

1. In order to make observations, an observer must always use
- 1) experiments
  - 2) the senses
  - 3) proportions
  - 4) mathematical calculations
- 
- 

2. Using a ruler to measure the length of a stick is an example of
- 1) extending the sense of sight by using an instrument
  - 2) calculating the percent of error by using a proportion
  - 3) measuring the rate of change of the stick by making inferences
  - 4) predicting the length of the stick by guessing
- 
- 

3. In the classroom during a visual inspection of a rock, a student recorded four statements about the rock. Which statement about the rock is an observation?
- 1) The rock formed deep in the Earth's interior.
  - 2) The rock cooled very rapidly.
  - 3) The rock dates from the Precambrian Era.
  - 4) The rock is black and shiny.
- 
- 

4. Which statement made by a student after examining a rock specimen is an inference?
- 1) The rock is of igneous origin.
  - 2) The rock has rounded edges.
  - 3) The rock is light-colored.
  - 4) The rock contains large crystals.
- 
- 

5. While on a field trip to a large lake in New York State, an observer recorded four statements about this lake. Which of these statements is most likely an inference?
- 1) The lake was formed by glacial action.
  - 2) The water is clear enough to see the bottom of the lake.
  - 3) A log is floating in the lake.
  - 4) The surface temperature of the lake is 18.5°C.
- 
- 

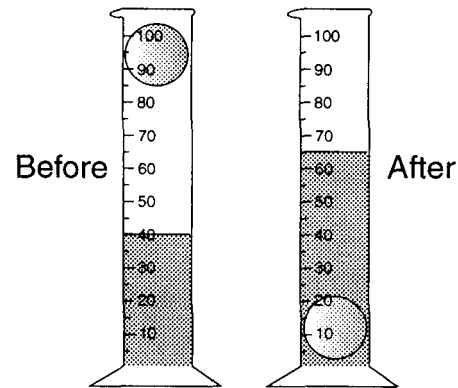
6. The grouping of objects or events based on similar characteristics is called
- 1) observation
  - 2) interpretation
  - 3) measurement
  - 4) classification
- 
- 

7. The greatest atmospheric pressure occurs in the
- 1) troposphere
  - 2) stratosphere
  - 3) mesosphere
  - 4) thermosphere
- 
- 

8. Which term is best defined as a measure of the amount of space a substance occupies?

- 1) mass
  - 2) volume
  - 3) density
  - 4) weight
- 
- 

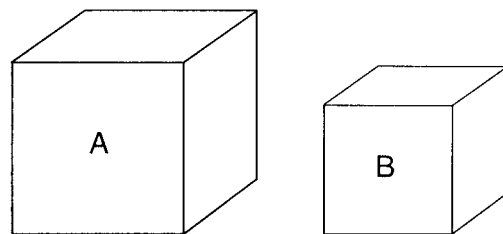
9. The sphere was dropped into water in a graduated cylinder as shown below.



What is the volume of the sphere?

- 1) 15 mL
  - 2) 25 mL
  - 3) 40 mL
  - 4) 65 mL
- 
- 

10. Base your answer to the following question on the diagrams below, which represent two different solid, uniform materials cut into cubes *A* and *B*.



Mass of A = 320 g      Density of B = 3 g/cm<sup>3</sup>  
Volume of A = 64 cm<sup>3</sup>      Volume of B = 27 cm<sup>3</sup>

(Not drawn to scale)

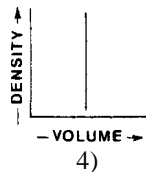
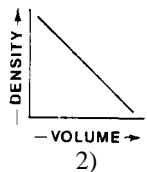
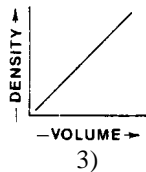
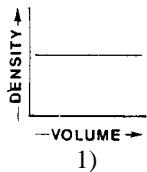
What is the mass of cube *B*?

- 1) 9 g
  - 2) 27 g
  - 3) 3 g
  - 4) 81 g
- 
-

11. A measurement is best defined as

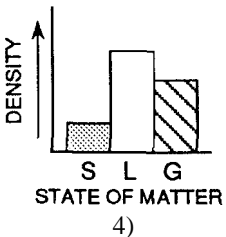
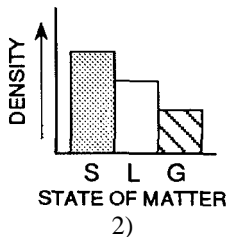
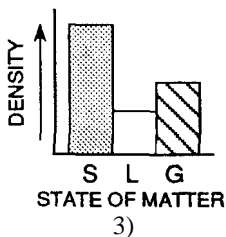
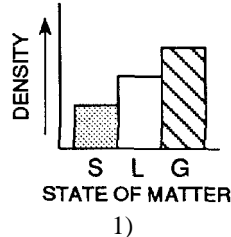
- 1) an inference made by using the human senses
  - 2) a direct comparison with a known standard
  - 3) an interpretation based on theory
  - 4) a group of inferred properties
- 
- 

12. A student calculates the densities of five different pieces of aluminum, each having a different volume. Which graph best represents this relationship?



13. Which graph best represents the relationship between the density of a substance and its state of matter (phase) for most earth materials, *excluding* water?

[Key: *S* = solid, *L* = liquid, *G* = gas]



14. Water has the greatest density at

- 1) 100°C in the gaseous phase
  - 2) 0°C in the solid phase
  - 3) 4°C in the solid phase
  - 4) 4°C in the liquid phase
- 
- 

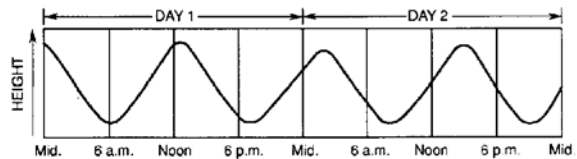
15. A mineral sample is found to have a density of 3.0 grams per cubic centimeter. It is then broken into two pieces, with one piece twice as large as the other. The smaller of the two pieces will have a density of

- 1) 1.0 g/cm<sup>3</sup>
  - 2) 1.5 g/cm<sup>3</sup>
  - 3) 3.0 g/cm<sup>3</sup>
  - 4) 6.0 g/cm<sup>3</sup>
- 
- 

16. Which factor can be predicted most accurately from day to day?

- 1) chance of precipitation
  - 2) direction of the wind
  - 3) time of an earthquake occurring
  - 4) altitude of the Sun at noon
- 
- 

17. The graph below shows the changes in height of ocean water over the course of 2 days at one Earth location.



Which statement concerning these changes is best supported by the graph?

