

Directed Reading

Section: Solar Energy and the Atmosphere

1. How is Earth's atmosphere heated?

2. Name the two primary sources of heat in the atmosphere.

RADIATION

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

- | | |
|-----------------------------------|--|
| _____ 3. radiation | a. the waves that make up all forms of radiation |
| _____ 4. wavelength | b. the distance from any point on a wave to an identical point on the next wave |
| _____ 5. electromagnetic waves | c. all the frequencies or wavelengths of electromagnetic radiation |
| _____ 6. electromagnetic spectrum | d. all forms of energy that travel through space as waves, including the energy that Earth receives from the sun |

7. What form of radiation can humans see?

8. What are three forms of radiation that humans cannot see?

9. At what speed does electromagnetic radiation travel through space?

10. How are the wavelengths of visible light seen?

Directed Reading *continued*

11. Which wavelengths are shorter than visible light? Which are longer?

THE ATMOSPHERE AND SOLAR RADIATION

_____ 12. Almost all radiation that has a wavelength shorter than the wavelengths of visible light is absorbed by the _____
a. lower atmosphere.
b. thermosphere.
c. upper atmosphere.
d. stratosphere.

_____ 13. X rays, gamma rays, and ultraviolet rays are absorbed by molecules of nitrogen and oxygen in the mesosphere and _____
a. lower atmosphere.
b. thermosphere.
c. upper atmosphere.
d. stratosphere.

_____ 14. Ultraviolet rays are absorbed and act upon oxygen molecules to form ozone in the _____
a. lower atmosphere.
b. thermosphere.
c. upper atmosphere.
d. stratosphere.

_____ 15. Solar rays with longer wavelengths, such as visible and infrared waves, reach the _____
a. lower atmosphere.
b. thermosphere.
c. upper atmosphere.
d. stratosphere.

_____ 16. Most incoming infrared radiation is absorbed by carbon dioxide, water vapor, and other complex molecules in the _____

Directed Reading *continued*

17. How much of the radiation from visible light waves is absorbed as the radiation passes through the atmosphere?

18. What causes scattering?

19. What happens when particles and gas molecules in the atmosphere reflect and bend, or deflect, solar rays?

20. What does scattering do to the solar radiation that travels to Earth?

21. What effect does scattering have on the sky's appearance?

22. What happens to solar energy that reaches Earth's surface?

Directed Reading *continued*

23. The amount of energy that is absorbed or reflected by Earth's surface depends on certain characteristics. List eight of them.

24. What is the fraction of solar radiation that is reflected off the surface of an object called?

25. What is Earth's albedo? Explain your answer.

ABSORPTION AND INFRARED ENERGY

- _____ 26. Solar radiation that is not reflected is
- a. absorbed.
 - b. scattered.
 - c. radiated.
 - d. dissipated.

- _____ 27. When Earth's surface absorbs solar radiation, the surface materials are heated by
- a. longer-wavelength infrared rays and ultraviolet light.
 - b. short-wavelength infrared rays and visible light.
 - c. short-wavelength microwaves and infrared light.
 - d. longer-wavelength microwaves and ultraviolet light.

Directed Reading *continued*

- _____ 28. Heated materials on Earth's surface convert solar energy into infrared rays
- a. with longer wavelengths.
 - b. with shorter wavelengths.
 - c. with equal wavelengths.
 - d. The solar energy is not converted.

29. What happens to the infrared radiation that Earth emits into the atmosphere?

30. What does the absorption of thermal energy from the ground do to Earth's surface?

31. Warm air near Earth's surface sometimes bends light rays to cause an effect called a _____.

32. Earth's atmosphere reduces the escape of energy that radiates from _____.

33. The warming of the surface and lower atmosphere of Earth that occurs when carbon dioxide, water vapor, and other gases in the air absorb and radiate infrared radiation is called the _____.

34. How does the amount of solar energy that enters Earth's atmosphere generally compare to the amount that escapes into space?

35. What is one human activity that may have caused the average temperature of the atmosphere to increase in recent years?

Directed Reading *continued*

VARIATIONS IN TEMPERATURE

36. Why are the warmest hours of the day usually mid- to late afternoon and not noon?

37. What is the primary factor that affects how much solar energy reaches any point on Earth's surface?

38. Near the equator, the rays of the sun strike the ground at an angle of about

39. What happens to the energy when sunlight hits Earth at an angle smaller than 90°?

40. Why are average temperatures higher at the equator than near the poles?

41. Seasonal variations in temperature occur because of

42. Why does the Northern Hemisphere have higher temperatures for one part of the year and lower temperatures the rest?

43. Why does the amount of water in the air affect the temperature of a region?

Directed Reading *continued*

44. Why do areas of high elevation become warm during the day and cool quickly at night?

45. Why do desert temperatures vary widely between day and night?

46. Why are land areas close to large bodies of water generally cooler during the day and warmer at night than similar inland areas?

CONDUCTION

_____ 47. As molecules in a substance become heated, they
a. move at the same rate as when they are cooled.
b. move faster.
c. move more slowly.
d. do not move at all.

_____ 48. What effect do collisions between molecules have on the molecules?
a. Collisions change their structures.
b. Collisions break them apart.
c. Collisions cool them.
d. Collisions warm them.

_____ 49. The transfer of energy as heat from one substance to another by direct contact is called
a. conduction.
b. collision.
c. firing.
d. baking.

Directed Reading *continued*

- _____ 50. Solid substances are good conductors because molecules
- a. are close together.
 - b. are far apart.
 - c. cannot collide.
 - d. move slowly.
- _____ 51. Air is a poor conductor because molecules
- a. are close together.
 - b. are far apart.
 - c. cannot collide.
 - d. move slowly.
- _____ 52. Conduction heats only the lowest few centimeters of the atmosphere because
- a. air does not come into direct contact with Earth.
 - b. air comes into direct contact with the warmed surface of Earth.
 - c. molecules of air in the lower atmosphere are closer together.
 - d. molecules in the upper atmosphere do not collide.

CONVECTION

53. What is the primary cause of the heating of the lower atmosphere?

54. The movement of matter due to differences in density, which is caused by temperature variations, results in the transfer of heat called

55. When does convection occur?

56. What happens to air heated by radiation or conduction?

Directed Reading *continued*

57. How is Earth's atmosphere warmed?

58. Why is the atmospheric pressure lower beneath a mass of warm air?

59. How do differences in atmospheric pressure create winds?
