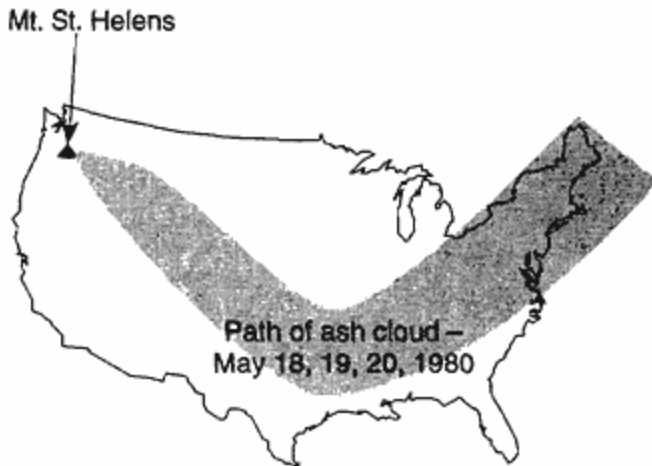


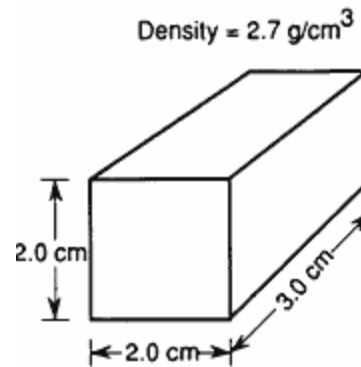
1. The map below shows the path of an ash cloud that resulted from the Mount St. Helens volcanic eruption. The map was developed from satellite photographs.



The path of the ash cloud was most probably determined by

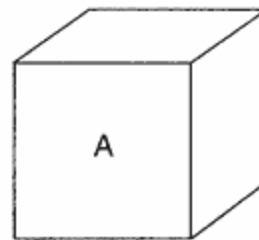
- 1) observation
 - 2) inference
 - 3) theory
 - 4) hypothesis
2. While walking on a glacier, an observer makes several statements. Which statement is an inference?
- 1) "There are many cracks in this glacier."
 - 2) "Some of the snow on this glacier is powdery."
 - 3) "The rocks on this glacier are of different sizes."
 - 4) "Some parts of this glacier will start melting this spring."
3. A student classifies several objects. The classification system should be based on
- 1) inferences
 - 2) observations
 - 3) interpretations
 - 4) hypotheses
4. An empty 100-milliliter beaker has a mass of 60 grams. When 100 milliliters of oil is added to the beaker, the total mass is 120 grams. The density of the oil is approximately
- 1) 1.7 g/ml
 - 2) 1.4 g/ml
 - 3) 0.8 g/ml
 - 4) 0.6 g/ml
5. The cyclic rise and fall of ocean tides on Earth is primarily caused by Earth's rotation and the
- 1) revolution of Earth around the Sun
 - 2) gravitational attraction of the Moon and the Sun
 - 3) temperature differences in ocean currents
 - 4) direction of Earth's planetary winds

6. Base your answer to the following question on the diagram below, which represents a solid material of uniform composition.

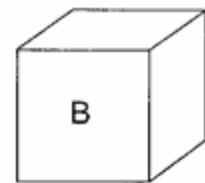


If this material is cooled and contracts, the density of the material will

- 1) increase
 - 2) remain the same
 - 3) decrease
7. 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
Volume of A = 64 cm³



Density of B = 3 g/cm³
Volume of B = 27 cm³

(Not drawn to scale)

Assume cube *B* was broken into many irregularly shaped pieces. Compared to the density of the entire cube, the density of one of the pieces would be

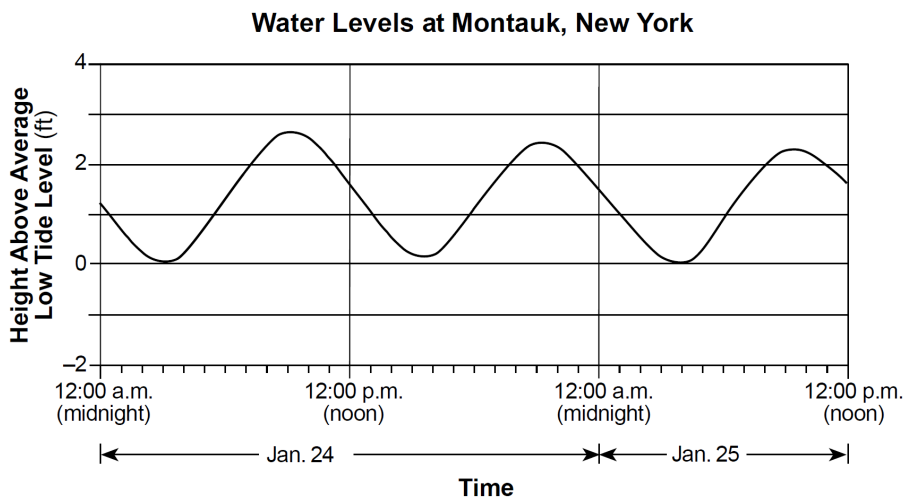
- 1) greater
 - 2) the same
 - 3) less
8. In which atmospheric temperature zone does most precipitation occur?
- 1) thermosphere
 - 2) troposphere
 - 3) mesosphere
 - 4) stratosphere

9. Base your answer to the following question on the data table below, which lists some properties of four minerals that are used as ores of zinc (Zn).

Mineral Property	Mineral			
	Smithsonite	Sphalerite	Willemite	Zincite
Composition	ZnCO ₃	ZnS	Zn ₂ SiO ₄	ZnO
Hardness	4–4.5	3.5–4	5.5	4
Density (g/cm ³)	4.4	4.0	4.0	5.6
Color	white, gray, green, blue, yellow	brown, yellow, red, green, black	white, yellow, green, reddish brown, black	deep red to orange yellow
Streak	white	white to yellow to brown	white	orange yellow

A sample of sphalerite has a mass of 176.0 grams. What is the volume of the sample?

- 1) 22.7 cm³ 2) 31.4 cm³ 3) 40.0 cm³ 4) 44.0 cm³
10. Base your answer to the following question on the graph below and on your knowledge of Earth science. The graph shows the observed water levels, in feet (ft), for a tide gauge located at Montauk, New York, on the easternmost end of Long Island, from January 24, 2008 to noon on January 25, 2008.



These changing water levels at Montauk can best be described as

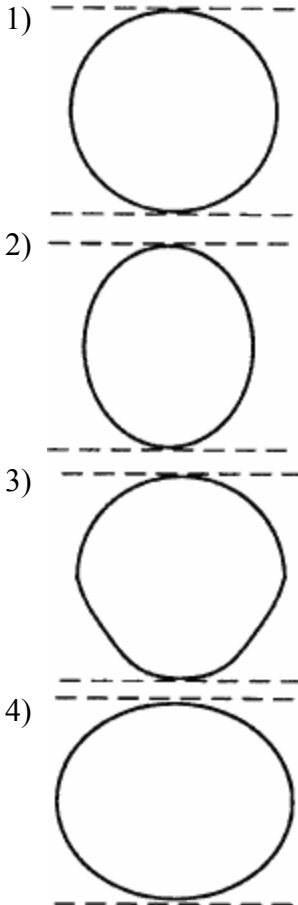
- 1) noncyclic and not predictable 2) noncyclic and predictable
 3) cyclic and predictable 4) cyclic and not predictable
-
11. Which two elements make up the greatest percentages by mass in Earth's crust?
- 1) aluminum and potassium
 2) oxygen and potassium
 3) oxygen and silicon
 4) aluminum and silicon
12. What is the inferred pressure, in millions of atmospheres, in Earth's interior at a depth of 2900 kilometers?
- 1) 1.4 2) 9.9 3) 3.0 4) 4900