- 1) The changes are cyclic and occur at predictable time intervals.
  - 2) The changes are cyclic and occur at the same time every day.
  - 3) The changes are noncyclic and occur at sunrise and sunset.
  - 4) The changes are noncyclic and may occur at any time.
- 
- 

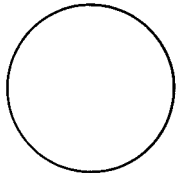
18. The north-south distance between the Earth's Equator (0°) and the North Pole (90° N) is 10,002 kilometers. The distance between 0° and 10° N is 1,106 kilometers. Which statement is best supported by this information?

- 1) The shape of the Earth is not perfectly spherical.
  - 2) The lines of longitude are not parallel.
  - 3) The north-south distance for every 10° of latitude is a constant value.
  - 4) The Earth's equatorial radius and polar radius are equal.
- 
- 

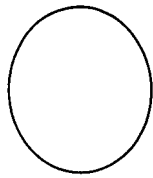
19. The best evidence of the Earth's nearly spherical shape is obtained through

- 1) telescopic observations of other planets
  - 2) photographs of the Earth from an orbiting satellite
  - 3) observations of the Sun's altitude made during the day
  - 4) observations of the Moon made during lunar eclipses
- 
-

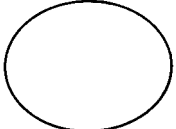
20. Which diagram most accurately shows the cross-sectional shape of the Earth drawn to scale?



1)



3)



2)



4)

\_\_\_\_\_

\_\_\_\_\_

21. What is the approximate elevation of the stratopause?

1) 10 km

3) 50 km

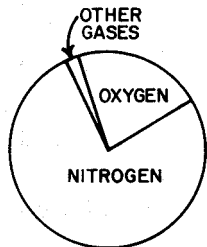
2) 30 km

4) 80 km

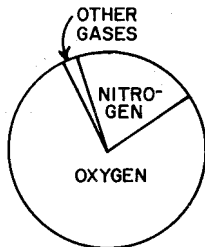
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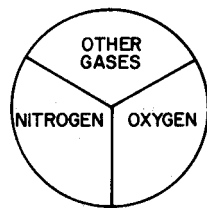
22. Which circle graph best represents the volume of gases in the troposphere?



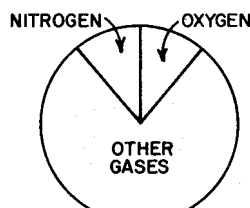
1)



3)



2)



4)

\_\_\_\_\_

\_\_\_\_\_

23. The solid rock material that directly underlies the sediments on the ocean floor is part of the Earth's

1) lithosphere

3) troposphere

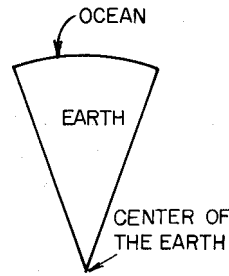
2) hydrosphere

4) outer core

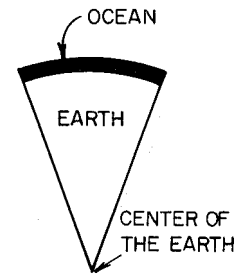
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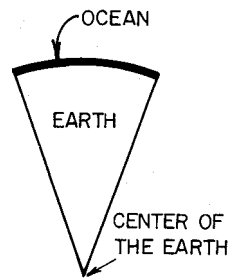
24. In the diagrams below, the dark zone at the surface of each wedge-shaped segment of the Earth represents average ocean depth. Which segment is drawn most nearly to scale?



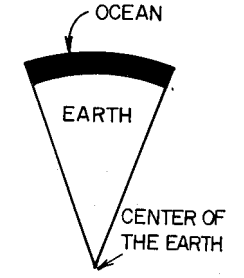
1)



3)



2)



4)

\_\_\_\_\_

\_\_\_\_\_

25. Which element is most abundant in Earth's lithosphere?

1) oxygen

3) hydrogen

2) silicon

4) nitrogen

\_\_\_\_\_

\_\_\_\_\_

26. A person knows the solar time on the Prime Meridian and the local solar time. What determination can be made?

1) the date

2) the altitude of Polaris

3) the longitude at which the person is located

4) the latitude at which the person is located

\_\_\_\_\_

\_\_\_\_\_

27. What could be the approximate location of an observer if he measured the altitude of Polaris to be 41 degrees above the horizon?

1) Watertown

3) Buffalo

2) Massena

4) New York City

\_\_\_\_\_

\_\_\_\_\_

28. At which latitude will *Polaris* be overhead?

1) 0°

3) 90° S.

2) 23 1/2°N.

4) 90° N.

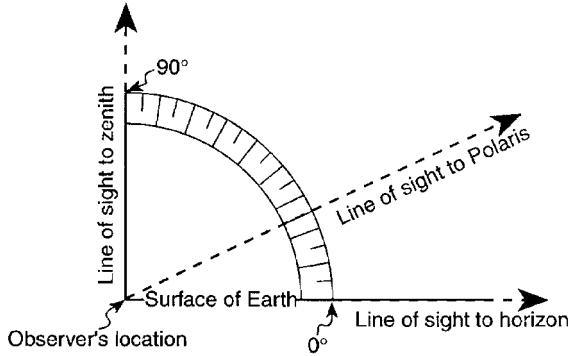
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\_\_\_\_\_

29. Cities located on the same meridian (longitude) must have the same

- 1) altitude
- 2) latitude
- 3) length of daylight
- 4) solar time

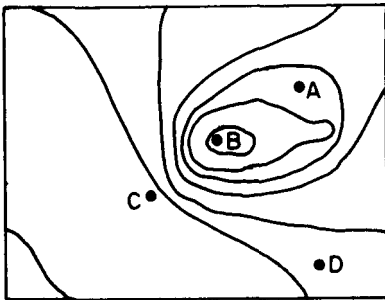
30. The diagram below shows the angular altitude of *Polaris* above the horizon at a certain location.



