

# ENERGY REVIEW

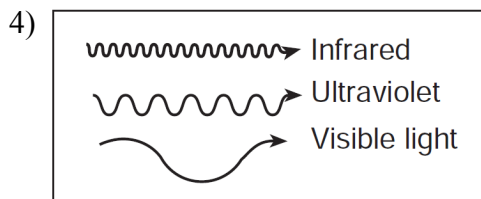
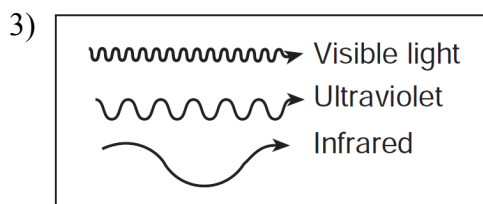
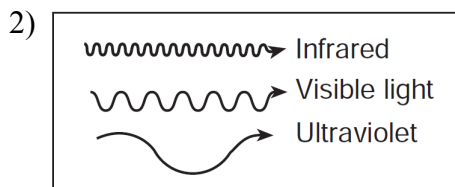
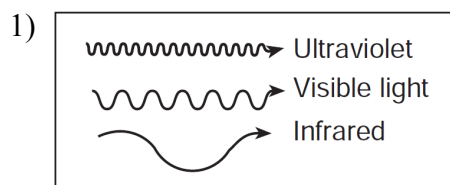
1. Which process is responsible for the greatest loss of energy from Earth's surface into space on a clear night?

- 1) condensation
- 2) conduction
- 3) radiation
- 4) convection

2. Which type of electromagnetic radiation has the longest wavelength?

- 1) ultraviolet
- 2) gamma rays
- 3) visible light
- 4) radio waves

3. Which diagram best represents the relative wave-lengths of visible light, ultraviolet energy, and infrared energy?



4. Which color of the visible light has the *shortest* wavelength?

- 1) violet
- 2) green
- 3) yellow
- 4) red

5. Energy is transferred from the Sun to Earth mainly by

- 1) molecular collisions
- 2) density currents
- 3) electromagnetic waves
- 4) red shifts

6. What is the basic difference between ultraviolet, visible, and infrared radiation?

- 1) half-life
- 2) temperature
- 3) wavelength
- 4) wave velocity

7. When electromagnetic energy travels from air into water, the waves are bent due to the density differences between the air and water. This bending is called

- 1) reflection
- 2) refraction
- 3) scattering
- 4) absorption

8. As the temperature of an object approaches absolute zero ( $0^{\circ}$  K), the amount of electromagnetic energy radiated by the object will

- 1) decrease
- 2) increase
- 3) remain the same

9. Changing the shingles on the roof of a house to a lighter color will most likely reduce the amount of solar energy that is

- 1) scattered
- 2) absorbed
- 3) reflected
- 4) refracted

10. The energy radiated from the Sun consists of a

- 1) narrow range of wavelengths, with ultraviolet radiation having the greatest intensity
- 2) narrow range of wavelengths, with infrared radiation having the greatest intensity
- 3) wide range of wavelengths, with visible radiation having the greatest intensity
- 4) wide range of wavelengths, with x-ray radiation having the greatest intensity

11. An object that is a good absorber of electromagnetic energy is also a good

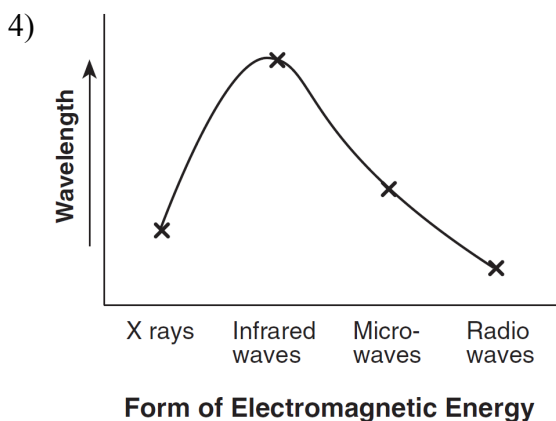
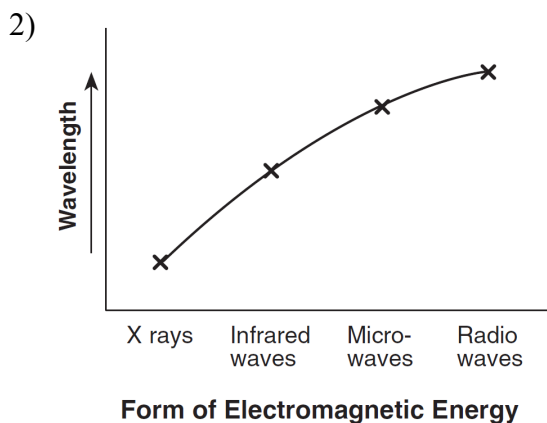
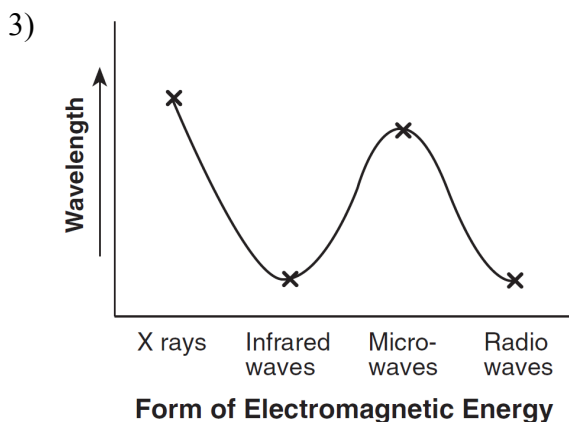
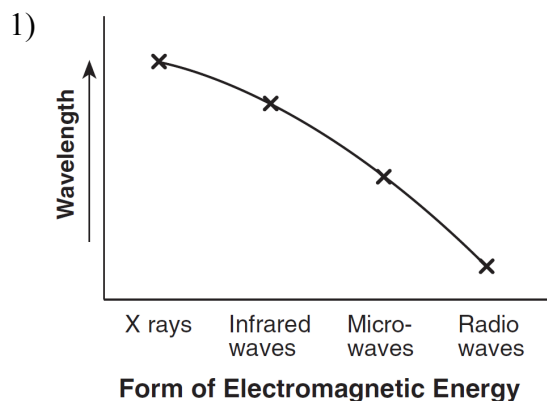
- 1) reflector of electromagnetic energy
- 2) refractor of electromagnetic energy
- 3) radiator of electromagnetic energy
- 4) convector of electromagnetic energy

