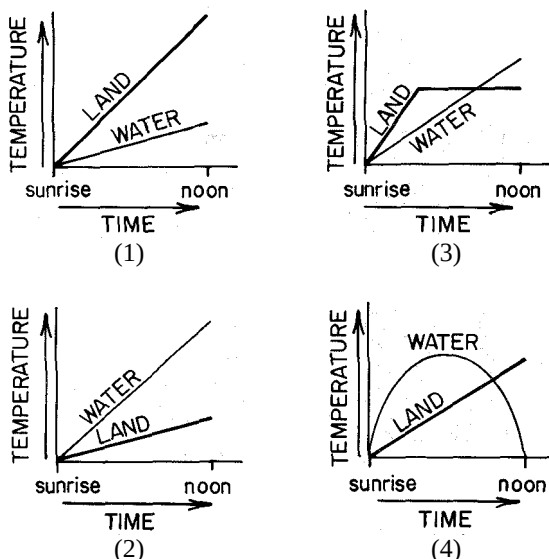


Mouse over '?' for answers. Mouse over key for hints and explanations.

1. Which substance has the highest specific heat?

-  ? (1) iron (3) lead
(2) water (4) granite

2. Which graph best illustrates the temperature changes on adjacent land and water surfaces as they are heated by the Sun from sunrise to noon on the same day?



3. Which process requires the addition of energy to water?

-  ? (1) freezing of water (3) vaporization of water
(2) cooling of water (4) condensation of water

4. On a clear summer day, the surface of land is usually warmer than the surface of a nearby body of water because the water

-  ? (1) receives less insolation (3) has a higher density
(2) reflects less insolation (4) has a higher specific heat

5. Which phase change requires water to gain 2260 Joules per gram?

-  ? (1) solid ice melting (3) liquid water vaporizing
(2) liquid water freezing (4) water vapor condensing

6. When 1 gram of liquid water at 0° Celsius freezes to form ice, how many total Joules of heat are lost by the water?

-  ? (1) 4.18 (3) 334
(2) 2.11 (4) 2260

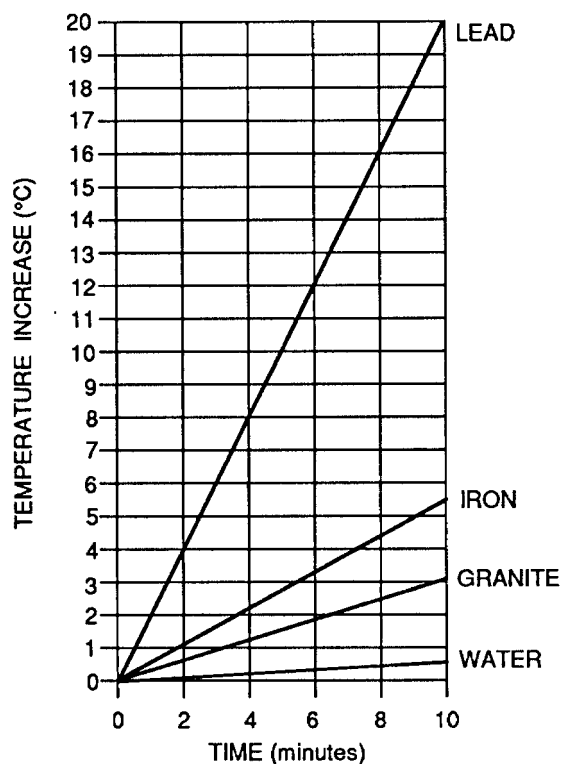
7. Which form of radiation given off by the Earth causes heating of the Earth's atmosphere?

-  ? (1) infrared (3) visible
(2) ultraviolet (4) X-ray

8. What is the most likely reason for a decrease in air temperature observed between 12 midnight and 6 a.m. in New York State?

-  ? (1) Air pressure was decreasing.
(2) Cloud cover was increasing.
(3) The Earth was radiating heat.
(4) Plants were giving off water vapor.