What is the latitude of the observer?

- 1) 15° N
- 2) 25° N
- 3) 30° N
- 4) 65° N

31. The diagram below is a contour map. Between which two points is the slope of the hill steepest?

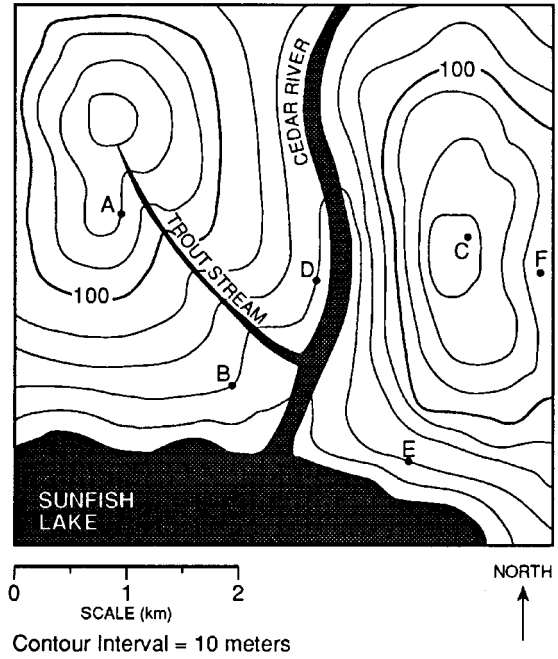


- 1) A and B
- 2) B and C
- 3) C and D
- 4) A and D

32. A stream has a source at an elevation of 1,000. meters. It ends in a lake that has an elevation of 300. meters. If the lake is 200. kilometers away from the source, what is the average gradient of the stream?

- 1) 1.5 m/km
- 2) 3.5 m/km
- 3) 10. m/km
- 4) 15 m/km

33. Base your answer to the following question on the contour map below. Points A through F represent locations on the map.



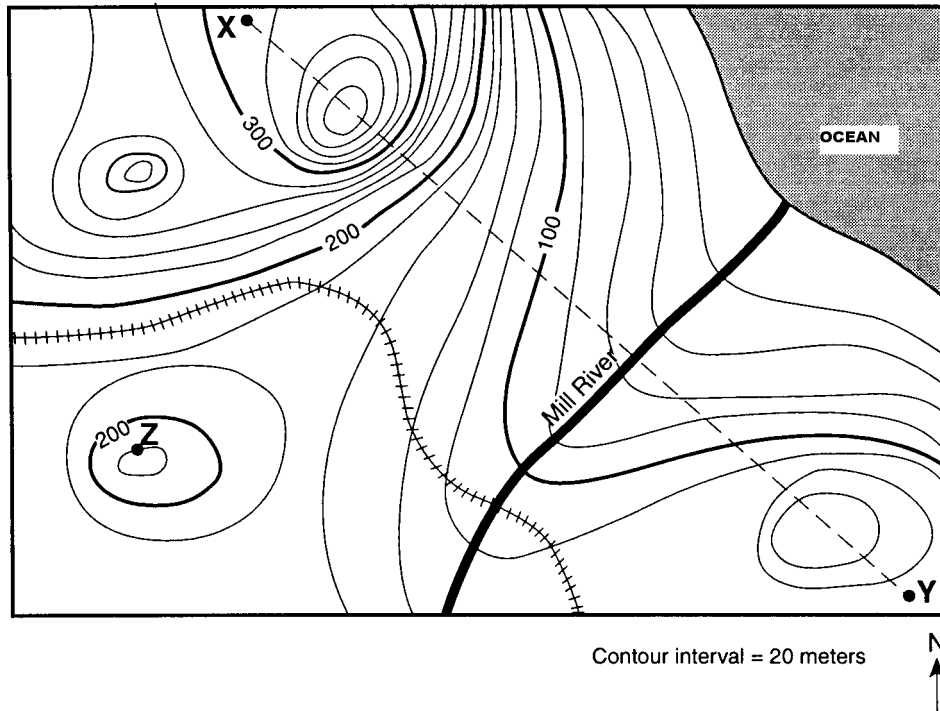
Which diagram best represents the topographic profile from location A to location F?

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

34. During which season in the Northern Hemisphere is the Earth closest to the Sun?

- 1) spring
- 2) summer
- 3) fall
- 4) winter

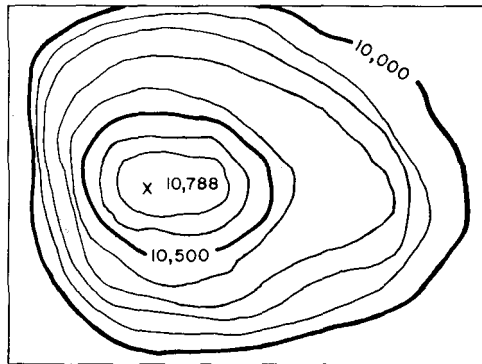
35. Base your answer to the following question on the topographic map below. Points X, Y, and Z are locations on the map. Elevations are expressed in meters.



Mill River generally flows toward the

- 1) southeast                      2) southwest                      3) northeast                      4) northwest

36. What is the elevation of the highest contour line shown on the map below?

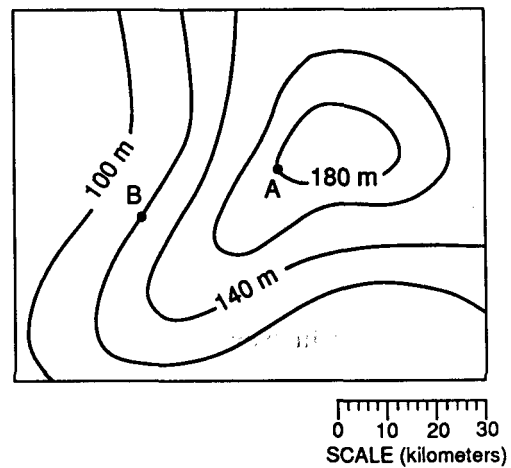


- 1) 10,000 feet                      3) 10,700 feet  
2) 10,688 feet                      4) 10,788 feet

37. Which location on the Earth would the Sun's vertical rays strike on December 21?

- 1) Tropic of Cancer ( $23\frac{1}{2}^{\circ}$  N)  
2) Equator ( $0^{\circ}$ )  
3) Tropic of Capricorn ( $23\frac{1}{2}^{\circ}$  S)  
4) South Pole ( $90^{\circ}$  S)

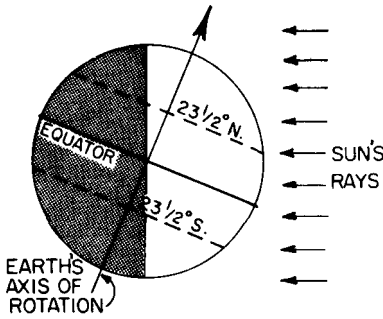
38. The map below represents an elevation field.