13. A student recorded the times of three successive high tides at one location as:

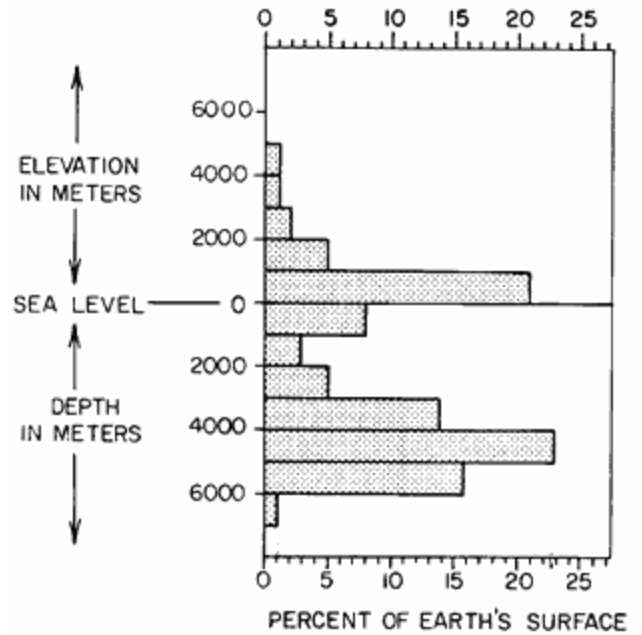
9:12 a.m.
9:38 p.m.
10:04 a.m.

What is the approximate time of the next high tide?

- 1) 11:04 p.m. 2) 10:12 p.m.
3) 10:30 p.m. 4) 10:38 p.m.
14. Compared to the weight of a person at the North Pole, the weight of the same person at the Equator would be
- 1) slightly less, because the person is farther from the center of Earth
2) slightly more, because the person is closer to the center of Earth
3) slightly less, because the person is closer to the center of Earth
4) slightly more, because the person is farther from the center of Earth
15. Which diagram most accurately shows the cross-sectional shape of the Earth?



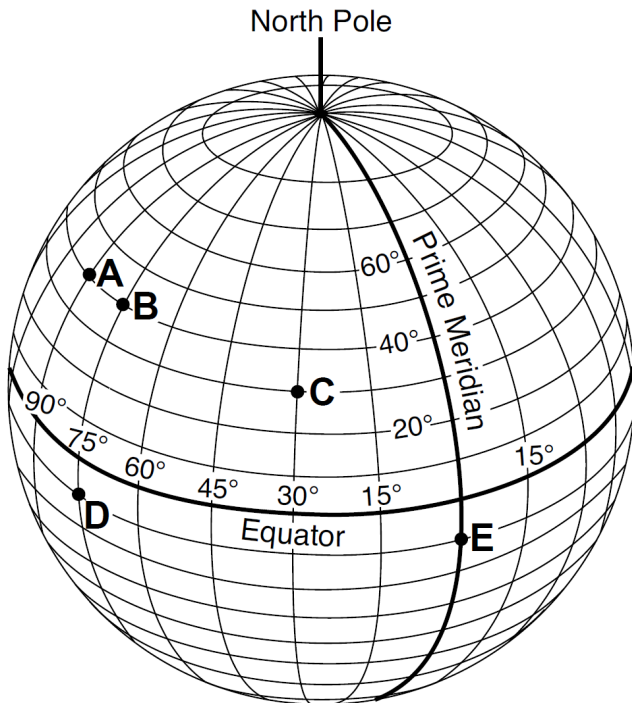
16. The graph below shows the percentage distribution of the Earth's surface elevation above and depth below sea level.



Approximately what total percentage of the Earth's surface is below sea level?

- 1) 30% 2) 70% 3) 90% 4) 50%
17. Which New York State city is located at 43°05' N 76°15' W?
- 1) Utica 2) Albany
3) Rochester 4) Syracuse
18. What is the approximate location of the Canary Islands hot spot? Use page 5 of the ESRT.
- 1) 32° N 18° W 2) 32° S 18° W
3) 32° S 18° E 4) 32° N 18° E
19. On April 21, the altitude of *Polaris*, as viewed from a location in New York State, was measured as 41.3°. What will the altitude of *Polaris* be when viewed one month later, on May 21, from the same location?
- 1) 41.3° 2) 23.5° 3) 90° 4) 66.7°
20. If the tilt of Earth's axis were increased from 23.5° to 30°, summers in New York State would become
- 1) warmer, and winters would become cooler
2) warmer, and winters would become warmer
3) cooler, and winters would become cooler
4) cooler, and winters would become warmer

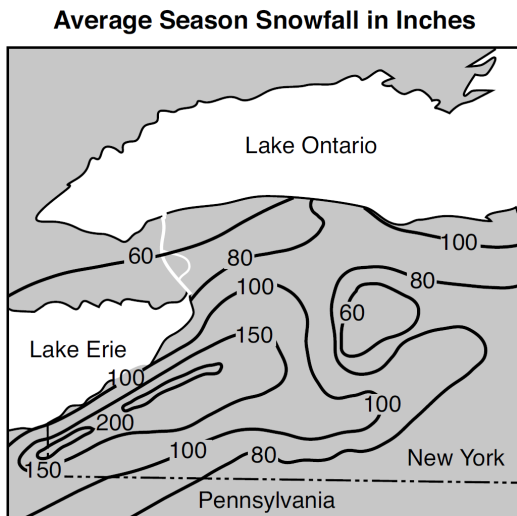
21. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the lines of latitude and longitude on Earth. Points *A* through *E* represent locations on Earth.



From which location would an observer *never* see *Polaris* in the nighttime sky?

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

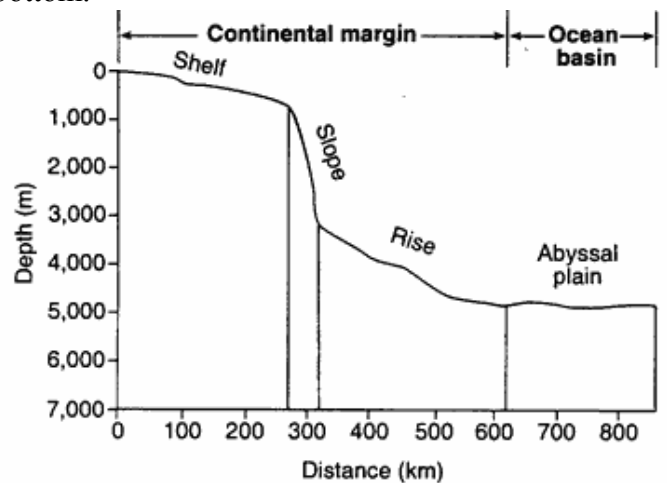
22. The map below shows the average annual snowfall, in inches, for western New York State.



According to the map, which of these cities receives the greatest average annual snowfall?