9. Base your answer to the following question on the graph below, which shows the temperature increase of samples of water, granite, iron, and lead. Each sample has a mass of 100 grams. Each sample was placed an equal distance from a light bulb and heated for a 10-minute period. This investigation was performed at room temperature under ordinary classroom conditions.



 ? Which sample would decrease in temperature at the greatest rate after the heat source is removed?

-  (1) iron (3) granite
(2) lead (4) water

10. On a sunny day at the beach, the dark-colored sand gets hot while the water stays cool because the sand

-  ? (1) reflects less energy and has a lower specific heat than the water
(2) reflects less energy and has a higher specific heat than the water
(3) reflects more energy and has a lower specific heat than the water
(4) reflects more energy and has a higher specific heat than the water

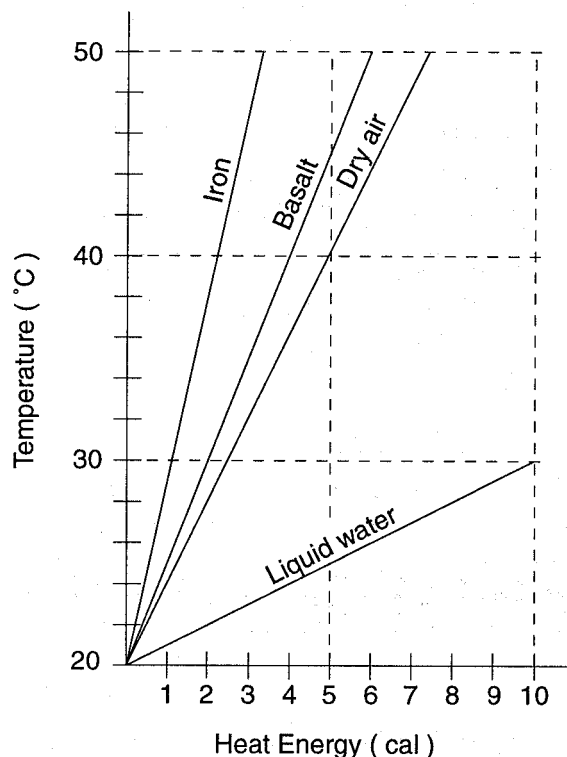
11. Changing the color of the roof of a house from light to dark would probably increase the amount of solar energy that is

-  ? (1) reflected (3) insulated
(2) created (4) absorbed

12. Which of these characteristics identify an Earth surface that is likely to be the best absorber of insolation?

-  ? (1) light colored and smooth (3) dark colored and smooth
(2) light colored and rough (4) dark colored and rough

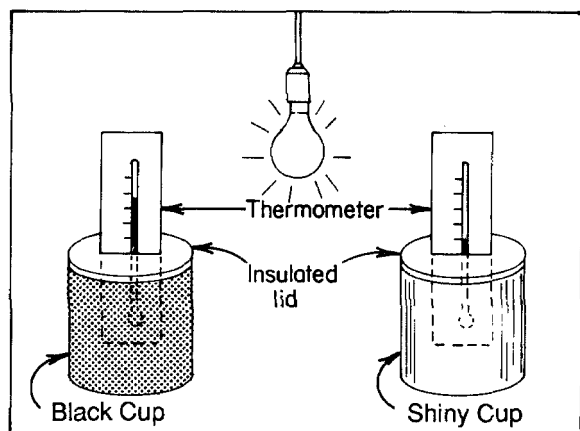
13. Base your answer to the following question on the graph below which shows the amount of heat energy (calories) needed to raise the temperature of 1-gram samples of four different materials.



- ?** If all four materials were heated to 100°C and then allowed to cool, which material would show the most rapid drop in temperature?