12. How much heat energy is required to change five grams of ice to liquid water at  $0^{\circ}$ C?

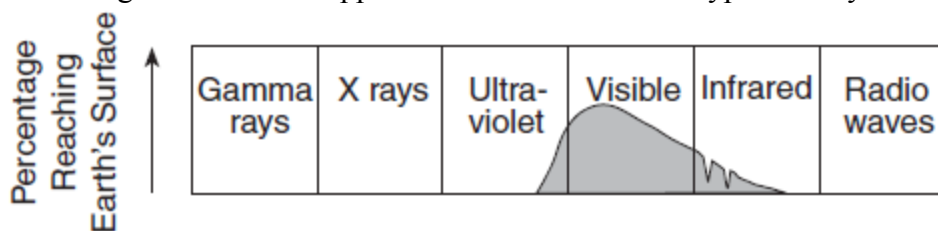
- 1) 334 joules
- 2) 1670 joules
- 3) 2260 joules
- 4) 11,300 joules

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13. Which graph best represents the relative wavelengths of the different forms of electromagnetic energy?



14. The diagram below shows the types of electromagnetic energy given off by the Sun. The shaded part of the diagram shows the approximate amount of each type actually reaching Earth's surface.



Which conclusion is best supported by the diagram?

- 1) All types of electromagnetic energy reach Earth's surface.
- 2) Gamma rays and x-rays make up the greatest amount of electromagnetic energy reaching Earth's surface.
- 3) Visible light makes up the greatest amount of electromagnetic energy reaching Earth's surface.
- 4) Ultraviolet and infrared radiation make up the greatest amount of electromagnetic energy reaching Earth's surface.

15. As water vapor changes phase from gas to liquid, each gram of water vapor

- 1) releases 2260 joules of heat energy
- 2) releases 334 joules of heat energy
- 3) gains 2260 joules of heat energy
- 4) gains 334 joules of heat energy

16. When a heat source loses energy, that energy is

- 1) reflected by a heat sink
- 2) refracted by a heat sink
- 3) scattered by a heat sink
- 4) absorbed by a heat sink

## ENERGY REVIEW

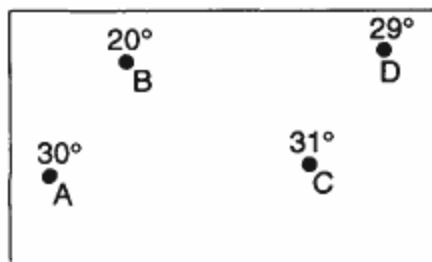
17. The picture below shows a calorimeter being used to demonstrate a method of heat transfer. One cup is filled with hot water, and the other cup is filled with cold water. A metal bar extends through the lids into the water in both cups. Thermometers record changes in temperature.



This calorimeter demonstrates the transfer of heat through the metal bar from

- 1) cold water to hot water by conduction
  - 2) cold water to hot water by radiation
  - 3) hot water to cold water by conduction
  - 4) hot water to cold water by radiation
18. When one gram of liquid water at its boiling point is changed into water vapor,
- 1) 334 J/g is gained from the surrounding environment.
  - 2) 334 J/g is released into the surrounding environment.
  - 3) 2260 J/g is gained from the surrounding environment.
  - 4) 2260 J/g is released into the surrounding environment.
19. Pieces of lead, copper, iron, and granite, each having a mass of 1 kilogram and a temperature of 100°C, were removed from a container of boiling water and allowed to cool under identical conditions. Which piece most likely cooled to room temperature first?
- 1) copper
  - 2) lead
  - 3) iron
  - 4) granite

20. The map below shows four locations in a temperature field. The temperature of each location is given in degrees Celsius.



Heat energy will normally flow from

- 1) *A* to *B*
  - 2) *A* to *C*
  - 3) *B* to *D*
  - 4) *D* to *C*
21. The greatest amount of energy would be gained by 1,000 grams of water when it changes from
- 1) water vapor to liquid water
  - 2) liquid water to water vapor
  - 3) liquid water to ice
  - 4) ice to liquid water
22. The data table below shows the temperatures of two similar objects for 10 minutes after the objects were placed near each other.