- 1) Elmira 2) Buffalo
3) Jamestown 4) Niagara Falls

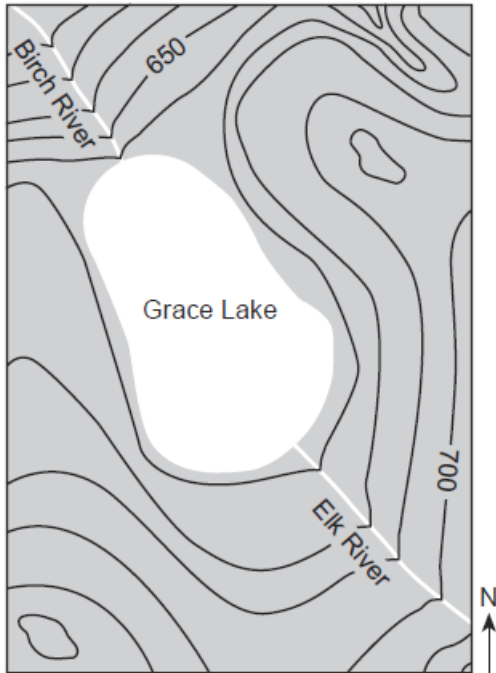
23. The profile below shows four regions of the ocean bottom.



In which list are these regions arranged in order of gradient from least steep to most steep?

- 1) rise → abyssal plain → shelf → slope
2) abyssal plain → shelf → rise → slope
3) shelf → abyssal plain → rise → slope
4) slope → rise → shelf → abyssal plain

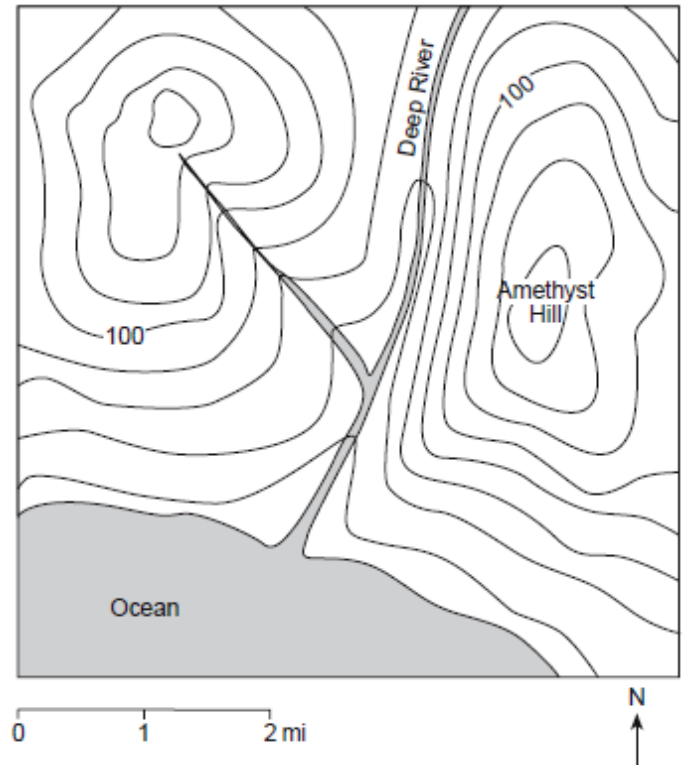
24. The contour map below shows a lake and river system. The Birch and Elk Rivers carry an equal volume of water.



Compared to the Birch River, the Elk River can best be described as flowing

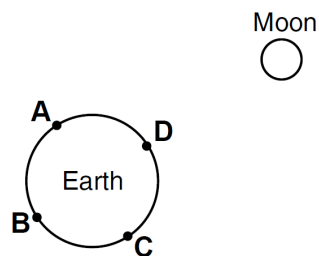
- 1) faster, and in the same general compass direction
 - 2) faster, and in the opposite general compass direction
 - 3) slower, and in the same general compass direction
 - 4) slower, and in the opposite general compass direction
25. The entire constellation of Orion is visible in the night sky in January to an observer in New York State. Which statement explains why this constellation is *not* visible in the night sky to this observer in June?
- 1) Earth revolves around the Sun.
 - 2) The tilt of Earth's axis changes throughout the year
 - 3) Earth rotates on its axis.
 - 4) The constellation Orion orbits the Sun.
26. Which star is cooler and less luminous than the Sun?
- 1) *Pollux*
 - 2) *Proxima Centauri*
 - 3) *40 Eridani B*
 - 4) *Rigel*

27. A contour map is shown below. Elevations are shown in feet.



What is the contour interval of this map?

- 1) 25 ft
 - 2) 15 ft
 - 3) 20 ft
 - 4) 10 ft
28. The diagram below represents Earth and the Moon as viewed from above the North Pole. Points *A*, *B*, *C*, and *D* are locations on Earth's surface.

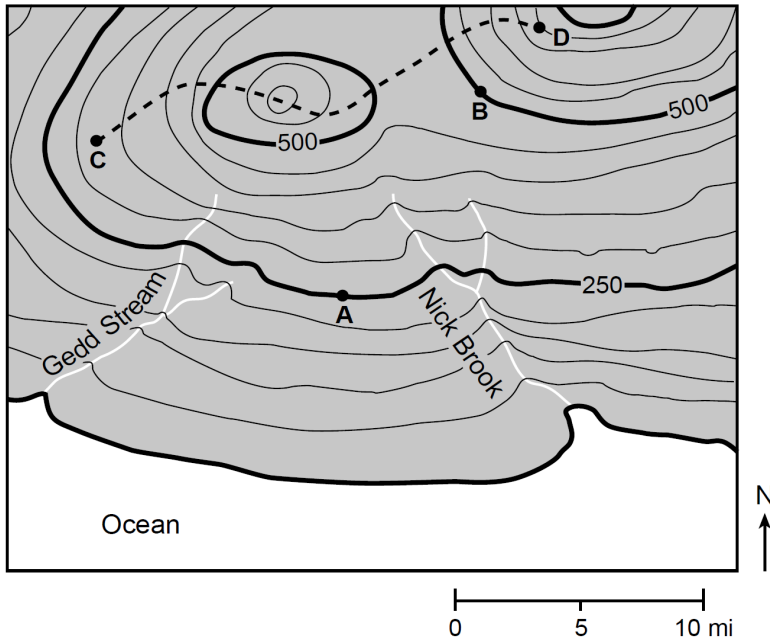


(Not drawn to scale)

According to the diagram, where will high ocean tides and low ocean tides most likely be located?

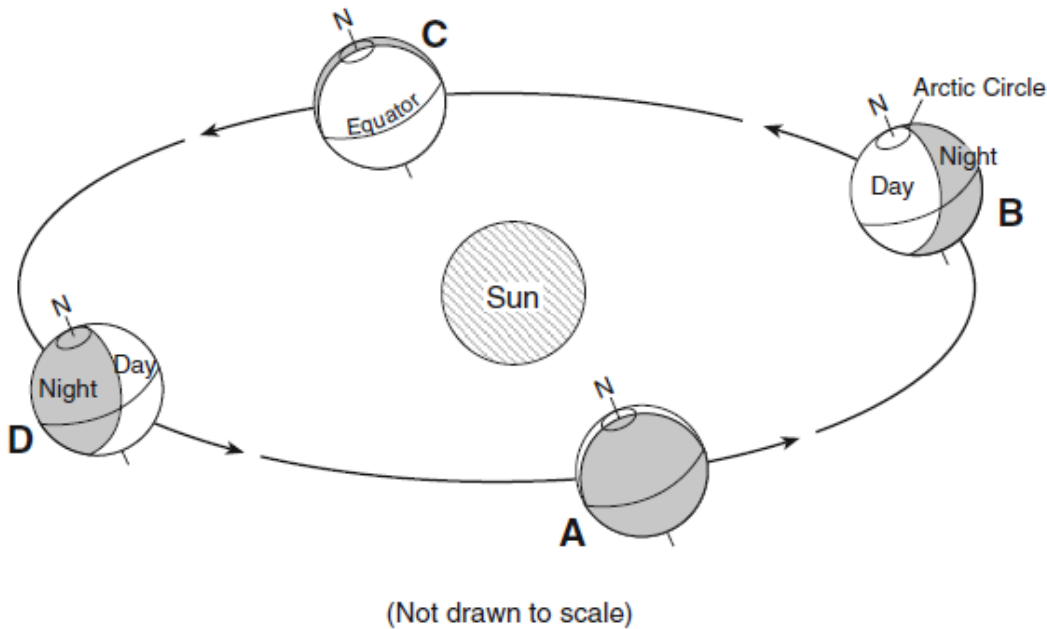
- 1) high tides at *A* and *C*; low tides at *B* and *D*
- 2) high tides at *B* and *D*; low tides at *A* and *C*
- 3) High tides at *A* and *B*; low tides at *C* and *D*
- 4) high tides at *C* and *D*; low tides at *A* and *B*

