6. thermosphere: the uppermost layer of the atmosphere, in which temperature increases as altitude increases

SECTION: ATMOSPHERIC HEATING

1. radiation: the transfer of energy as electromagnetic waves
2. thermal conduction: the transfer of energy as heat through a material
3. convection: the transfer of thermal energy by the circulation or movement of a liquid or gas
4. greenhouse effect: the warming of the surface and lower atmosphere of Earth that occurs when water vapor, carbon dioxide, and other gases absorb and reradiate thermal energy
5. global warming: a gradual increase in average global temperature

SECTION: GLOBAL WINDS AND LOCAL WINDS

1. wind: the movement of air caused by differences in air pressure
2. Coriolis effect: the apparent curving of the path of a moving object from an otherwise straight path due to the Earth's rotation
3. polar easterlies: prevailing winds that blow from east to west between 60° and 90° latitude in both hemispheres
4. westerlies: prevailing winds that blow from west to east between 30° and 60° latitude in both hemispheres
5. trade winds: prevailing winds that blow northeast from 30° north latitude to the equator and that blow southeast from 30° south latitude to the equator
6. jet stream: a narrow belt of strong winds that blow in the upper troposphere

SECTION: AIR POLLUTION

1. air pollution: the contamination of the atmosphere by the introduction of pollutants from human and natural sources
2. acid precipitation: rain, sleet, or snow that contains a high concentration of acids

Section Review

SECTION: CHARACTERISTICS OF THE ATMOSPHERE

1. Sample answer: Air pressure is caused by gravity pulling air molecules in the atmosphere toward the Earth. The atmosphere is a mixture of gases that surrounds the Earth. The troposphere is the layer where most weather occurs. The stratosphere is where the ozone layer is located. The mesosphere is the middle atmospheric layer. The thermosphere is the atmospheric layer with the highest temperatures.
2. D
3. Air pressure decreases as altitude increases because the atmosphere is less dense at higher altitudes.
4. Temperatures in the thermosphere are high because particles are moving quickly in the thermosphere. The thermosphere does not feel hot because is not very dense, so particles cannot collide to transfer much thermal energy.
5. The temperature of atmospheric layers varies because of the way solar energy is absorbed by different gases.
6. nitrogen and oxygen
7. $0.5 g/m^3 \times 1{,}000{,}000{,}000\ m^3 =$ 500,000,000g, or 500,000 kg
8. Answers may vary. Students should recognize that air density is lower at higher altitudes. Helicopters need air to provide lift. At altitudes higher than 6,000 m, air density is so low that it is difficult for helicopters to fly.
9. Answers may vary. Space vehicles reenter the atmosphere at a very high speed. Although the atmosphere is not very dense at the altitude that space vehicles reenter, the vehicles are traveling fast enough to compress air in front of them. This layer of air transfers thermal energy to the spacecraft's exterior.
10. Answers may vary. Helium does not have enough mass to be held by the Earth's gravitational attraction.

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