What is the approximate gradient between point A and point B?

- 1) 0.5 m/km                      3) 3.0 m/km  
2) 2.0 m/km                      4) 4.0 m/km

39. In the diagram below, the direct rays of the Sun are striking the Earth's surface at  $23\frac{1}{2}^{\circ}$  N. What is the date shown in the diagram?



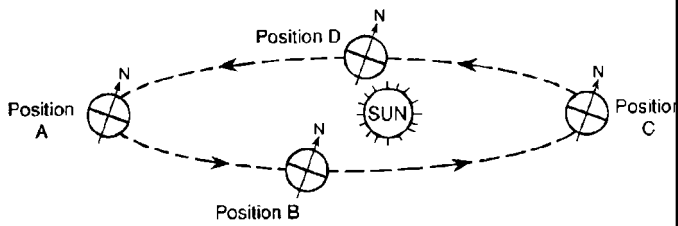
- 1) March 21                      3) September 23  
2) June 21                        4) December 21

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40. The diagram below represents four positions of the Earth as it revolves around the Sun.



(NOT DRAWN TO SCALE)

At which position is the Earth located on December 21?

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

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41. To an observer located at the Equator, on which date would the Sun appear to be directly overhead at noon?

- 1) February 1                        3) March 21  
2) June 6                                4) December 21

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42. Which motion causes the apparent rising and setting of the Moon each day, as seen from a location in Kansas?

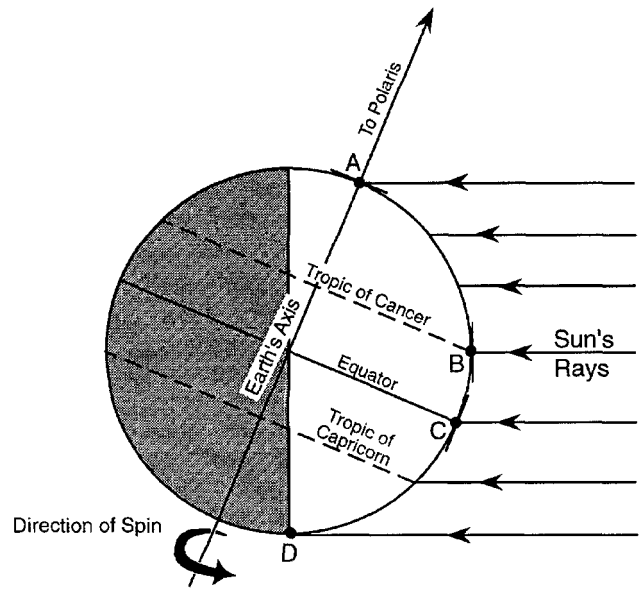
- 1) the Earth revolving around the Sun  
2) the Moon revolving around the Earth  
3) the Earth rotating on its axis  
4) the Moon rotating on its axis

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43. Base your answer to the following question on the diagram below. The diagram represents the Earth at a position in orbit around the Sun, the Sun's rays at solar noon, and the direction to *Polaris*. Letters A through D represent positions on the Earth's surface.



During one complete rotation of the Earth on its axis, which position receives the *least* number of hours of daylight?

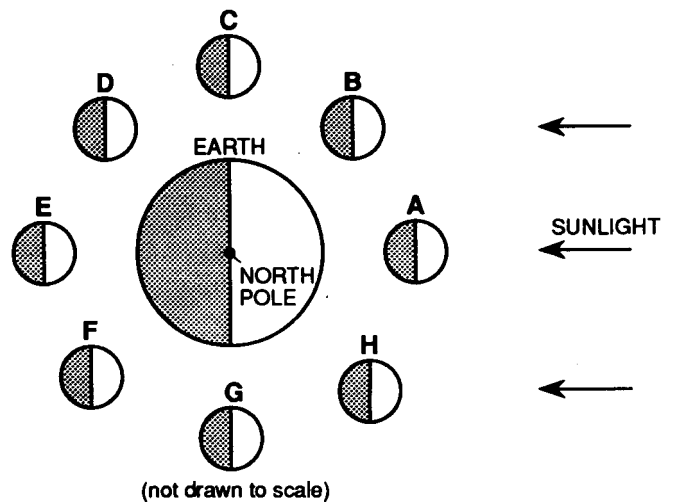
- 1) A                                      3) C  
2) B                                      4) D

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44. The diagram below represents eight positions of the Moon as it revolves around the Earth.



(not drawn to scale)

When viewed from the Earth, which phase of the Moon will be seen when the Moon is at point E?

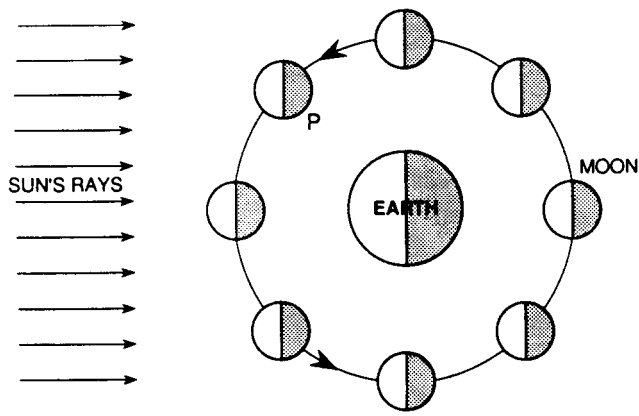
- 1) first quarter                        3) new moon  
2) full moon                            4) last quarter

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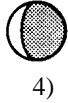
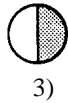
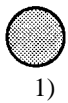


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45. The diagram below shows the relative positions of the Earth, Moon, and Sun for a 1-month period.