- (1) basalt (2) iron (3) dry air (4) liquid water

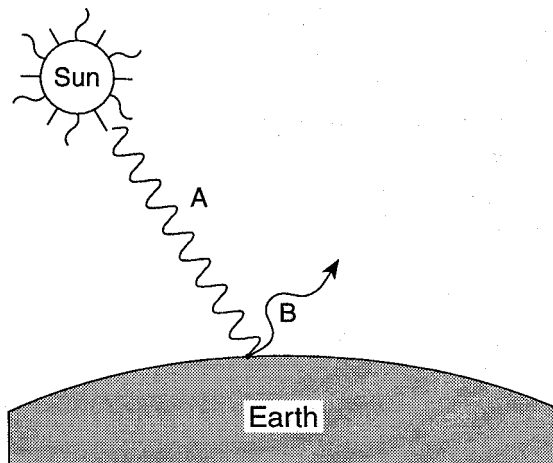
14. The diagram below shows a light source that has been heating two metal containers of air for 10 minutes. Both cups are made of the same material and are equal distances from the light source.



Compared to the amount of energy reflected by the shiny cup during the 10 minutes of heating, the amount of energy reflected by the black cup is

- (1) less (2) greater (3) the same

15. The diagram below represents energy being absorbed and reradiated by the Earth.



- ?** Which type of energy is represented by the radiation at B?
 (1) insolation (2) visible light (3) ultraviolet rays (4) infrared energy

16. A person in Florida worked outdoors in sunlight for several hours on a day in July. Which type of clothing should the person have worn to absorb the *least* electromagnetic radiation?

- (1) dark colored with a rough surface
 (2) dark colored with a smooth surface
 (3) light colored with a rough surface
 (4) light colored with a smooth surface

17. When Earth cools, most of the energy transferred from Earth's surface to space is transferred by the process of
 (1) conduction (2) reflection (3) refraction (4) radiation

18. Why are some scientists concerned about an increase in the amount of carbon dioxide in the atmosphere?

- (1) An increase would change the decay rate of C¹⁴.
 (2) An increase would cause more ultraviolet energy to strike the Earth's outer atmosphere.
 (3) An increase would cause energy to flow from energy sinks to energy sources.
 (4) An increase would cause an overall heating up of the Earth's atmosphere.

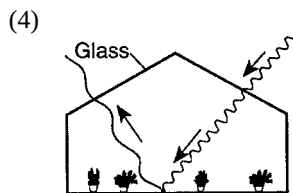
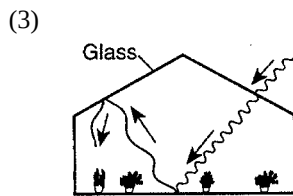
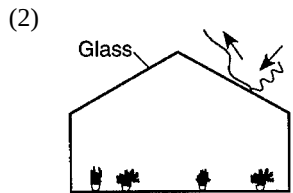
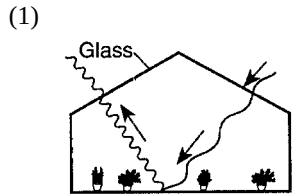
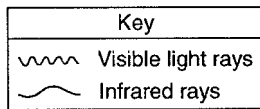
19. Earth's atmosphere is warmed when

- ?** (1) ultraviolet radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere
 (2) x-ray radiation emitted by Earth is absorbed by nitrogen and carbon dioxide in the atmosphere
 (3) infrared radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere
 (4) gamma radiation emitted by Earth is absorbed by carbon dioxide and water vapor in the atmosphere

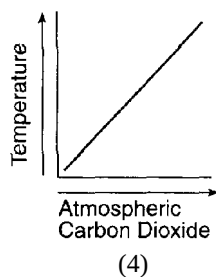
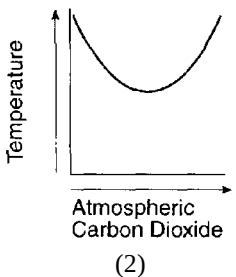
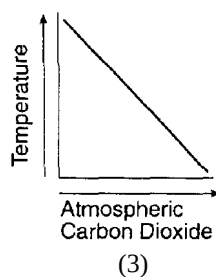
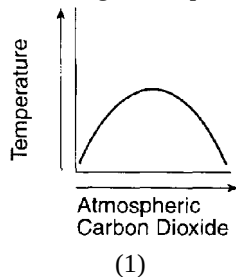
20. By which process does starlight travel through space?