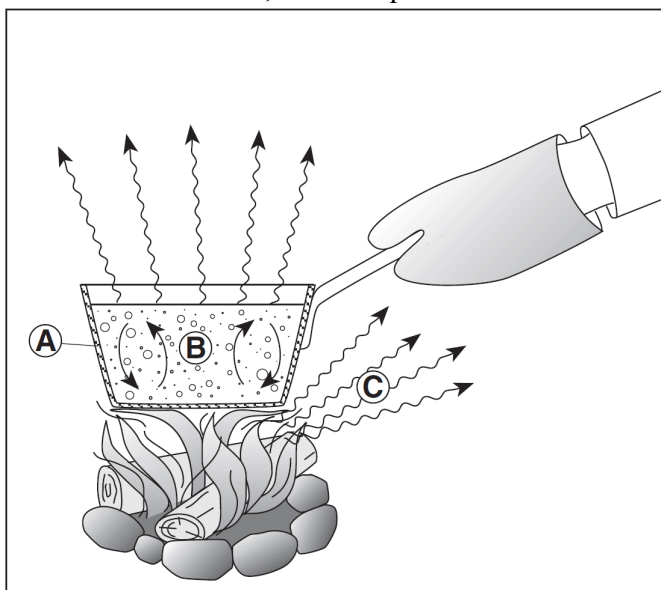
| Time (minutes) | Temperature (°C) |          |
|----------------|------------------|----------|
|                | Object A         | Object B |
| 0              | 32               | 18       |
| 2              | 29               | 19       |
| 4              | 26               | 20       |
| 6              | 25               | 20       |
| 8              | 24               | 21       |
| 10             | 23               | 21       |

Which statement is best supported by the data?

- 1) Some of the heat energy lost by object *B* was gained by object *A*.
  - 2) Most of the heat energy lost by object *A* was gained by the environment.
  - 3) Both objects lost heat energy.
  - 4) Both objects gained heat energy.
23. Which process transfers heat energy through molecular collisions?
- 1) radiation
  - 2) convection
  - 3) infiltration
  - 4) conduction

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24. The diagram below shows a student heating a pot of water over a fire. The arrows represent the transfer of heat. Letter *A* represents heat transfer through the metal pot, *B* represents heat transfer by currents in the water, and *C* represents heat that is felt in the air surrounding the pot.



Which table correctly identifies the types of heat transfer at A, B, and C?

1)

| Letter | Type of Heat Transfer |
|--------|-----------------------|
| A      | conduction            |
| B      | radiation             |
| C      | convection            |

3)

| Letter | Type of Heat Transfer |
|--------|-----------------------|
| A      | radiation             |
| B      | conduction            |
| C      | convection            |

2)

| Letter | Type of Heat Transfer |
|--------|-----------------------|
| A      | conduction            |
| B      | convection            |
| C      | radiation             |

4)

| Letter | Type of Heat Transfer |
|--------|-----------------------|
| A      | radiation             |
| B      | convection            |
| C      | conduction            |

25. An insulated cup contains 200 milliliters of water at 20°C. When 100 grams of ice is added to the water, heat energy will most likely flow from the

- 1) water to the ice, and the temperature of the mixture will drop below 20°C
- 2) water to the ice, and the temperature of the mixture will rise above 20°C
- 3) ice to the water, and the temperature of the mixture will drop below 20°C
- 4) ice to the water, and the temperature of the mixture will rise above 20°C

26. Heat energy transfer will normally occur between two objects that are close to each other if the objects have different

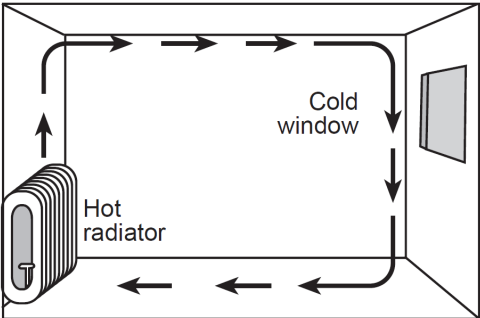
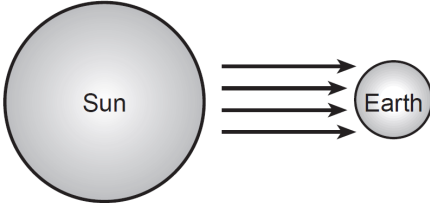
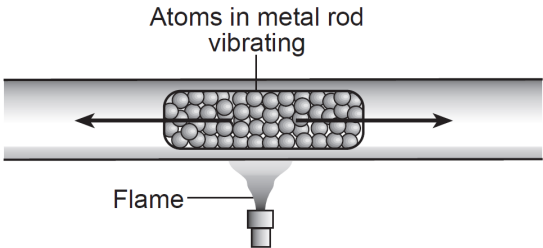

- 1) specific heats
- 2) temperatures
- 3) masses
- 4) densities

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?

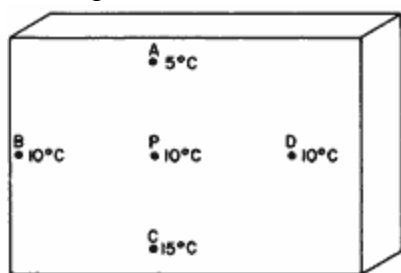
- 1) The ice cube gains heat and the water loses heat.
- 2) The ice cube loses heat and the water gains heat.
- 3) Both the ice cube and the water gain heat.
- 4) Both the ice cube and the water lose heat.

