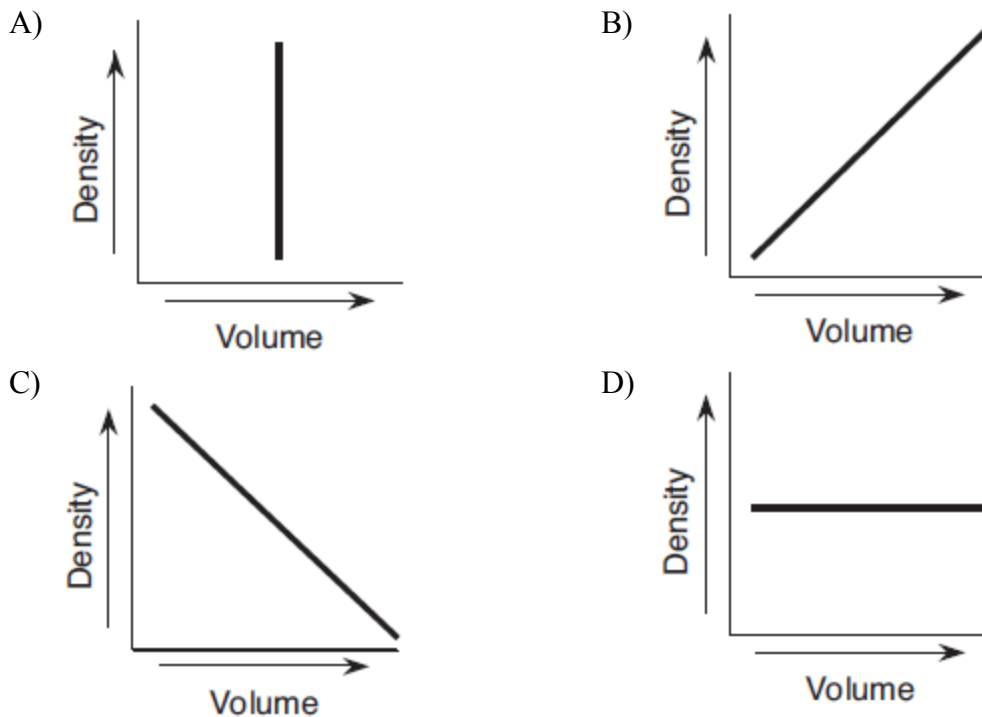


1. The data table below shows the mass and volume of three samples of the same mineral. [The density column is provided for student use.]

**Data Table**

Sample	Mass (g)	Volume (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )
A	50	25	
B	100	50	
C	150	75	

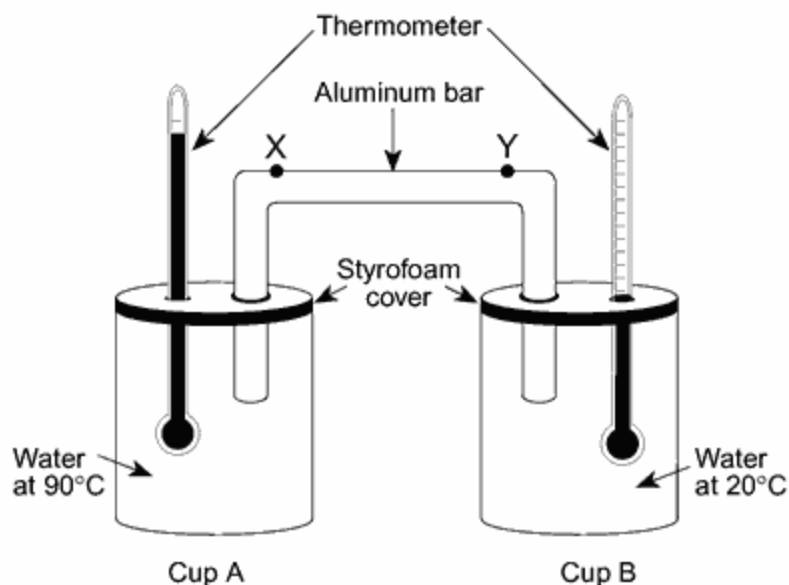
Which graph best represents the relationship between the density and the volume of these mineral samples?



2. Which action can be performed most accurately using only the human senses?
- tearing a sheet of paper into squares whose sides measure 1 centimeter
  - adding 10 grams of salt to a cup of water
  - measuring the air pressure of a room
  - counting 28 shells from a beach
3. Which statement about an unidentified rock sample is most likely an inference?
- The rock is composed of large crystals.
  - The rock has shiny, wavy mineral bands.
  - The rock formed million of years ago.
  - The rock has no visible fossils.
4. Measurements taken from space show the Earth to be
- greatest in diameter at the Equator
  - greatest in diameter at the poles
  - a perfect sphere
  - pear shaped
5. The town of Massena, NY is located at approximately
- 45°55' N 74°05' W
  - 44°55' N 74°55' W
  - 74°55' N 44°55' W
  - 74°05' N 44°05' W
6. When the time of day for a certain ship at sea is 12 noon, the time of day at the Prime Meridian (0° longitude) is 6 p.m. What is the ship's longitude?
- 90° W
  - 90° E
  - 75° W
  - 75° E

7. Base your answer to the following question on "the information about a laboratory procedure, diagram, and data table below.

