Chapter 3

Answers to Section 1 Review

1. The three compositional layers are the crust, the mantle, and the core. The five physical layers are the lithosphere, the asthenosphere, the mesosphere, the outer core, and the inner core.
2. When rocks that are under stress suddenly break along a fault, a series of ground vibrations is set off. Many earthquakes are so small that we cannot feel them; others cause widespread damage.
3. Large-scale volcanic eruptions can cause a drop in the average global surface temperature.
4. Earth's surface is continually battered by wind and scoured by running water. Wind can blow soil away very quickly and erode soft rock. Waves can erode coastlines, and rivers can carve deep gorges.
5. Answers may vary but might include the idea that Earth's surface would be largely flat, the positions of the continents and oceans would not change, there would be fewer islands, and there would be fewer earthquakes.
6. A young mountain range would have tall, jagged peaks and deep valleys. An old mountain range would have rounded peaks and shallow valleys.

Answers to Section 2 Review

1. Earth's atmosphere is composed mainly of nitrogen and oxygen and small quantities of other gases.
2. Answers may vary. Sample Answers: The troposphere is the warmest layer of the atmosphere. Ozone is concentrated in a layer in the stratosphere, where it absorbs ultraviolet rays, protecting organisms from damage. The mesosphere absorbs little heat from the sun, and the air is thin and cold. Nitrogen and oxygen in the thermosphere absorb highenergy solar radiation such as X-rays and gamma rays.
3. The three mechanisms of heat transfer in the atmosphere are radiation, conduction, and convection.
4. Greenhouse gases absorb heat and radiate it back to the surface of the Earth.
5. Fewer gas molecules are found with increasing altitude above Earth's surface. Therefore, less pressure at these altitudes pushes downward on atmospheric gases. As a result, the air is less dense as altitude increases.
6. Answers may vary. One answer is that the burning of fossil fuels increases the amount of carbon dioxide in the atmosphere.

Answers to Section 3 Review

1. The three major processes in the water cycle are evaporation—liquid water is converted to water vapor, condensation—water vapor forms droplets on dust particles, and precipitation—large droplets fall from clouds.
2. Salinity and temperature are two important properties of ocean water.
3. The two types of ocean currents are surface currents, which are wind driven and may be hot or cold, and deep currents, which are cold and flow slowly along the ocean floor.
4. Answers may vary. A moderate temperature and an energy source (such as sunlight) are two physical factors that constrain living things to the biosphere.
5. Answers may vary. Sample answer: Earth's seasonal temperatures might change more quickly.
6. Answers may vary. Answers may include that humans obtain energy from plant and animal life and release energy and matter during life processes and when they die.

Chapter 3 Review

Using Key Terms

1. Sample answer: Earth's lithosphere is broken up into segments called tectonic plates.
2. Sample answer: Wind and water alter the landscape by a process called erosion.
3. Sample answer: The transfer of energy across space and in the atmosphere is called radiation.
4. Sample answer: Ozone is a molecule with three oxygen atoms that absorbs UV light in the stratosphere.
5. Sample answer: Salinity is the total quantity of dissolved solids in sea water.
6. The lithosphere refers to the crust and part of the upper mantle. The lithosphere is divided into tectonic plates. The asthenosphere is a layer at the top of the mantle that is solid yet plastic and flows slowly enough to allow plates to move on top of it.

7. Conduction is the direct transfer of energy, and convection is the transfer of heat by currents.
8. The crust is the outermost layer of the Earth that is made up of lower-density minerals. Beneath the crust is the mantle, which is composed of denser, iron-rich minerals.
9. Evaporation is the process by which water is heated, forming water vapor. Water vapor forms liquid water on dust particles in the process of condensation.

Understanding Key Ideas

10. d
11. b
12. c
13. a
14. d
15. b
16. c
17. b
18. d

Short Answer

19. As seismic waves travel through Earth's interior, they are altered by the nature of the material through which they travel. By measuring changes in the speed and direction of the waves as they penetrate the interior, scientists can infer what types of materials each layer is made of.
20. Gravity pulls gas molecules toward Earth's surface. Because of gravity, Earth's lower atmosphere is denser than its upper atmosphere.
21. Convection currents transport heat in the atmosphere through the interaction between warm and cool currents. As warm air rises into the atmosphere, it cools and eventually becomes cool enough to sink. As the cool air moves back toward Earth's surface, it is heated and rises once again.
22. Land near the ocean changes temperature less rapidly than land farther from the ocean because of the moderating effect of the ocean. Whereas land loses heat rapidly after the sun goes down, the ocean does not.
23. Life on Earth is confined to a narrow layer near Earth's surface because living things require a moderate temperature, liquid water, and a source of energy.

Interpreting Graphics

24. There is more marine algae at location A.
25. Marine algae live where there is sunlight, nutrients, and warm water. Regions that have heavy "vertical mixing" in the upper layer of the ocean tend to be areas with the greatest algae populations. For example, northern ocean waters experience vertical mixing, because the chilled surface water there sinks and is replaced by upwelling water in which there are abundant nutrients.

Concept Mapping

26. Concept mapping answers are on pp. 715–720.
27. The larger and more violent an eruption is, the more material is ejected into the stratosphere, which blocks sunlight and lowers average global temperature. Simultaneous eruptions could potentially block out so much sunlight that Earth's temperature could grow cold enough to kill off some animal and plant species, particularly those species that are adapted to a narrow temperature range. Although humans can survive in a wide range of temperatures, their food supply could be compromised by crop failures and by the collapse of parts of the food chain.
28. If greater percentages of radiation were absorbed by Earth's surface, the surface would be considerably hotter. Currently, Earth's surface deflects a portion of the solar radiation that reaches its surface. If less radiation was absorbed, Earth's surface would grow cooler. Even small temperature changes (either hotter or cooler) could severely compromise the viability of the biosphere.
29. If Earth had no landmasses, surface currents would move with the wind direction and the Coriolis effect. Warm surface currents would originate near the equator, and cold currents would originate near the poles.

Cross-Disciplinary Connection

30. Answers may vary.

Portfolio Project

31. Answers may vary.

Math Skills

32. In order of highest depth-to-area ratio to the lowest: Arctic, Indian, Atlantic, Pacific.

33. 4,250 (Pacific) _ 4,000 (Atlantic) _ 4,000 (Indian) _ 1,250 (Arctic) _ 13,500 _ 4 _ 3,375 meters on average.

Writing Skills

34. Answers may vary but should include the movement of energy by convection, conduction, and radiation.

35. Answers may vary. Students should note that in open systems matter and energy enter and leave the system. In a closed system, energy enters the system but matter does not. The atoms that make up Earth, which is mostly a closed system, have been the same for billions of years. Students may cite asteroids and meteors as rare examples of how matter enters the Earth system today.

36. Answers may vary. Students might discuss, for example, how the movement of winds in the atmosphere affects currents in the oceans (hydrosphere), which in turn affects aquatic life and the movement of nutrients.

Reading Skills

1. c

2. b

Standardized Test Prep Answers

1. C

2. H

3. D

4. G

5. Answers will vary. See Test Doctor for detailed scoring rubric.

6. The Richter scale is used to quantify the amount of energy released by an earthquake.

7. D

8. H

9. A

10. F

11. D

12. G