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28. Which diagram best represents heat transfer mainly by the process of conduction?

- 1) 
- 2) 
- 3) 
- 4) 

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

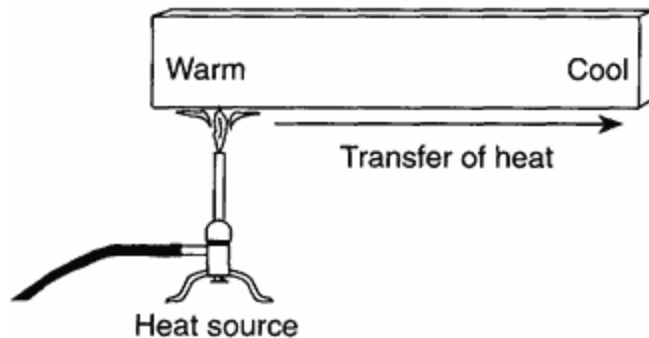


- 1) *A*    2) *B*    3) *C*    4) *D*

30. Heat energy from the lower latitudes is transferred to colder Earth regions by planetary wind circulation mainly through the process of

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

31. 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                      3) absorption  
2) conduction                     4) advection

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

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

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33. The air above a burning candle is heated and rises. Which table correctly identifies the type of heat transfer within the rising air and the change in air density above the burning candle?

1) 

| Type of Heat Transfer | Change in Air Density |
|-----------------------|-----------------------|
| conduction            | density increases     |

3) 

| Type of Heat Transfer | Change in Air Density |
|-----------------------|-----------------------|
| convection            | density increases     |

2) 

| Type of Heat Transfer | Change in Air Density |
|-----------------------|-----------------------|
| conduction            | density decreases     |

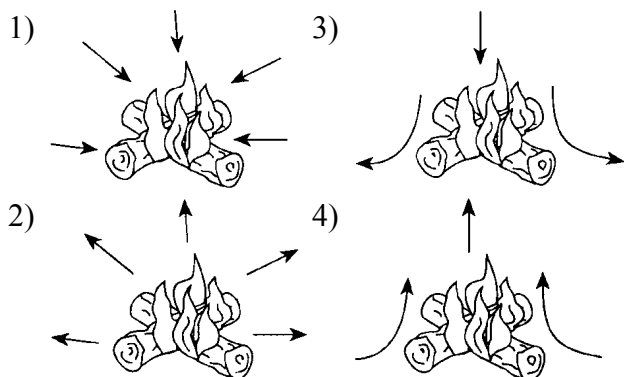
4) 

| Type of Heat Transfer | Change in Air Density |
|-----------------------|-----------------------|
| convection            | density decreases     |

34. Which statement is the best example of heat energy transfer by conduction?

- 1) Heat energy is transferred from the bottom to the top of a lake.
- 2) Heat energy is transferred from the surface soil to the rocks below.
- 3) Heat energy is transferred from the Earth's surface to the upper atmosphere.
- 4) Heat energy is transferred from the Sun to the Earth.

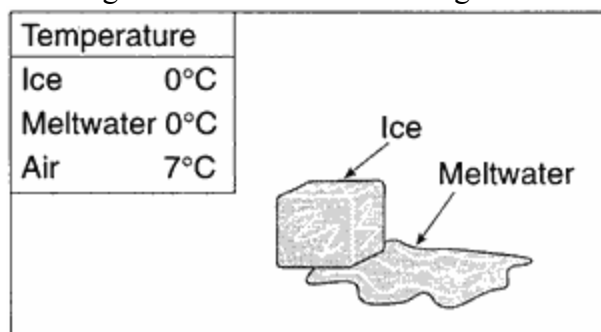
35. Which diagram best represents the direction of convection currents around the burning wood of a campfire?



36. When equal masses of ice and liquid water receive the same amount of energy, without a change in state, the ice changes temperature faster than the liquid water does because the

- 1) specific heat of ice is less than the specific heat of liquid water
- 2) specific heat of ice is greater than the specific heat of liquid water
- 3) density of ice is less than the density of liquid water
- 4) density of ice is greater than the density of liquid water

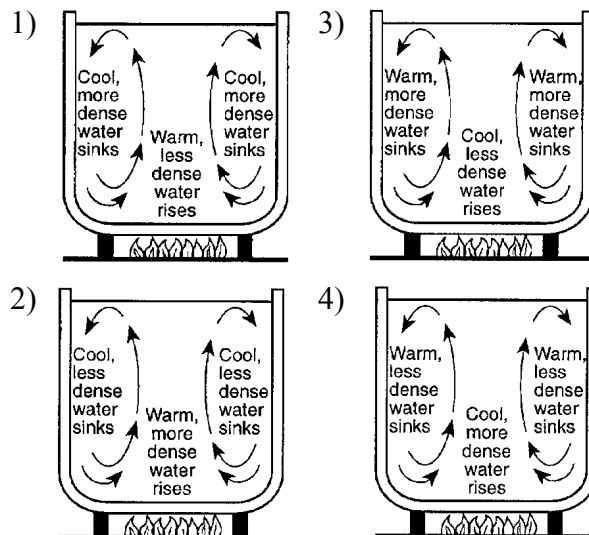
37. The diagram below shows a melting ice cube.