Hot water at  $90^{\circ}\text{C}$  is poured into cup *A*. Cool water at  $20^{\circ}\text{C}$  is poured into cup *B*. Styrofoam covers are placed on the cups. An aluminum bar and a thermometer are placed through holes in each cover. Points *X* and *Y* are locations on the aluminum bar. The data table shows temperature readings taken every minute for 20 minutes.



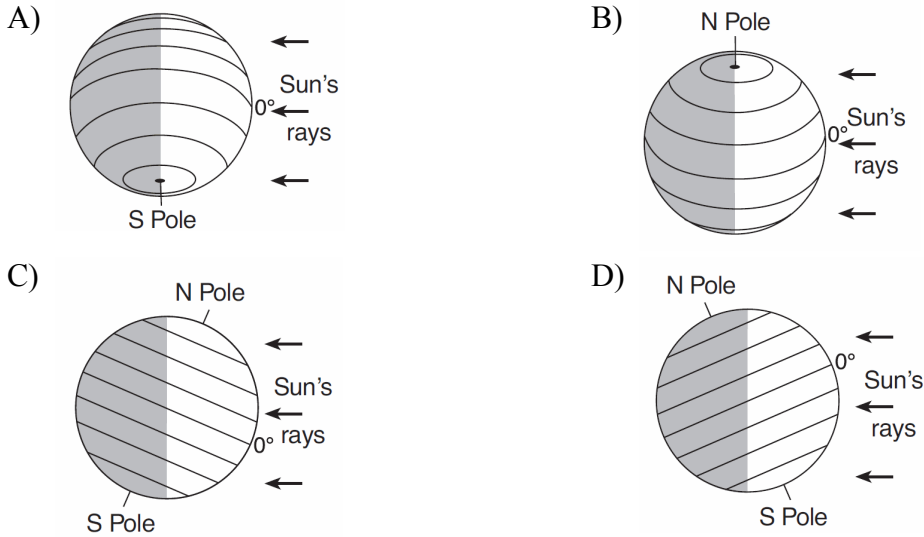
Temperature of Water ( $^{\circ}\text{C}$ )		
Minute	Cup A	Cup B
0	90	20
1	88	20
2	86	20
3	85	21
4	83	21
5	82	22
6	81	22
7	80	22
8	79	22
9	78	23
10	77	23
11	76	23
12	75	23
13	74	23
14	73	23
15	72	24
16	71	24
17	70	24
18	69	24
19	68	25
20	67	25

The rate of temperature change for the water in cup *B* for the first 10 minutes was approximately

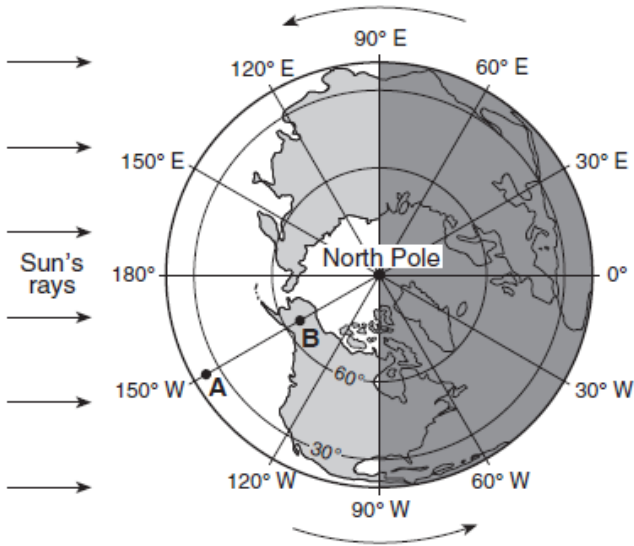
- A)  $0.23^{\circ}\text{C}/\text{min}$     B)  $0.3^{\circ}\text{C}/\text{min}$     C)  $3.0^{\circ}\text{C}/\text{min}$     D)  $23.0^{\circ}\text{C}/\text{min}$

8. On April 21, the altitude of *Polaris*, as viewed from a location in New York State, was measured as  $41.3^{\circ}$ . What will the altitude of *Polaris* be when viewed one month later, on May 21, from the same location?
- A)  $23.5^{\circ}$     B)  $41.3^{\circ}$     C)  $66.7^{\circ}$     D)  $90^{\circ}$
9. During which month does the Sun rise north of due east in New York State?
- A) February    B) July  
C) October    D) December
10. Evidence that Earth revolves around the Sun is provided by the
- A) apparent rising and setting of the Sun during one day  
B) apparent rising and setting of *Polaris* during one day  
C) seasonal changes in the apparent positions of constellations  
D) hourly changes in the apparent direction of the swing of a Foucault pendulum

11. Which diagram represents the tilt of Earth's axis relative to the Sun's rays on December 15?



12. The diagram below represents a view of Earth from above the North Pole. Points *A* and *B* represent locations on Earth's surface.