29. Base your answer to the following question on the topographic map below and on your knowledge of Earth science. On the map, points *A*, *B*, *C*, and *D* represent surface locations. The dashed line between points *C* and *D* represents a hiking trail. Elevations are in feet (ft).



The gradient between location *A* and location *B* is approximately

- 1) 50 ft/mi 2) 0.04 ft/mi 3) 25 ft/mi 4) 40 ft/mi
30. The diagram below shows Earth's orbit around the Sun. Locations *A*, *B*, *C*, and *D* represent Earth on the first day of each season.



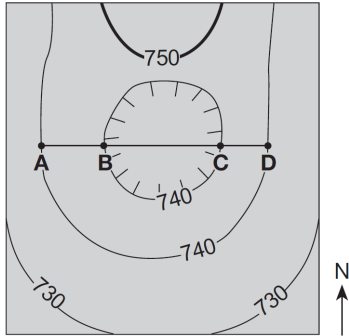
Which location represents the start of the spring season in the Northern Hemisphere?

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

31. The topographic map below shows a depression contour line on Earth's surface.

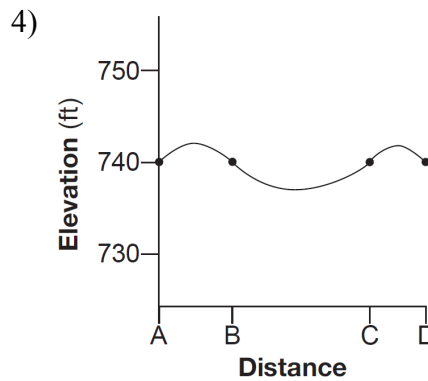
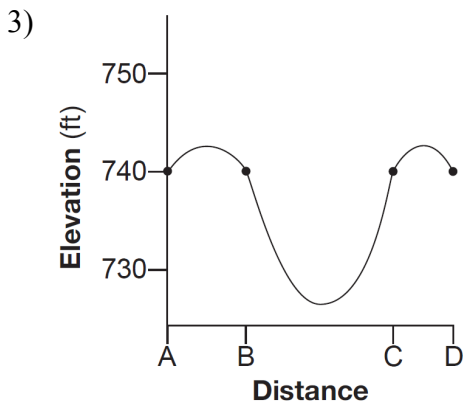
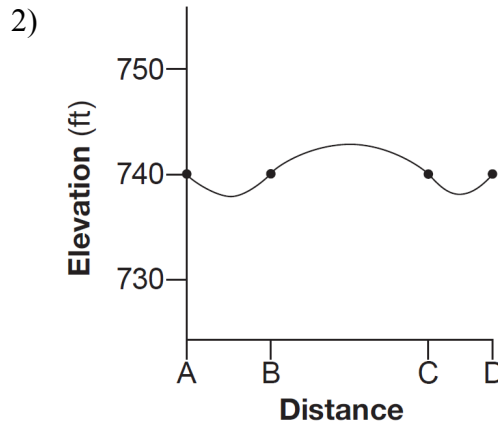
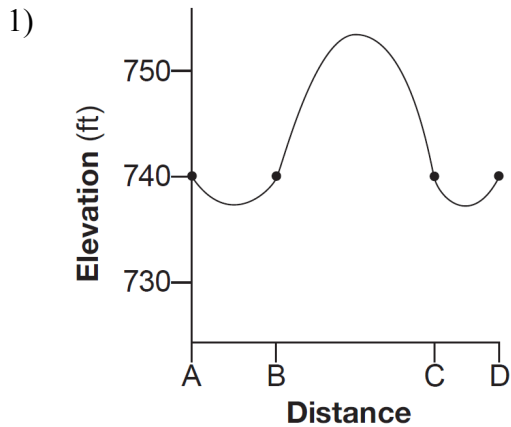


Points *A*, *B*, *C*, and *D* represent surface locations. Contour line elevations are in feet.



Contour interval = 10 ft

Which profile best shows the topography along line *AD*?



32. During the month of January, at which location in New York State is the Sun lowest in the sky at solar noon?

- 1) New York City 2) Niagara Falls
- 3) Utica 4) Massena

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

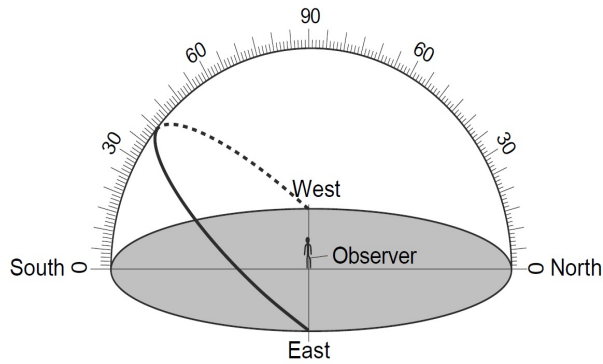
- 1) visible light rays 2) ultraviolet rays
- 3) infrared rays 4) gamma rays

34. To an observer in New York State, the duration of daylight increases and then decreases from

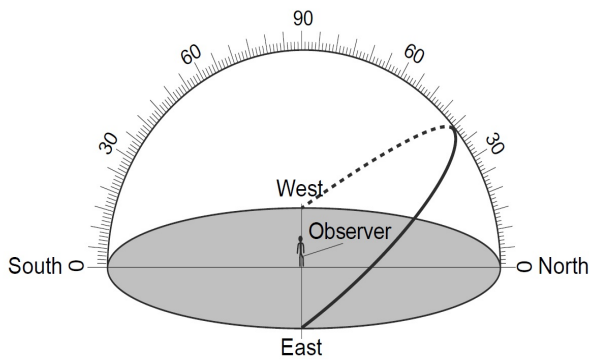
- 1) March 1 to May 1
- 2) June 1 to August 1
- 3) December 1 to February 1
- 4) September 1 to November 1

35. Which diagram represents the apparent path of the Sun on March 21 for an observer at 50° N?

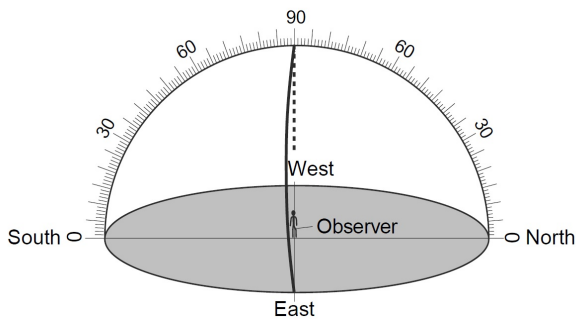
1)