Which statement best describes the energy transfer?

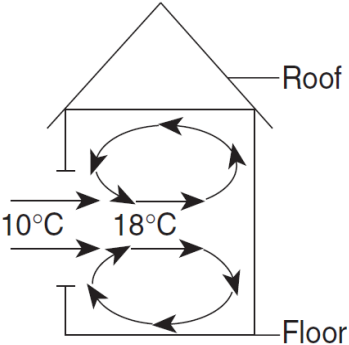
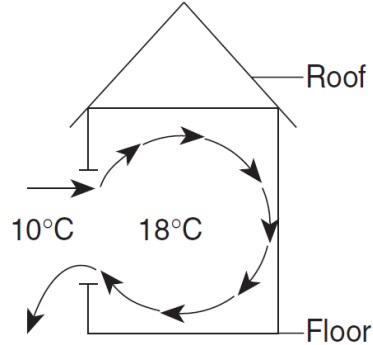
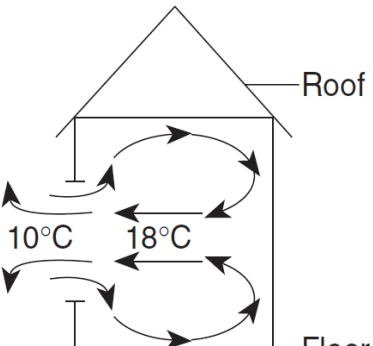
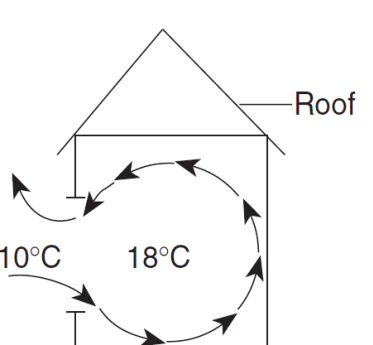
- 1) The meltwater is a heat source and the surrounding air is a heat sink.
- 2) The meltwater and ice cube are both heat sources
- 3) The ice cube and surrounding air are both heat sources.
- 4) The ice cube is a heat sink and the surrounding air is a heat source.

38. Which diagram correctly indicates why convection currents form in water when water is heated?

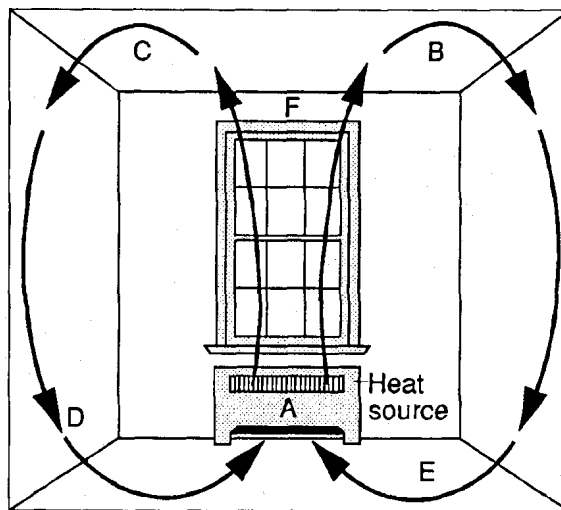


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39. On a day with no wind, the air temperature outside a house is  $10^{\circ}\text{C}$ . The air temperature inside the house is  $18^{\circ}\text{C}$ . Which diagram best represents the air circulation pattern that is most likely to occur when a window of the house is first opened?

- 1) 
- 2) 
- 3) 
- 4) 

40. Base your answer to the following question on the diagram below. The diagram shows the pattern of air movement within a closed room.







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

- 1) *F*    2) *B*    3) *C*    4) *E*
41. Water is being heated in a beaker as shown below.



Which drawing shows the most probable movement of water in the beaker due to the heating?

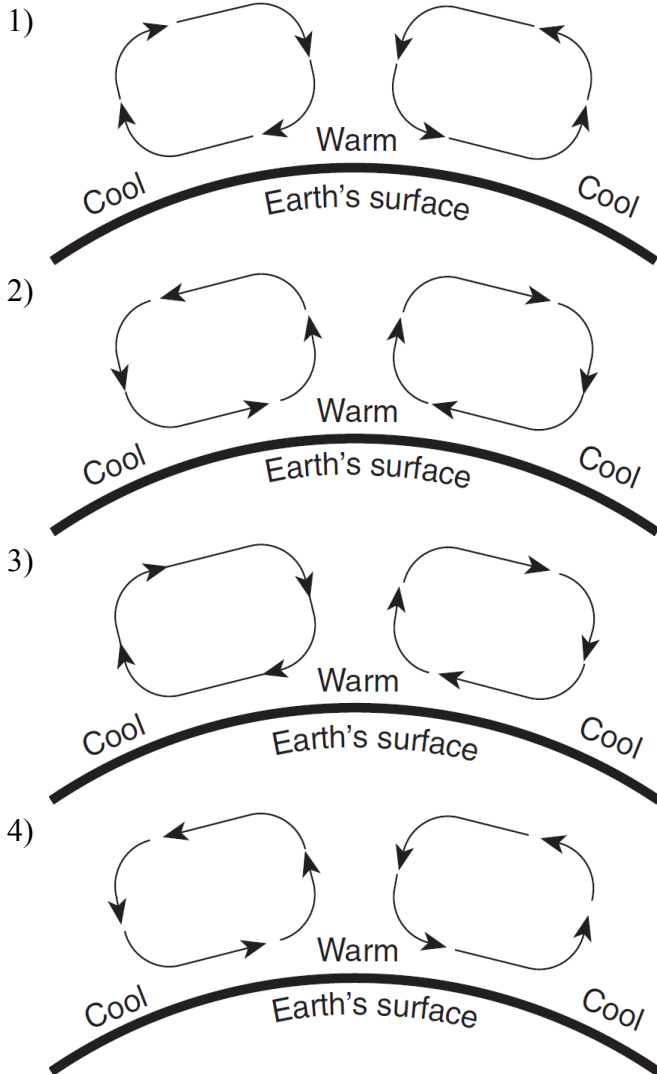
- 1) 
- 2) 
- 3) 
- 4) 