- ?** (1) absorption (2) conduction (3) convection (4) radiation

21. Which diagram best shows how air inside a greenhouse warms as a result of energy from the Sun?



22. Which graph best shows the relationship between the amount of carbon dioxide contained in Earth's atmosphere and the average atmospheric temperature?



23. Two identical glass containers were placed in direct sunlight. The first container was filled with air and the second container was filled with a mixture of air and additional carbon dioxide. Each container was sealed with a thermometer inside. Temperatures were recorded at 2-minute intervals, as shown in the data table below.

Time (minutes)	Temperature (°C)	
	Container 1 (Air)	Container 2 (Air + CO ₂)
0	24°	24°
2	25°	26°
4	26°	29°
6	27°	32°
8	28°	33°
10	29°	35°

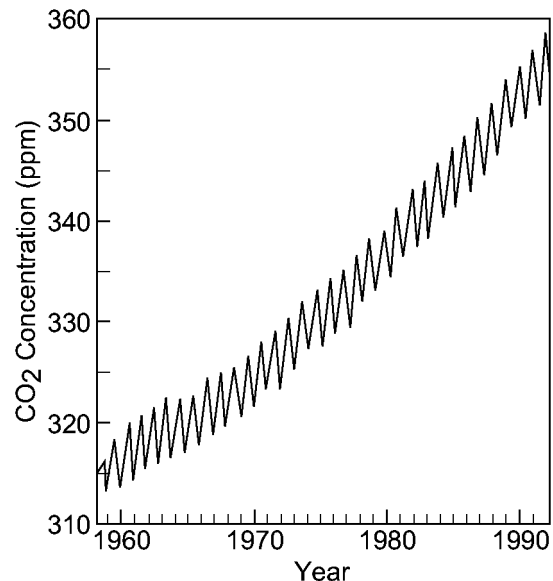


Which statement best explains the results of this activity?



- (1) Carbon dioxide is a good absorber of infrared radiation.
- (2) Carbon dioxide causes a random reflection of energy.
- (3) Carbon dioxide has no effect on the atmosphere's energy balance.
- (4) Carbon dioxide converts some energy into potential energy.

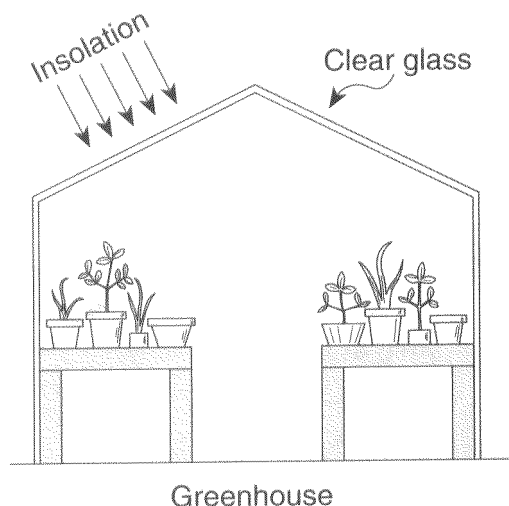
24. The graph below shows the change in carbon dioxide concentration in parts per million (ppm) in Earth's atmosphere from 1960 to 1990.



The most likely cause of the overall change in the level of carbon dioxide from 1960 to 1990 is an increase in the

- (1) number of violent storms
- (2) number of volcanic eruptions
- (3) use of nuclear power
- (4) use of fossil fuels

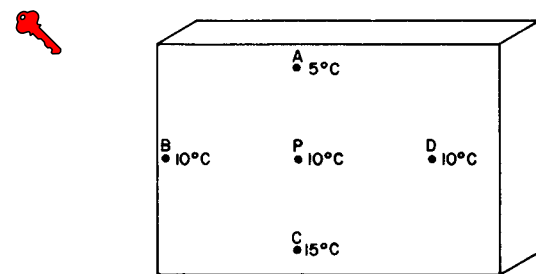
25. The diagram below shows a greenhouse.