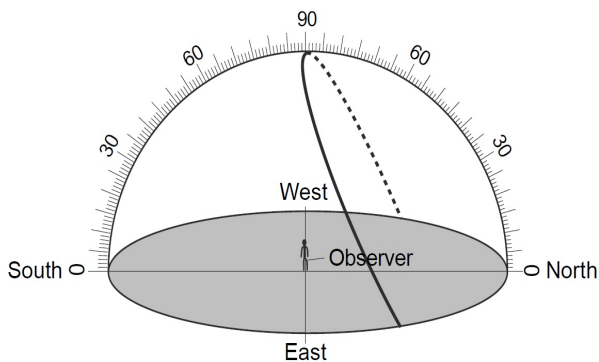
2)



3)



4)



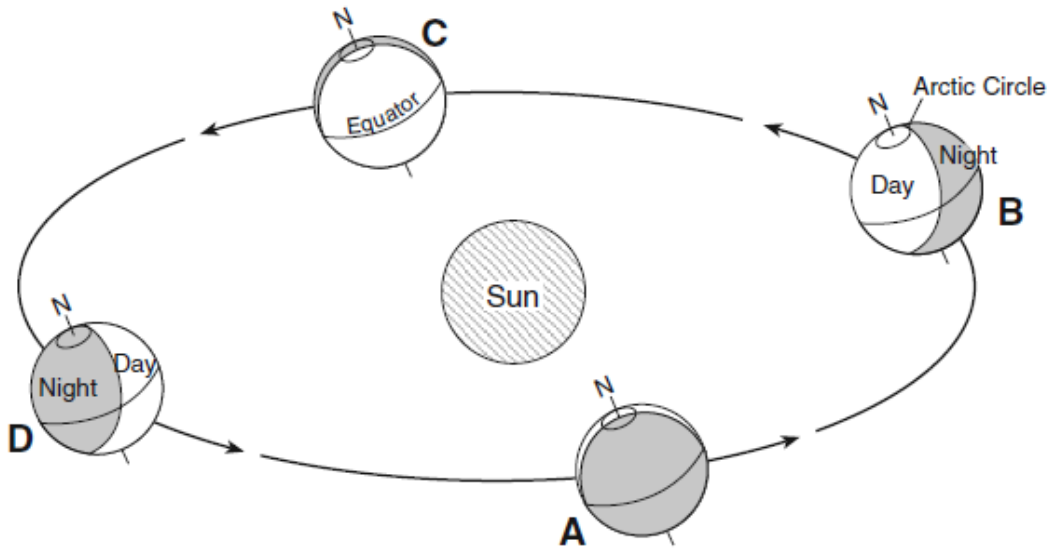
36. When it is solar noon at a location at 75° W longitude, what is the solar time at a location at 120° W longitude?

- 1) 12 noon
- 2) 3 p.m.
- 3) 9 a.m.
- 4) 12 midnight

37. The gravitational attraction between two objects in the solar system is greatest when their masses are

- 1) large, and the objects are close together
- 2) small, and the objects are far apart
- 3) small, and the objects are close together
- 4) large, and the objects are far apart

38. The diagram below shows Earth's orbit around the Sun. Locations *A*, *B*, *C*, and *D* represent Earth on the first day of each season.

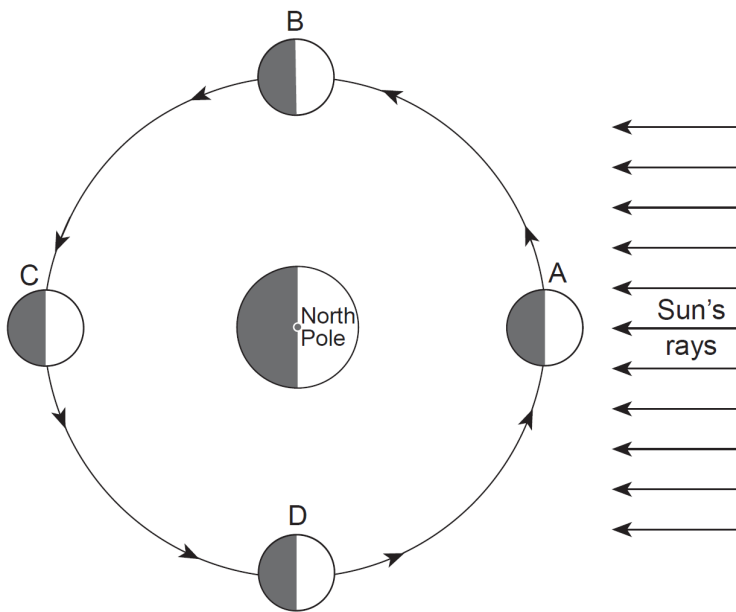


(Not drawn to scale)

Which the Earth is at position B, how many hours of daylight does New York State receive?

- 1) 24 2) 9 3) 15 4) 12

39. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the Moon at different positions, labeled *A*, *B*, *C*, and *D*, in its orbit around Earth.

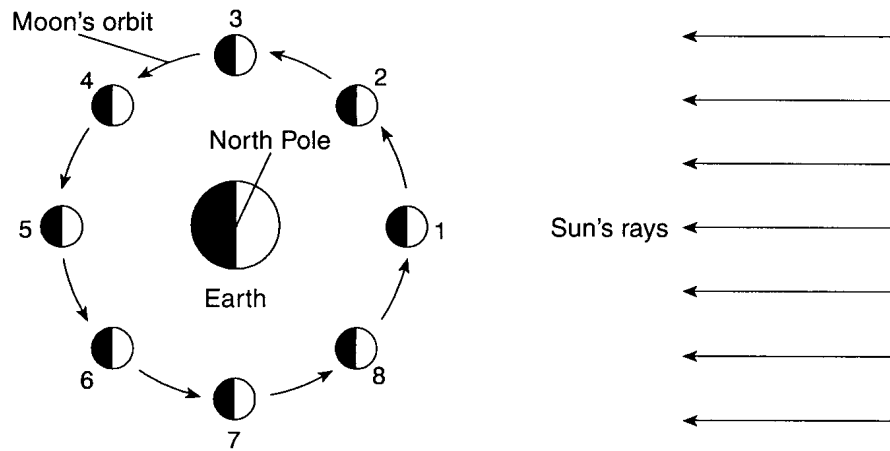


(Not drawn to scale)

At which two Moon positions would an observer on Earth most likely experience the smallest difference between high and low tides?

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

40. Base your answer to the following question on the diagram below, which represents the Moon orbiting Earth as viewed from space above the North Pole. The Moon is shown at eight different positions in its orbit.



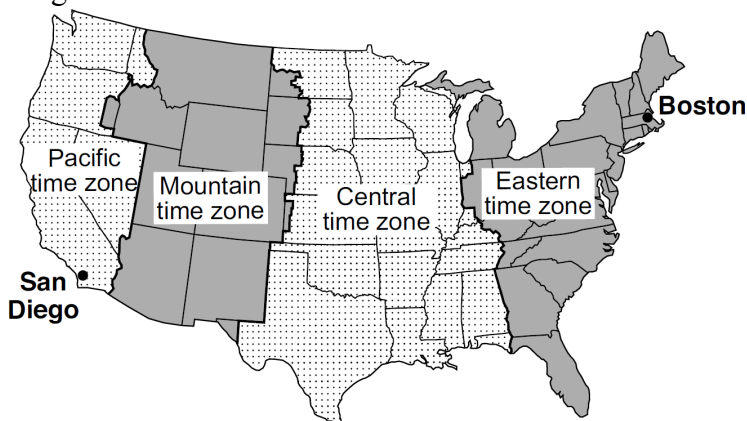
(Not drawn to scale)

Key	
	Lighted, visible part of the Moon
	Dark, invisible part of the Moon

When the Moon is in position 4, which phase would be visible to an observer in Maine?