42. During which phase change will the greatest amount of energy be absorbed by 1 gram of water?

- 1) melting                      3) evaporation
- 2) freezing                      4) condensation

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43. The cross sections below show different patterns of air movement in Earth's atmosphere. Air temperatures at Earth's surface are indicated in each cross section. Which cross section shows the most likely pattern of air movement in Earth's atmosphere that would result from the surface air temperatures shown?



44. Specific heat is used to explain why different substances

- 1) sink or float in water
- 2) change temperature at different rates
- 3) vaporize or condense at different temperatures
- 4) melt and freeze at the same temperature

45. What best explains why, in early spring, ice remains longer on Lake Erie than on the surrounding land areas when the air temperature is above freezing?

- 1) Water has a higher specific heat than land.
- 2) Energy is needed for water to evaporate.
- 3) Cool winds from the surrounding land cool the ice on the lake.
- 4) Air temperature does not affect water temperature.



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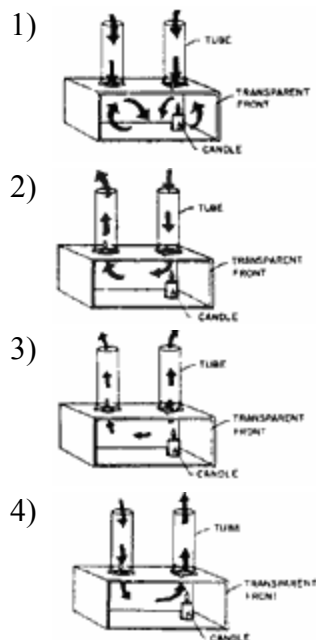
46. Equal volumes of the four samples shown below were placed outside and heated by energy from the Sun's rays for 30 minutes.



The surface temperature of which sample increased at the *slowest* rate?

- 1) water      2) copper pennies    3) basaltic sand    4) iron fragments

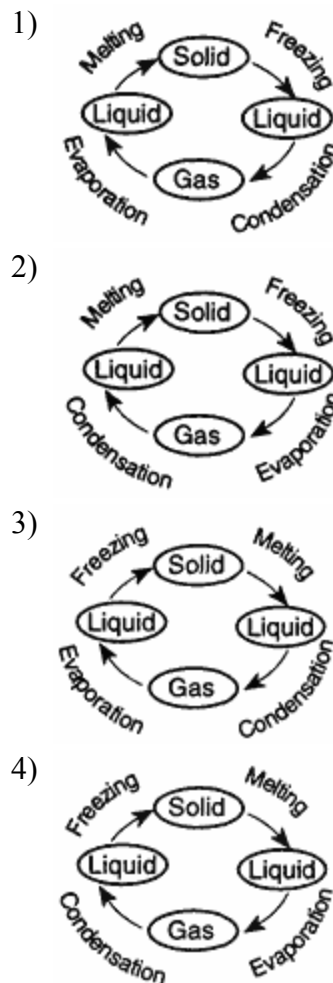
47. The diagrams below represent a laboratory model used to demonstrate convection currents. Each model shows a burning candle in a closed box with two open tubes at the top of the box. Which diagram correctly shows the air flow caused by the burning candle?



48. During explosive volcanic eruptions, large amounts of ash entering Earth's atmosphere often rise to an altitude of 20 kilometers. What is the most likely effect of this ash cloud?

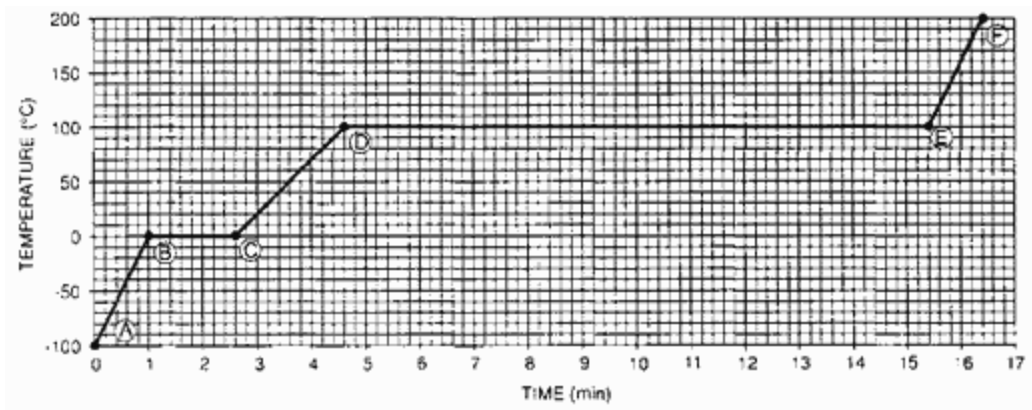
- 1) a decrease in the insolation reaching Earth's surface
- 2) a decrease in the thickness of Earth's stratosphere layer
- 3) an increase in the insolation reaching Earth's surface
- 4) an increase in the thickness of the Earth's stratosphere layer