? What is the primary function of the clear glass of the greenhouse?

- key
- (1) The glass reduces the amount of insolation entering the greenhouse.
 - (2) The glass allows all wavelengths of radiation to enter and all wavelengths of radiation to escape.
 - (3) The glass allows short wavelengths of radiation to enter, but reduces the amount of longwavelength radiation that escapes.
 - (4) The glass allows long wavelengths of radiation to enter, but reduces the amount of shortwavelength radiation that escapes.

26. The diagram below shows temperature values at various points in a solid piece of aluminum. Toward which point will heat flow from point P?



- (1) A
- (2) B
- (3) C
- (4) D

27. An ice cube is placed in a glass of water at room temperature. Which heat exchange occurs between the ice and the water within the first minute?

- key
- (1) The ice cube gains heat and the water loses heat.
 - (2) The ice cube loses heat and the water gains heat.
 - (3) Both the ice cube and the water gain heat.
 - (4) Both the ice cube and the water lose heat.

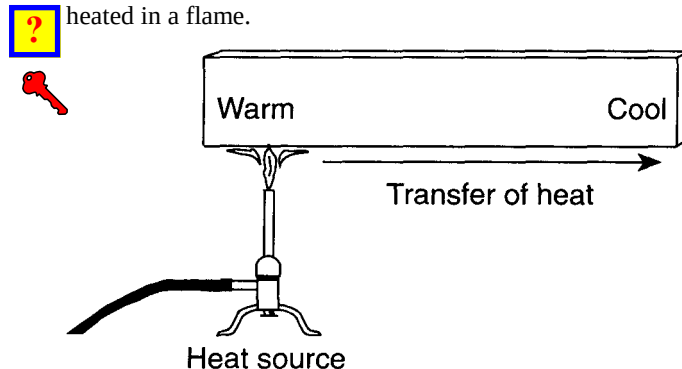
28. By which process is heat energy transferred when molecules within a substance collide?

- key
- (1) conduction
 - (2) convection
 - (3) radiation
 - (4) sublimation

29. Which statement best describes the pattern of energy flow in a closed system?

- key
- (1) Energy flows out of the system.
 - (2) Energy flow is cyclical, so that equilibrium is never reached.
 - (3) Energy flows from energy sinks to energy sources.
 - (4) Energy flows from energy sources to energy sinks.

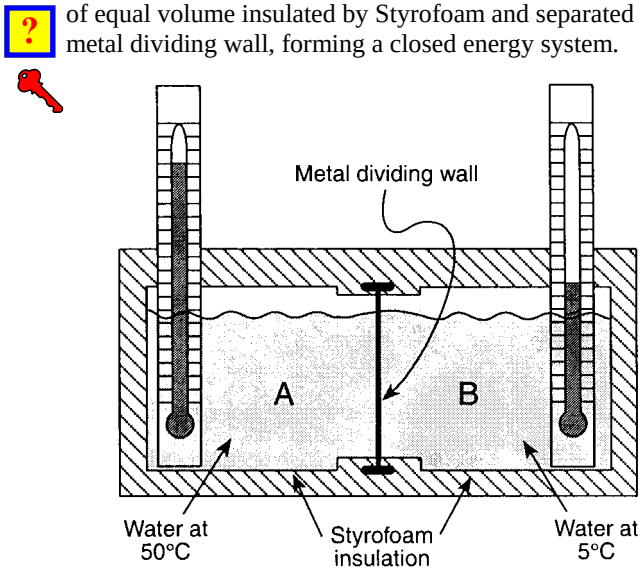
30. The diagram below shows a solid iron bar that is being heated in a flame.