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

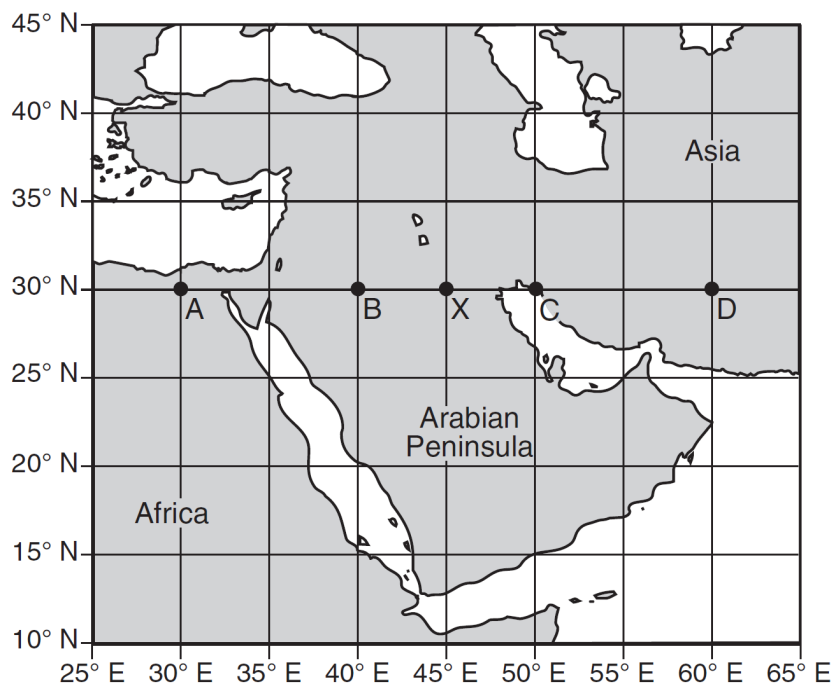
41. The map below shows four major time zones of the United States. The locations of Boston and San Diego are shown.



What is the time in Boston when it is 11 a.m. in San Diego?

- 1) 3 p.m. 2) noon 3) 2 p.m. 4) 8 a.m.

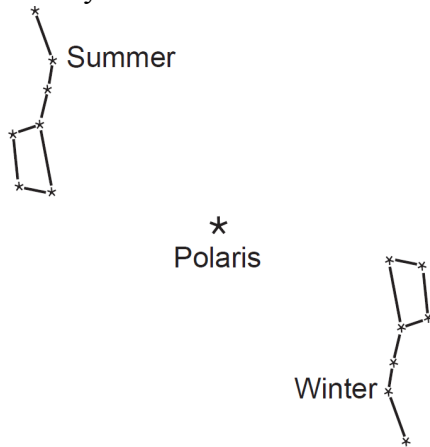
42. The map below shows a portion of the Middle East. Points *A*, *B*, *C*, *D*, and *X* are locations on Earth's surface.



When it is 10:00 a.m. solar time at location *X*, at which location is 11:00 a.m. solar time being observed?

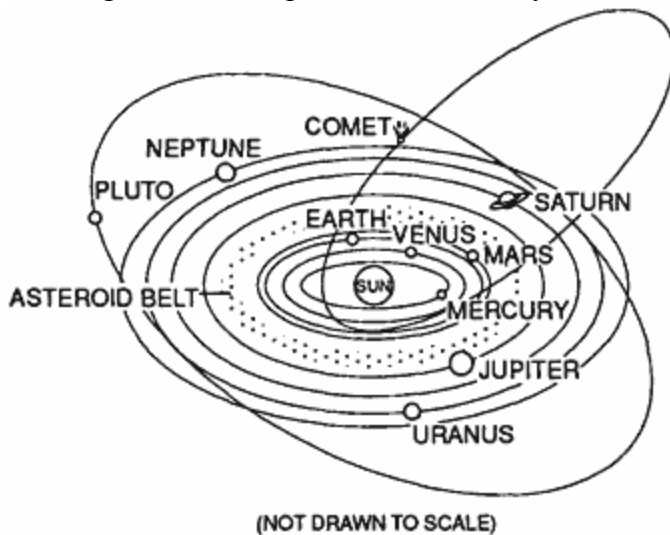
- 1) *A* 2) *B* 3) *C* 4) *D*

43. The diagram below represents the apparent positions of the Big Dipper, with respect to *Polaris*, as seen by an observer in New York State at midnight on the first day of summer and on the first day of winter.



The change in the apparent position of the Big Dipper between the first day of summer and the first day of winter is best explained by Earth

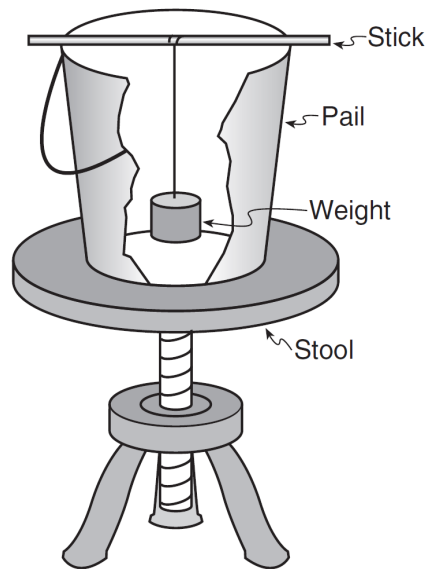
- 1) rotating for 12 hours
 - 2) revolving for 1 year
 - 3) rotating for 1 day
 - 4) revolving for 6 months
44. The diagram below represents our solar system.



This system is best classified as

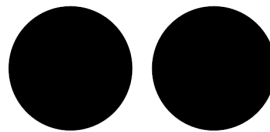
- 1) geocentric, with elliptical orbits
- 2) geocentric, with circular orbits
- 3) heliocentric, with circular orbits
- 4) heliocentric, with elliptical orbits

45. The diagram below shows the equipment used to demonstrate a Foucault pendulum.



In the demonstration, a student swings the weight hanging in the pail and then spins the stool. The stool represents

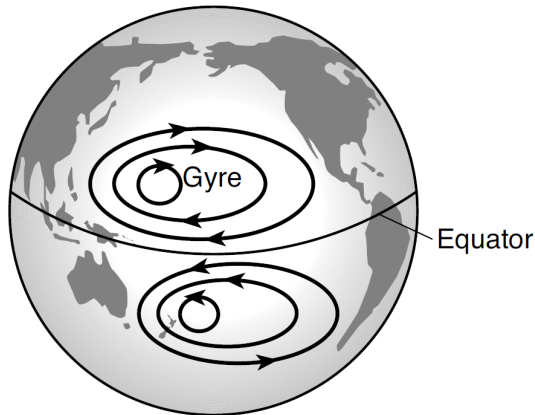
- 1) the Coriolis effect
 - 2) the rotating Earth
 - 3) the revolving Earth
 - 4) convection currents
46. The diagram below compares the relative diameters of two planets in our solar system.



Which two planets have diameters that most closely resemble this comparison?