49. Which diagram correctly shows the processes that change the states of matter?



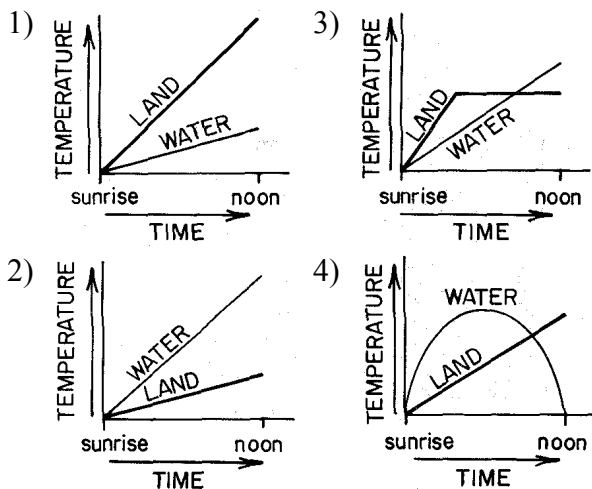
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Base your answers to questions 50 through 53 on the graph below which shows the temperatures recorded when a sample of water was heated from  $-100^{\circ}\text{C}$  to  $200^{\circ}\text{C}$ . The water received the same amount of heat every minute.



50. The greatest amount of energy was absorbed by the water between points
- 1) *A* and *B*
  - 2) *B* and *C*
  - 3) *C* and *D*
  - 4) *D* and *E*
51. What is the rate of temperature change between points *C* and *D*?
- 1)  $10^{\circ}\text{C}/\text{min}$
  - 2)  $25^{\circ}\text{C}/\text{min}$
  - 3)  $50^{\circ}\text{C}/\text{min}$
  - 4)  $150^{\circ}\text{C}/\text{min}$
52. How many joules were required to change 10 grams of liquid water at point *D* to water vapor at point *E*?
- 1) 300 joules
  - 2) 3,000 joules
  - 3) 22,600 joules
  - 4) 678,000 joules
53. At which point in time would most of the water be in the liquid phase?
- 1) 1 minute
  - 2) 14 minutes
  - 3) 16 minutes
  - 4) 4 minutes

54. 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?


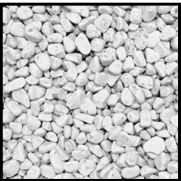




55. For weeks after a series of major volcanic eruptions, Earth's surface air temperatures are often

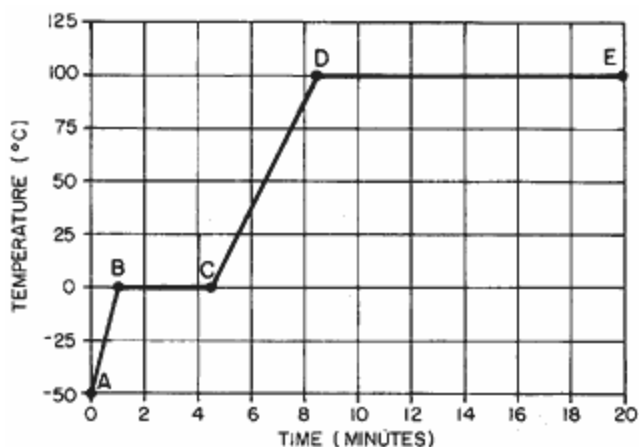
- 1) warmer because ash and dust decrease atmospheric transparency
- 2) warmer because ash and dust increase atmospheric transparency
- 3) cooler because ash and dust decrease atmospheric transparency
- 4) cooler because ash and dust increase atmospheric transparency

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56. Equal areas of which surface will typically absorb the greatest amount of insolation?

|  |  |  |   |
|--|--|--|---|
| 1)  | 2)  | 3)  | 4)  |
| Smooth White Marble Tile   | Rough White Marble Gravel  | Smooth Black Marble Tile   | Rough Black Marble Gravel   |

Base your answers to questions 57 through 60 on the graph below which shows the temperatures recorded when a sample of water was heated at a constant rate from  $-50^{\circ}\text{C}$  to  $100^{\circ}\text{C}$  during a 20-minute period.



57. Between which points was the temperature changing at the greatest rate?

- |                          |                          |
|--------------------------|--------------------------|
| 1) <i>A</i> and <i>B</i> | 3) <i>C</i> and <i>D</i> |
| 2) <i>B</i> and <i>C</i> | 4) <i>D</i> and <i>E</i> |

58. Between points *D* and *E* the water most likely was

- |             |               |
|-------------|---------------|
| 1) freezing | 3) vaporizing |
| 2) melting  | 4) condensing |

59. The greatest amount of energy is required to heat the sample from point

- |                               |                               |
|-------------------------------|-------------------------------|
| 1) <i>A</i> to point <i>B</i> | 3) <i>C</i> to point <i>D</i> |
| 2) <i>B</i> to point <i>C</i> | 4) <i>D</i> to point <i>E</i> |

60. The water temperature reached  $65^{\circ}\text{C}$  after the sample had been heated for approximately how many minutes?