Which diagram best represents the appearance of the Moon at position P when viewed from the Earth?

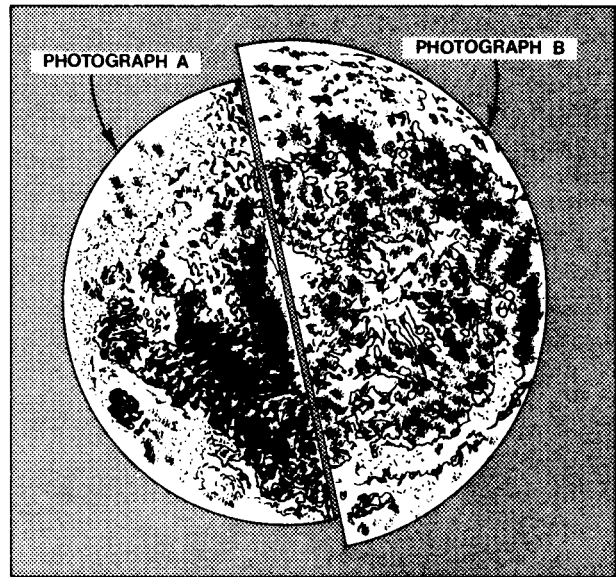


46. Why do stars appear to move through the night sky at the rate of 15 degrees per hour?
- 1) The Earth actually moves around the Sun at a rate of 15° per hour.
  - 2) The stars actually move around the center of the galaxy at a rate of 15° per hour.
  - 3) The Earth actually rotates at a rate of 15° per hour.
  - 4) The stars actually revolve around the Earth at a rate of 15° per hour.

47. If the distance between the Earth and the Sun were increased, which change would occur?
- 1) The apparent diameter of the Sun would decrease.
  - 2) The amount of insolation received by the Earth would increase.
  - 3) The time for one Earth rotation (rotation period) would double.
  - 4) The time for one Earth revolution (orbital period) would decrease.

48. The apparent change in direction of a swinging Foucault pendulum is the result of the
- 1) rotation of Earth
  - 2) revolution of Earth
  - 3) tilt of Earth's axis
  - 4) shape of Earth's orbit

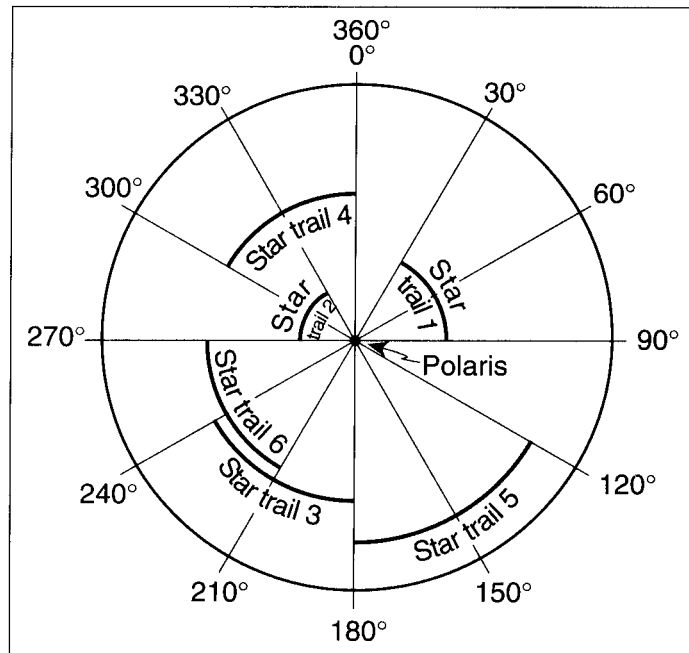
49. The diagram below represents two photographs of the Moon, A and B, taken at full moon phase several months apart. The photographs were taken using the same magnification. Each photograph was cut in half and the halves placed next to each other.



What most likely caused the difference in the apparent size of the Moon in photographs A and B?

- 1) The phases of the Moon changed.
  - 2) The Moon expanded.
  - 3) The distance from the Earth to the Moon changed.
  - 4) The Moon rotated.
50. In 1851, the French physicist Jean Foucault constructed a large pendulum that always changed its direction of swing at the same rate in a clockwise direction. According to Foucault, this change in direction of swing was caused by the
- 1) Moon's rotation on its axis
  - 2) Moon's revolution around the Earth
  - 3) Earth's rotation on its axis
  - 4) Earth's revolution around the Sun
51. The Coriolis effect provides evidence that Earth
- 1) rotates
  - 2) has a tilted axis
  - 3) has seasons
  - 4) revolves
52. What is the total number of degrees that the Earth rotates on its axis during a 12-hour period?
- 1) 1°
  - 2) 15°
  - 3) 180°
  - 4) 360°

53. A camera was placed outside at night and pointed directly at *Polaris* and several other stars. The lens was kept open and a time-exposure photograph was taken. The diagram below represents that photograph of *Polaris* and star trails, with an angular protractor to measure apparent motion.



How many hours was the lens kept open to create the star trails in this photograph?

- 1) 1 hour                      2) 6 hours                      3) 3 hours                      4) 4 hours

54. Approximately how many degrees does the Earth rotate on its axis in 1 hour?

- 1) 1°                              3) 24°  
2) 15°                            4) 360°

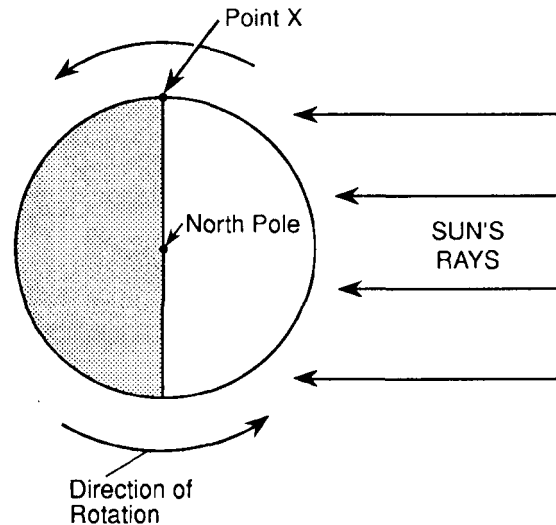
55. In the geocentric model (the Earth at the center of the universe), which motion would occur?