- 1) Jupiter and Saturn
 - 2) Uranus and Neptune
 - 3) Earth and Mars
 - 4) Mercury and Venus
47. Scientists infer that the Big Bang occurred approximately
- 1) 9 billion years ago
 - 2) 4.6 billion years ago
 - 3) 13.8 billion years ago
 - 4) 7 billion years ago

48. The diagram below represents the location of gyres in the Pacific Ocean. A gyre is a circular pattern of flowing ocean currents.

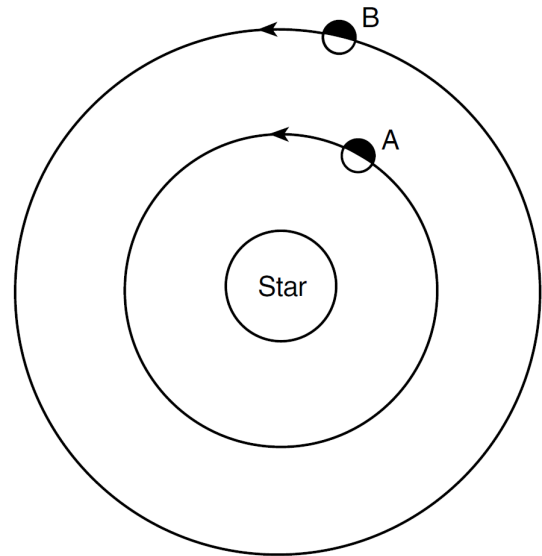


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The clockwise direction of flow of these currents in the Northern Hemisphere, and the counterclockwise direction of flow in the Southern Hemisphere are the result of

- 1) Earth's magnetism
 - 2) the Doppler effect
 - 3) the Moon's magnetism
 - 4) the Coriolis effect
49. Why are impact structures (craters) more common on the surface of Mars than on the surfaces of Venus, Earth, and Jupiter?
- 1) The thin atmosphere of Mars offers little protection against falling rock fragments from space.
 - 2) Mars has the greatest surface area and receives more impacts.
 - 3) The tiny moons of Mars are breaking into pieces and showering its surface with rock fragments.
 - 4) Mars has a strong magnetic field that attracts iron-containing rock fragments from space.
50. The ozone layer helps life on Earth because ozone
- 1) reflects insolation from the Sun
 - 2) deflects winds from a straight line to a curved path
 - 3) modifies the normal El Niño weather pattern
 - 4) absorbs damaging ultraviolet radiation from the Sun

51. The diagram below represents two planets of equal mass, *A* and *B*, revolving around a star. The planets are represented at specific positions in their orbits.

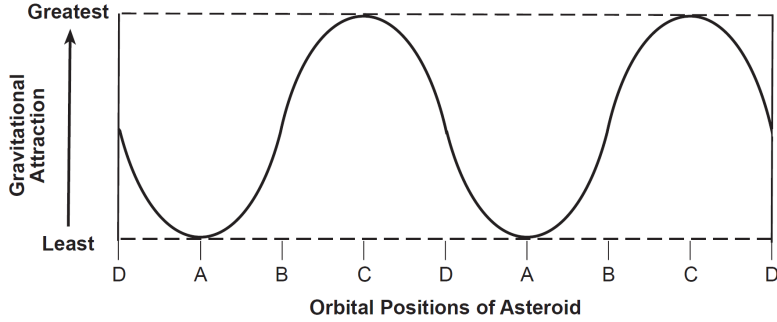


(Not drawn to scale)

When both planets are at the positions represented, planet *B*

- 1) can be seen at night from planet *A*, and planet *B* is moving slower in its orbit
 - 2) can be seen at night from planet *A*, and planet *B* is moving faster in its orbit
 - 3) cannot be seen at night from planet *A*, and planet *B* is moving slower in its orbit
 - 4) cannot be seen at night from planet *A*, and planet *B* is moving faster in its orbit
52. Which event is cyclic and predictable?
- 1) an asteroid striking Earth's surface
 - 2) an earthquake occurring at the San Andreas Fault
 - 3) a volcano erupting above a subducting tectonic plate
 - 4) Jupiter's apparent movement across the night sky

53. The graph below shows the varying amount of gravitational attraction between the Sun and an asteroid in our solar system. Letters *A*, *B*, *C*, and *D* indicate four positions in the asteroid's orbit.



Which diagram best represents the positions of the asteroid in its orbit around the Sun? [Note: The diagrams are not drawn to scale.]

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

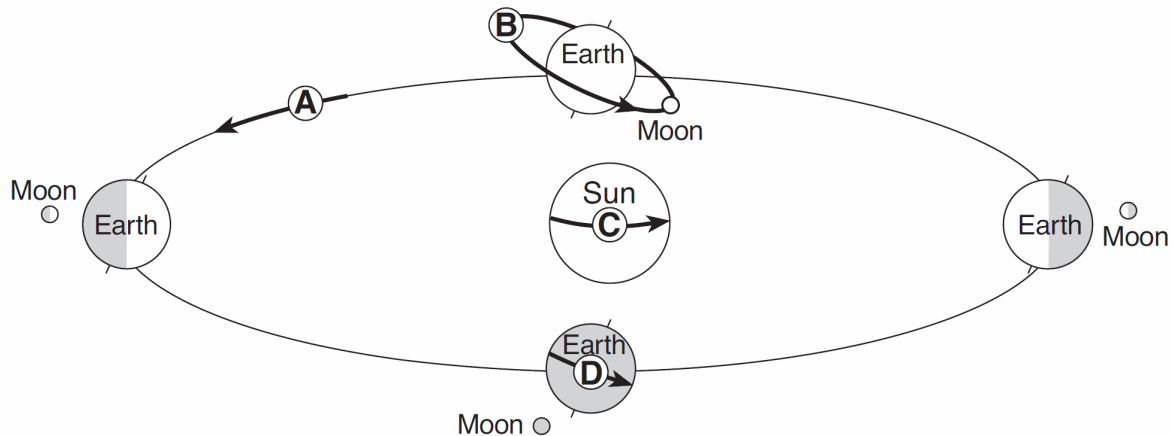
54. The chart below describes some components of the solar system.

Object	Description
X	chunk of rock and ice orbiting from the outer solar system to near the Sun
Y	streak of light seen when a space rock enters Earth's atmosphere and starts burning up
Z	rocky/metallic object orbiting the Sun between Mars and Jupiter

Letters *X*, *Y*, and *Z* identify which components of our solar system?

- 1) *X* = asteroid; *Y* = meteor; *Z* = comet 2) *X* = comet; *Y* = meteor; *Z* = asteroid
 3) *X* = comet; *Y* = moon; *Z* = meteor 4) *X* = asteroid; *Y* = meteor; *Z* = moon

55. The diagram below shows Earth and the Moon in four locations during their orbits. Arrows *A* through *D* represent different motions of Earth, the Moon, and the Sun.

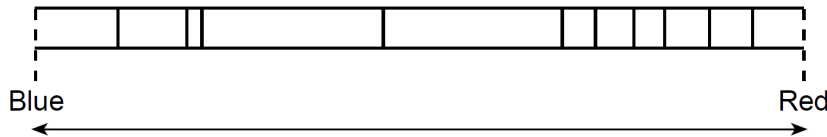


(Not drawn to scale)

Which arrows represents a rates of movement of take approximately the same amount of time ?

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

56. The diagram below represents the spectral lines from the light emitted from a mixture of two gaseous elements in a laboratory on Earth.



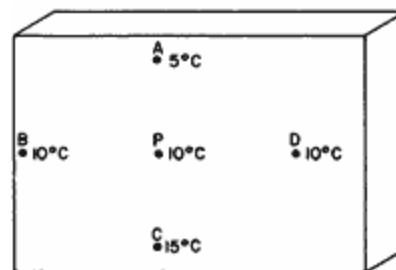
If the same two elements were detected in a distant star that was moving away from Earth, how would the spectral lines appear?