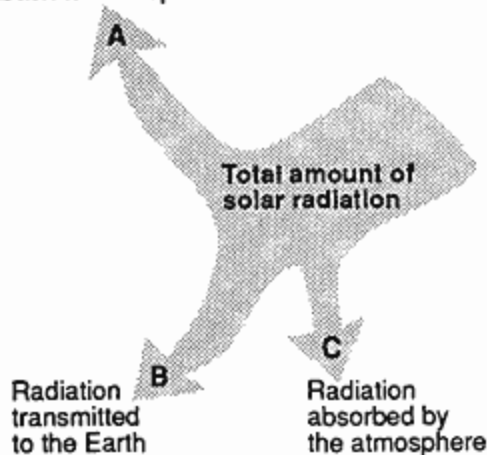
- 1) 5 min   2) 7 min   3) 3 min   4) 9 min

61. How do clouds affect the temperature at the Earth's surface?

- 1) Clouds block sunlight during the day and prevent heat from escaping at night.
- 2) Clouds block sunlight during the day and allow heat to escape at night.
- 3) Clouds allow sunlight to reach the Earth during the day and prevent heat from escaping at night.
- 4) Clouds allow sunlight to reach the Earth during the day and allow heat to escape at night.

62. The diagram below represents what normally happens to insolation as it enters the Earth's atmosphere.

**Radiation reflected back toward space**

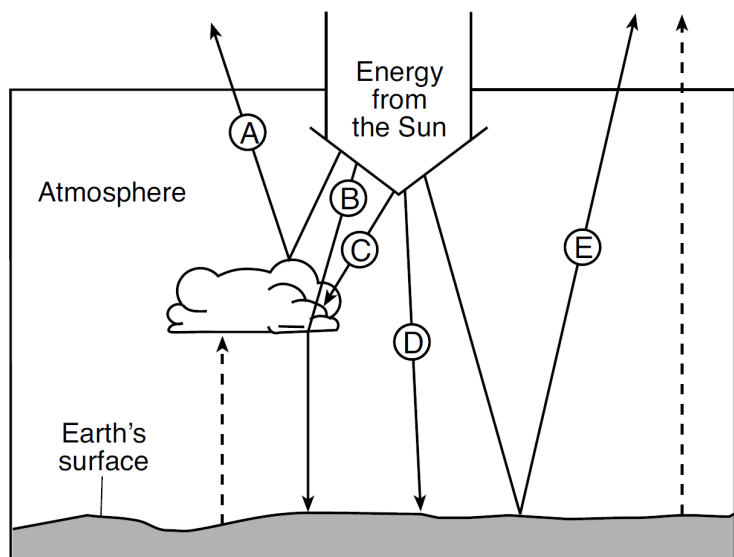


An increase in cloud cover and water vapor within the Earth's atmosphere will cause an increase in

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1) <i>A</i> and <i>B</i> , only | 3) <i>C</i> , only              |
| 2) <i>A</i> and <i>C</i> , only | 4) <i>B</i> and <i>C</i> , only |

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Base your answers to questions 63 and 64 on the cross section below and on your knowledge of Earth science. The cross section represents the effect of Earth's atmosphere on energy from the Sun. Arrows labeled *A*, *B*, *C*, *D*, and *E* represent some possible paths of this insolation. The dashed arrows represent energy reradiated from Earth's surface.



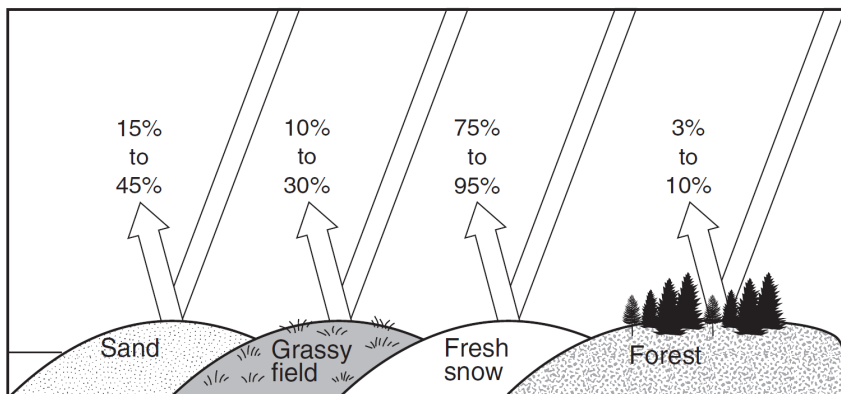
63. Which type of surface material absorbs and reradiates the greatest amount of energy?

- 1) white with a smooth texture
- 2) white with a rough texture
- 3) dark with a smooth texture
- 4) dark with a rough texture

64. Which arrows represent reflected insolation?

- 1) *A* and *E*
- 2) *B* and *C*
- 3) *C* and *D*
- 4) *D* and *A*

65. The diagram below indicates the amount of solar radiation that is reflected by equal areas of various materials on Earth's surface.



Which material absorbs the most solar radiation?

- 1) grassy field
- 2) fresh snow
- 3) sand
- 4) forest