The primary method of heat transfer in the solid iron bar is

- (1) convection
- (2) conduction
- (3) absorption
- (4) advection

31. The cross section below shows two compartments of water of equal volume insulated by Styrofoam and separated by a metal dividing wall, forming a closed energy system.



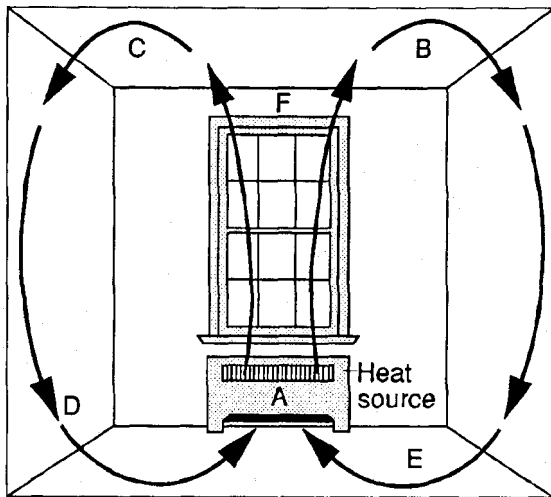
When the temperature of the water in compartment A decreases by 10°C, the temperature of the water in compartment B will

- (1) remain unchanged
- (2) decrease by only 5°C
- (3) decrease by approximately 10°C
- (4) increase by approximately 10°C

32. Which process is primarily responsible for the transfer of energy by air currents within the Earth's atmosphere?

- key
- (1) convection
 - (2) radiation
 - (3) absorption
 - (4) conduction

Base your answers to questions 33 through 35 on the diagram below. The diagram shows the pattern of air movement within a closed room.



33. Which type of energy transfer is indicated by the arrows in the diagram?

- (1) insolation (3) convection
(2) conduction (4) radiation

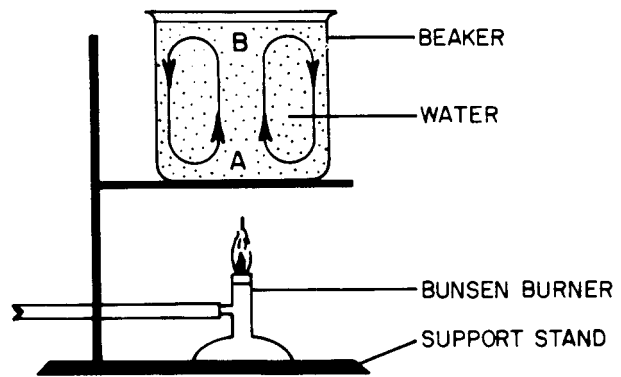
34. At which location in the room will the density of the air be greatest?

- (1) F (3) C
(2) B (4) E

35. What color should the heat source in the room be painted in order to radiate the most heat?

- (1) red (3) green
(2) black (4) silver

36. The diagram below represents a large beaker of water being heated to demonstrate convection.



The movement of water upward from A toward B results primarily from

- (1) differences in density in the water
(2) air movement across the surface of the water
(3) capillary action within the water
(4) the shape of the beaker

37. During which process does heat transfer occur because of density differences?



- (1) conduction (3) radiation
(2) convection (4) reflection

38. Which action would help an air-conditioner use less energy on a hot, sunny summer day?



- (1) opening draperies and blinds
(2) adding insulation in the walls and ceiling
(3) turning on lights and heat-producing appliances
(4) replacing light-colored roofing materials with dark-colored ones

39. During nighttime cooling, most of the energy radiated by Earth's oceans into space is



- (1) ultraviolet rays (3) visible light rays
(2) gamma rays (4) infrared rays

40. Which type of surface absorbs the greatest amount of electromagnetic energy from the Sun?



- (1) smooth, shiny, and light colored
(2) smooth, shiny, and dark colored
(3) rough, dull, and light colored
(4) rough, dull, and dark colored