- 1) The Earth would revolve around the Sun.  
2) The Earth would rotate on its axis.  
3) The Moon would revolve around the Sun.  
4) The Sun would revolve around the Earth.

56. The elliptical shape of the Earth's orbit results in

- 1) changes in the orbital velocity of the Earth  
2) tilting of the Earth's axis  
3) the oblate spheroid shape of the Earth  
4) the phases of the Moon

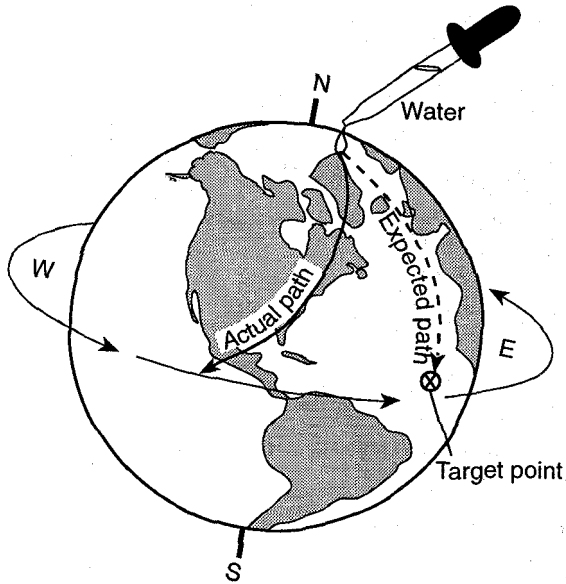
57. The diagram below shows the rotating Earth as it would appear from a satellite over the North Pole.



The time at point X is closest to

- 1) 6 a.m.                      3) 6 p.m.  
2) 12 noon                    4) 12 midnight

58. The diagram below represents an activity in which an eye dropper was used to place a drop of water on a spinning globe. Instead of flowing due south toward the target point, the drop followed a curved path and missed the target.

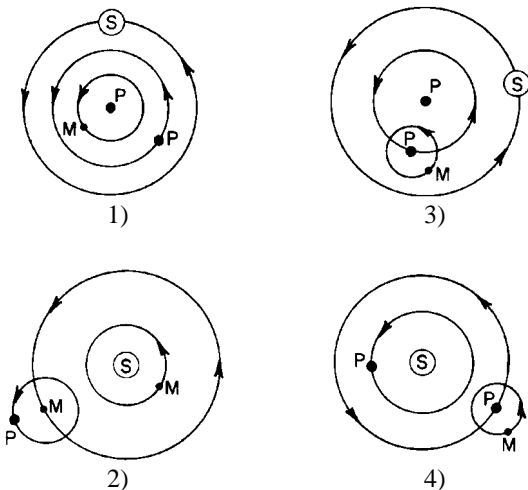


The actual path results from

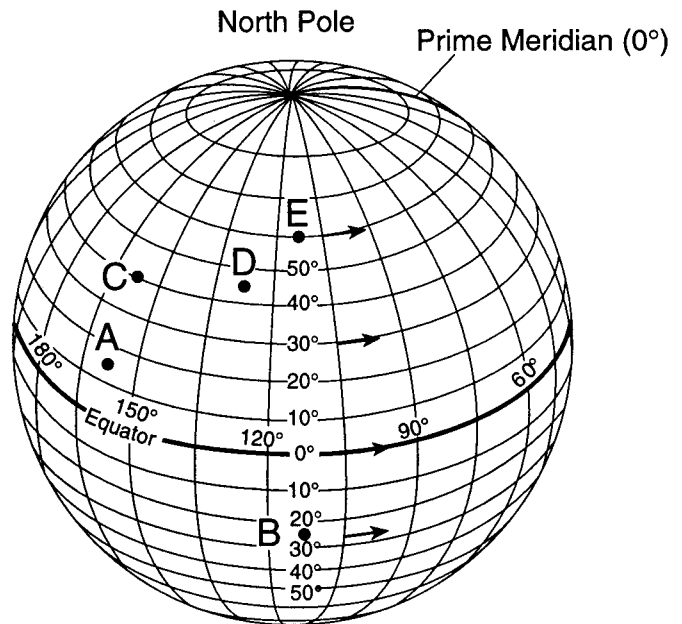
- 1) the tilt of the globe's axis
- 2) the Coriolis effect
- 3) the globe's revolution
- 4) dynamic equilibrium

59. Which diagram best represents the motions of celestial objects in a heliocentric model?

Key:  
 P ● = Planet  
 M ● = Moon  
 S ⊙ = Sun



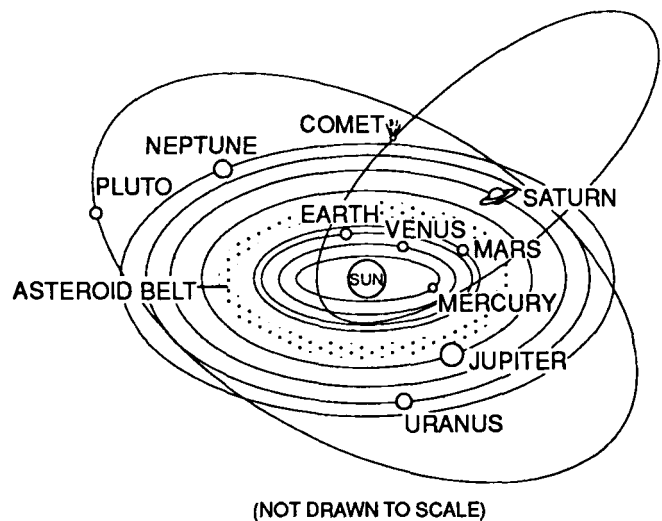
60. Base your answer to the following question on the diagram below, which represents latitude and longitude lines on Earth. Points A through E represent locations on Earth. Arrows represent direction of rotation.



When the local time at location C is 3 p.m., the local time at location D is

- 1) 1 p.m.
- 2) 5 p.m.
- 3) 3 p.m.
- 4) 3 a.m.