- 1) The entire set of spectral lines would shift toward the red end.
- 2) The entire set of spectral lines would shift toward the blue end.
- 3) The spectral lines of the longer wavelengths would move closer together.
- 4) The spectral lines of the shorter wavelengths would move closer together.

57. How does the amount of heat energy reflected by a smooth, dark-colored concrete surface compare with the amount of heat energy reflected by a smooth, light-colored concrete surface?

- 1) The dark-colored surface will reflect the same amount of heat energy.
- 2) The dark-colored surface will reflect more heat energy.
- 3) The dark-colored surface will reflect less heat energy.

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

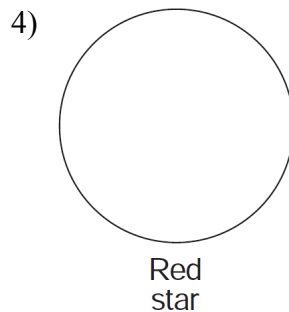
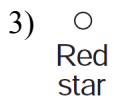
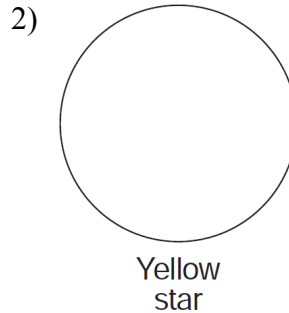
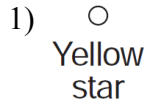


- 1) *A* 2) *B* 3) *C* 4) *D*

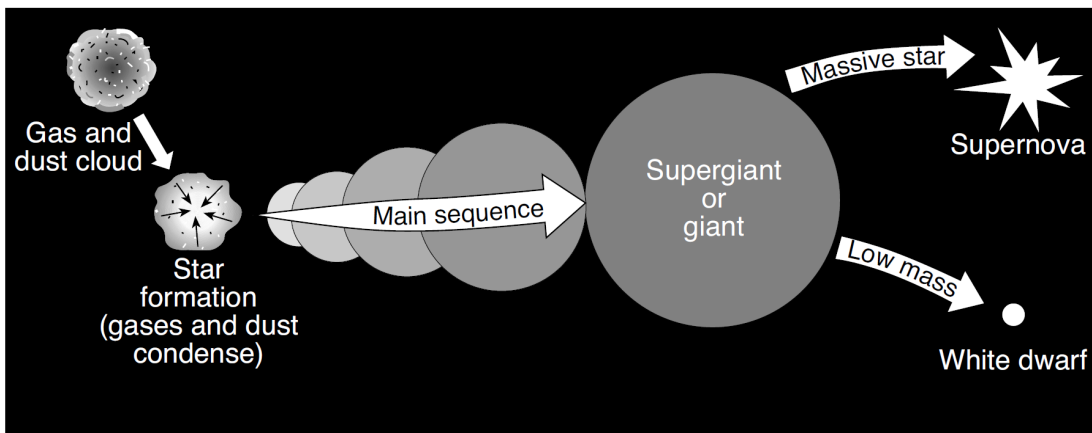
59. The diagram below represents a model of the size of the Sun and indicates the color of the Sun.



Which diagram best represents the relative size and indicates the color of *Polaris* compared to the Sun?



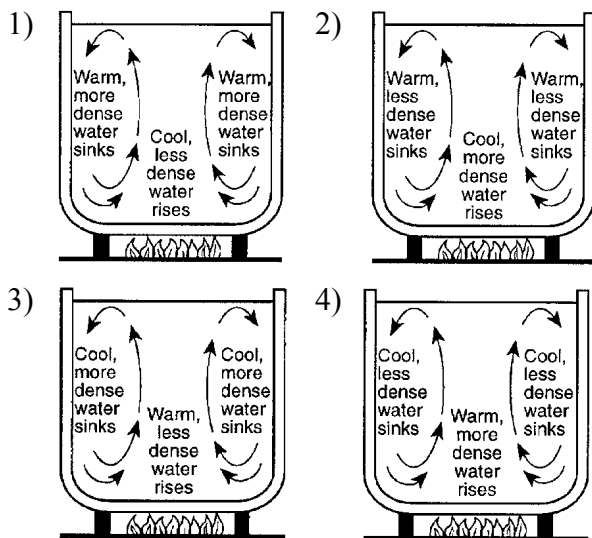
60. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the inferred origin and evolution of most stars.



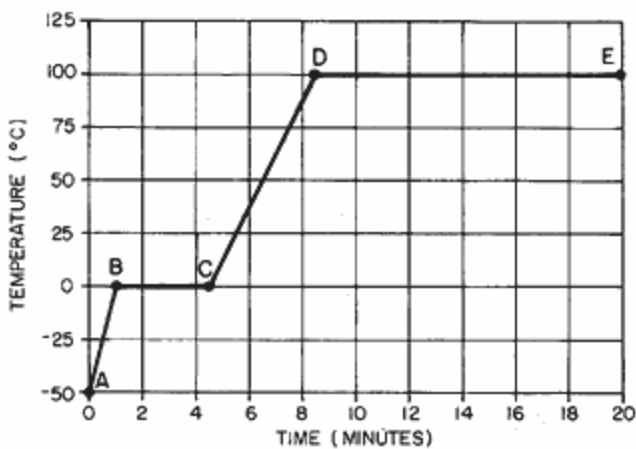
Which star is most likely to become a supernova?

- 1) *Pollux* 2) *Deneb* 3) *Barnard's Star* 4) Sun

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



62. 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°C to 100°C during a 20-minute period.



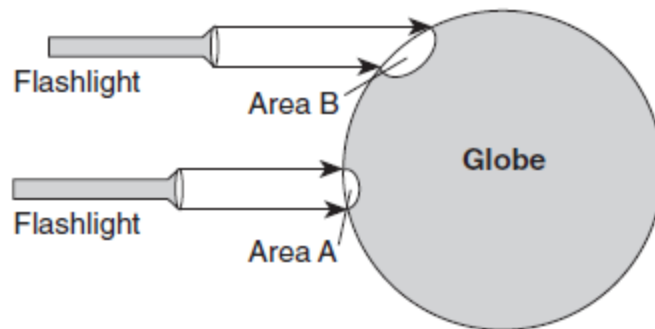
Between points *C* and *B* the water most likely was

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

63. 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 higher specific heat than the water
- 2) reflects more energy and has a lower specific heat than the water
- 3) reflects more energy and has a higher specific heat than the water
- 4) reflects less energy and has a lower specific heat than the water

64. The diagram below shows a classroom demonstration. Two identical flashlights were placed in the positions shown and they illuminated areas of varying size, *A* and *B*, on a classroom globe. Thermometers were then placed at the center of each illuminated area to measure the rate of temperature increase. Readings were taken over a period of 30 minutes.



Students most likely observed that the temperature of area *A* increased at a

- 1) slower rate than the temperature of area *B* because area *A* received rays that were more slanted
- 2) slower rate than the temperature of area *B* because area *A* received rays that were less concentrated
- 3) faster rate than the temperature of area *B* because area *A* received rays with less total energy
- 4) faster rate than the temperature of area *B* because area *A* received rays that were more perpendicular to the surface

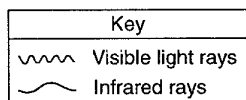
65. Equal volumes of the four samples shown below were placed outside and heated by energy from the Sun's rays for 30 minutes.



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

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

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



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