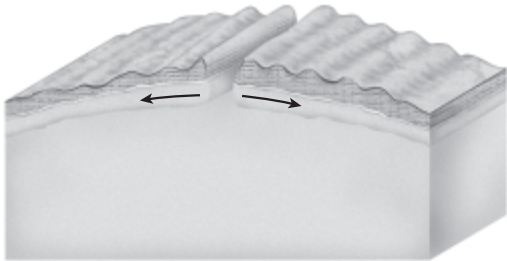
Sample Test *(continued)*



23. The atmosphere of Venus is composed primarily of **4. d.**

- A. water vapor.
- B. carbon dioxide.
- C. sulfuric acid.
- D. oxygen.

24. What type of plate boundary is shown in this diagram? **3. b.**



- A. convergent
- B. transform
- C. divergent
- D. subduction zone

25. Geologic hazard maps help people **9. d.**

- A. locate water resources.
- B. identify evidence of past geologic events.
- C. predict future geologic events.
- D. predict the future and learn about the past.

26. What role does respiration play in the carbon cycle? **7. d.**

- A. It releases carbon to the atmosphere.
- B. It removes carbon from the atmosphere.
- C. It has no impact on the carbon cycle.
- D. It changes the carbon to a different form.

27. Most terrestrial impact craters are found **1. f.**

- A. on the seafloor.
- B. in stable cratons.
- C. near volcanoes.
- D. near transform boundaries.

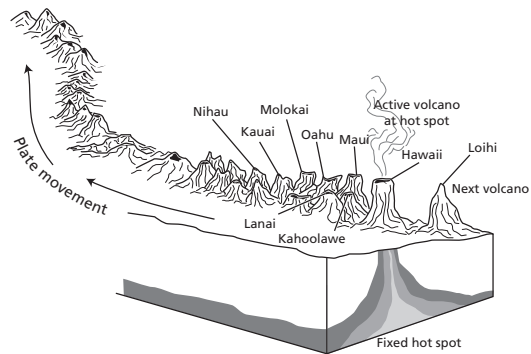
28. Approximately how old is our solar system? **1. b.**

- A. 15 million years
- B. 250 million years
- C. 4.6 billion years
- D. 15 billion years

29. What did the universe consist of before the stars formed? **2. e.**

- A. dust
- B. planets
- C. subatomic particles
- D. oxygen and nitrogen

30. According to this diagram, which of these Hawaiian Islands is oldest? **3. f.**



- A. Maui
- B. Oahu
- C. Hawaii
- D. Kauai

31. Most galaxies **2. b.**

- A. are moving away from Earth.
- B. are moving toward Earth.
- C. have a distinct shape.
- D. are spread uniformly throughout the universe.

32. Short-term climate changes caused by regular variations in daylight, temperature, and weather pattern are called **6. a.**

- A. microclimates.
- B. El Niño.
- C. La Niña.
- D. seasons.

33. Which is closer to Earth? **1. d.**

- A. Mars
- B. the Sun
- C. the Andromeda galaxy
- D. Betelgeuse



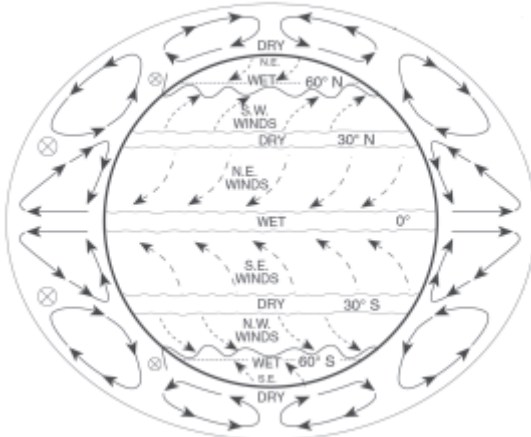
Sample Test *(continued)*



34. Which is a major source of water for eastern California? **9. c.**
A. the Pacific Ocean
B. the Colorado River
C. groundwater
D. snowmelt

35. Geothermal energy is driven by **7. c.**
A. solar radiation.
B. radioactive decay.
C. gravity.
D. Earth's internal processes.

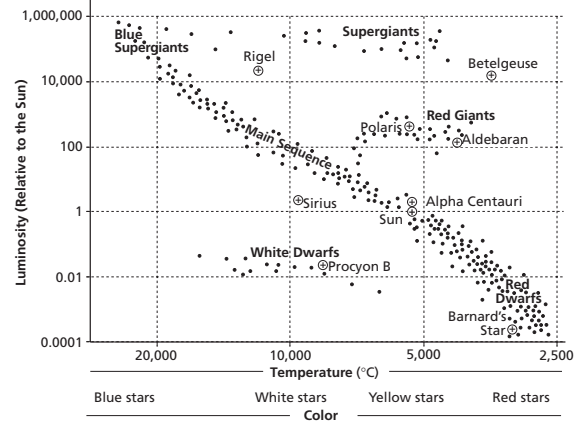
36. According to this diagram, where should most of Earth's rain forests be located? **5. e.**



- A.** 30° N and S of the equator
B. near the poles
C. around the equator
D. 50° S of the equator
37. Which statement has the most supporting evidence? **1. g.**
A. Our Sun is the only star with planets.
B. All stars have planets.
C. There is evidence of other solar systems around stars.
D. All planets formed at the same time.
38. How do elements with atomic numbers greater than that of lithium form? **2. c.**
A. nuclear fusion
B. nuclear fission
C. radioactive decay
D. meteor impact

39. Which source provides the least energy to Earth's surface? **4. a.**
A. ultraviolet radiation
B. radioactive decay
C. infrared radiation
D. visible light

40. Which stars have the highest temperature? **2. f.**



- A.** blue
B. white
C. yellow
D. red
41. Which statement about the differences between early Earth and present-day Earth is not supported by evidence? **1. c.**
A. Anaerobic bacteria were among the first life-forms on the planet.
B. The positions of landmasses have changed.
C. Earth's atmosphere once had little oxygen.
D. Earth's mass has changed dramatically.
42. How does climate change with latitude? **6. b.**
A. Temperatures increase with latitude.
B. Temperatures decrease with latitude.
C. Humidity increases with latitude.
D. There is no connection between latitude and climate.



Sample Test *(continued)*



- 43.** Most of the carbon in the atmosphere exists as **7. b.**
- A.** elemental carbon.
 - B.** graphite.
 - C.** carbon dioxide.
 - D.** carbon monoxide.
- 44.** Which describes the formation of gold deposits in the Sierra Nevada? **9. a.**
- A.** heat and pressure exerted on a coarse-grained metamorphic rock
 - B.** heat and pressure compacted carbonized material
 - C.** mineral deposited by hydrothermal solutions in quartz veins
 - D.** highly viscous magma cooled quickly at Earth's surface
- 45.** Temperatures generally decrease with altitude in the troposphere except when there is a **5. c.**
- A.** thunderstorm.
 - B.** temperature inversion.
 - C.** sea breeze.
 - D.** land breeze.
- 46.** The circulation patterns in the oceans and atmosphere are caused by **5. a.**
- A.** the Coriolis Effect.
 - B.** gravity.
 - C.** the spin of Earth on its axis.
 - D.** differential heating.