61. The diagram below represents our solar system.



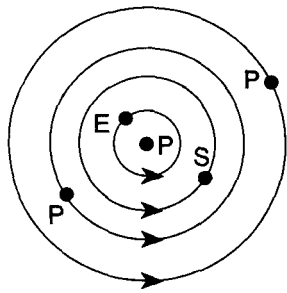
This system is best classified as

- 1) geocentric, with elliptical orbits
- 2) geocentric, with circular orbits
- 3) heliocentric, with elliptical orbits
- 4) heliocentric, with circular orbits

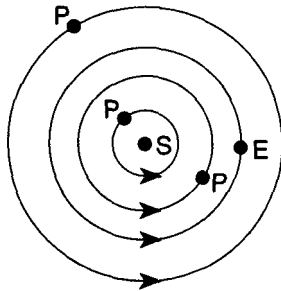
62. Which diagram represents a geocentric model?

[Key: E = Earth, P = Planet, S = Sun]

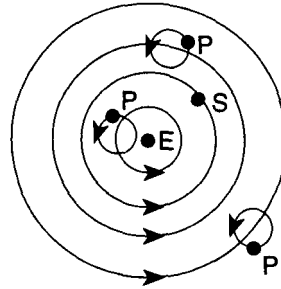
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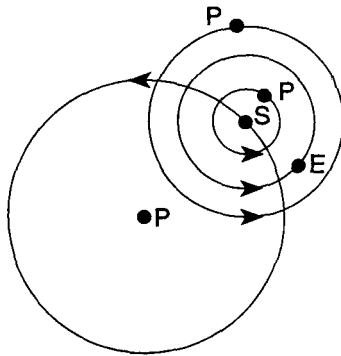
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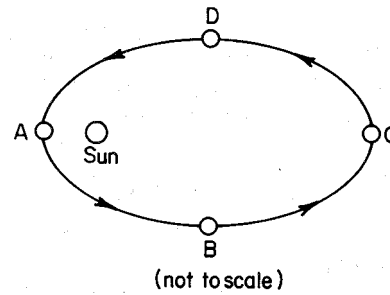
4)



63. Three planets known as gas giants because of their large size and low density are

- 1) Venus, Neptune, and Jupiter
- 2) Jupiter, Saturn, and Venus
- 3) Jupiter, Saturn, and Uranus
- 4) Venus, Uranus, and Jupiter

64. The diagram below shows a planet's orbit around the Sun.



At which location is the planet's orbital velocity greatest?

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

65. Compared to Jupiter and Saturn, Venus and Mars have greater

- 1) periods of revolution
- 2) orbital velocities
- 3) mean distances from the Sun
- 4) equatorial diameters

66. Which planet has the most eccentric orbit?

- 1) Mercury
- 2) Venus
- 3) Neptune
- 4) Jupiter

67. Compared to the distances between the planets of our solar system, the distances between stars are usually

- 1) much less
- 2) much greater
- 3) about the same

68. A belt of asteroids is located an average distance of 503 million kilometers from the Sun. Between which two planets is this belt located?

- 1) Mars and Jupiter
- 2) Mars and Earth
- 3) Jupiter and Saturn
- 4) Saturn and Uranus

69. Scientists believe that Earth's early atmosphere changed in composition as a result of

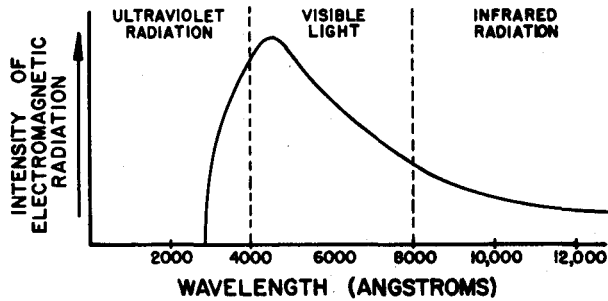
- 1) the appearance of oxygen-producing organisms
- 2) the drifting of the continents
- 3) the changes in Earth's magnetic field
- 4) a transfer of gases from the Sun



79. Compared to the wavelength of ultraviolet radiation, the wavelength of infrared radiation is

- 1) shorter
- 2) longer
- 3) the same

80. The graph below represents the relationship between the intensity and wavelength of the Sun's electromagnetic radiation.



Which statement is best supported by the graph?

- 1) The infrared radiation given off by the Sun occurs at a wavelength of 2,000 angstroms.
- 2) The maximum intensity of radiation given off by the Sun occurs in the visible region.
- 3) The infrared radiation given off by the Sun has a shorter wavelength than ultraviolet radiation.
- 4) The electromagnetic energy given off by the Sun consists of a single wavelength.

81. 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.

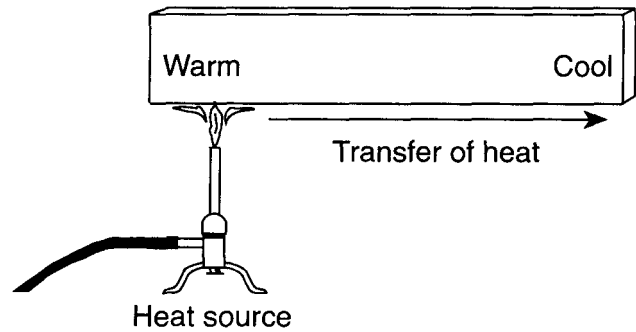
82. By which process is heat energy transferred when molecules within a substance collide?

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

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

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

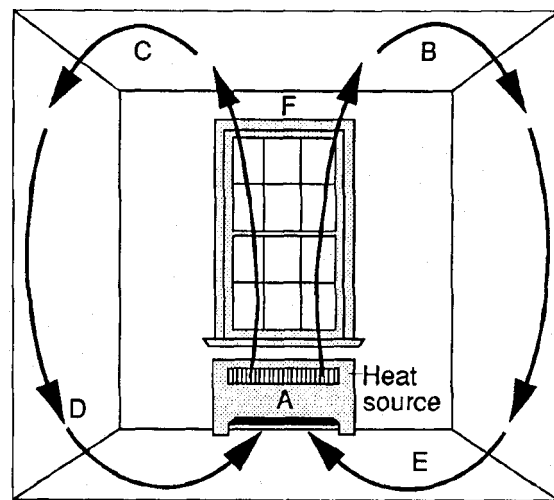
84. The diagram below shows a solid iron bar that is being heated in a flame.



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

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

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



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

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

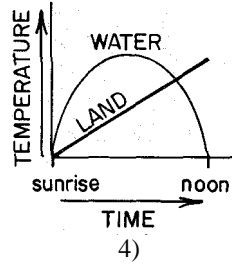
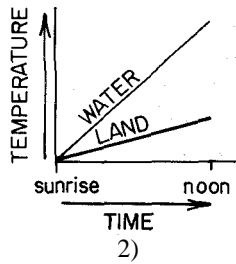
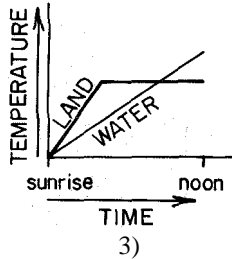
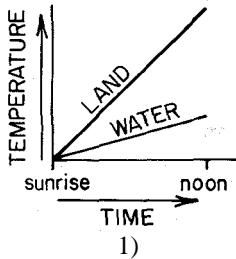
86. By which process does starlight travel through space?

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

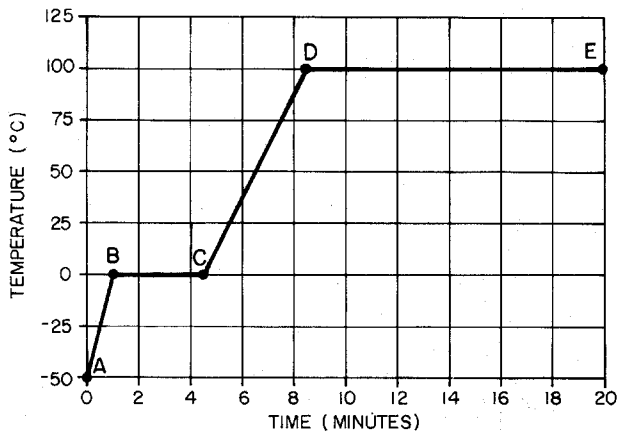
87. Which method of energy transfer is primarily responsible for energy being lost from Earth into space?

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

88. 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?



89. Base your answer to the following question 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.



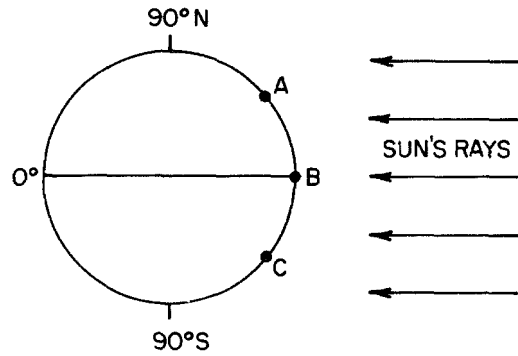
Between points *D* and *E* the water most likely was

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

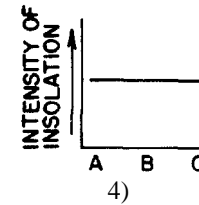
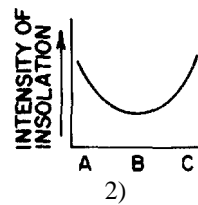
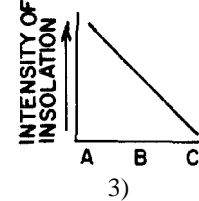
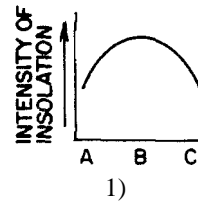
90. Which process requires the addition of energy to water?

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

91. The diagram below shows the position of the Earth in relation to rays of light from the Sun. *A*, *B*, and *C* are three positions on the Earth's surface.



Which graph best shows the relationship between intensity of insolation and position on the Earth's surface?



92. On which date does maximum insolation usually occur in New Jersey?

- 1) June 21
- 2) July 10
- 3) August 21
- 4) August 31

93. In New York State, the number of hours of daylight each day increases continuously from

- 1) March 1 to May 1
- 2) June 1 to August 1
- 3) September 1 to November 1
- 4) December 1 to February 1

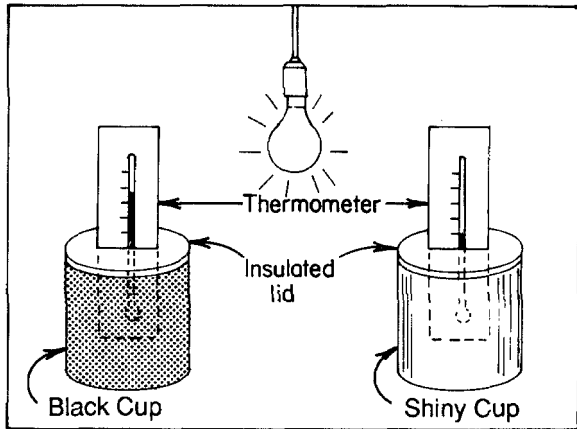
94. What is the usual cause of the drop in temperature that occurs between sunset and sunrise at most Kansas locations?

- 1) strong winds
- 2) ground radiation
- 3) cloud formation
- 4) heavy precipitation

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

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

96. 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

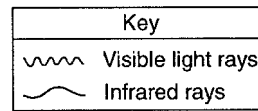
97. What is the most likely reason for a decrease in air temperature observed between 12 midnight and 6 a.m. in New York State?

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

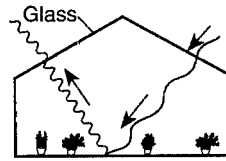
98. Why are carbon dioxide and water vapor called the greenhouse gases?

- 1) They are found in varying amounts in Earth's atmosphere.
- 2) They are found in fixed amounts in Earth's bedrock.
- 3) They are good reflectors of infrared radiation.
- 4) They are good absorbers of infrared radiation.

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



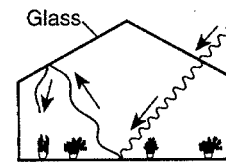
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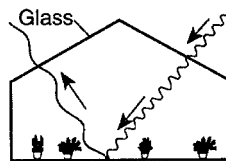
2)



3)



4)



100. 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 <sub>2</sub> )
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.
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