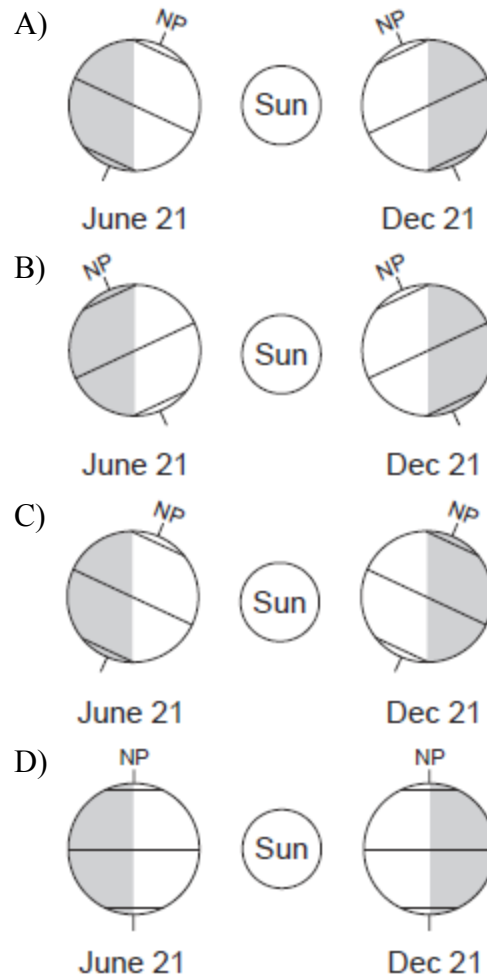
Locations *A* and *B* have the same

- A) latitude and local time
- B) latitude and elevation
- C) longitude and local time
- D) longitude and elevation

13. The best evidence of Earth's rotation is provided by the

- A) Foucault pendulum and global warming
- B) Foucault pendulum and Coriolis effect
- C) Moon phases and global warming
- D) Moon phases and Coriolis effect

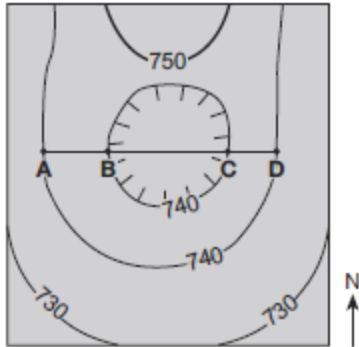
14. Which diagram best represents the regions of Earth in sunlight on June 21 and December 21? [NP indicates the North Pole and the shading represents Earth's night side. Diagrams are not drawn to scale.]



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



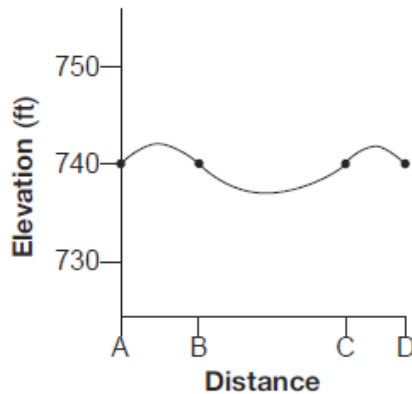
Points *A*, *B*, *C*, and *D* represent surface locations. Contour line elevations are in feet.



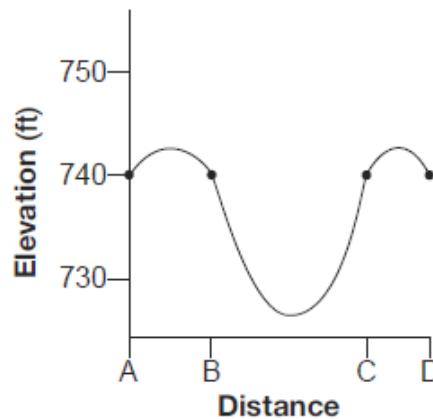
Contour interval = 10 ft

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

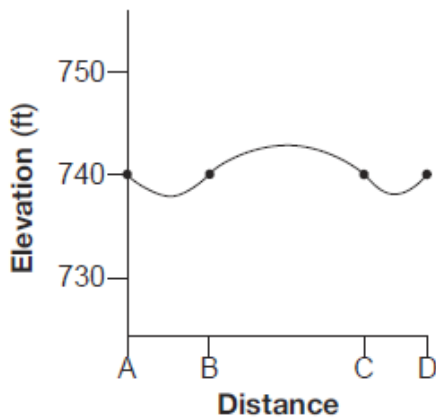
A)



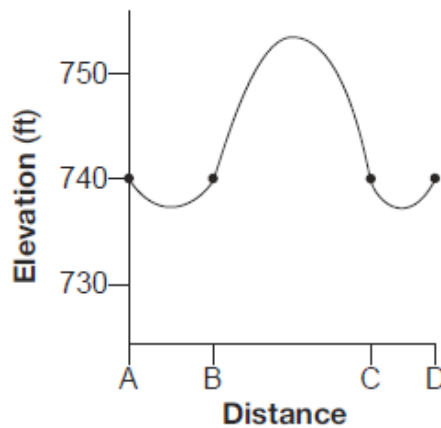
B)



C)



D)



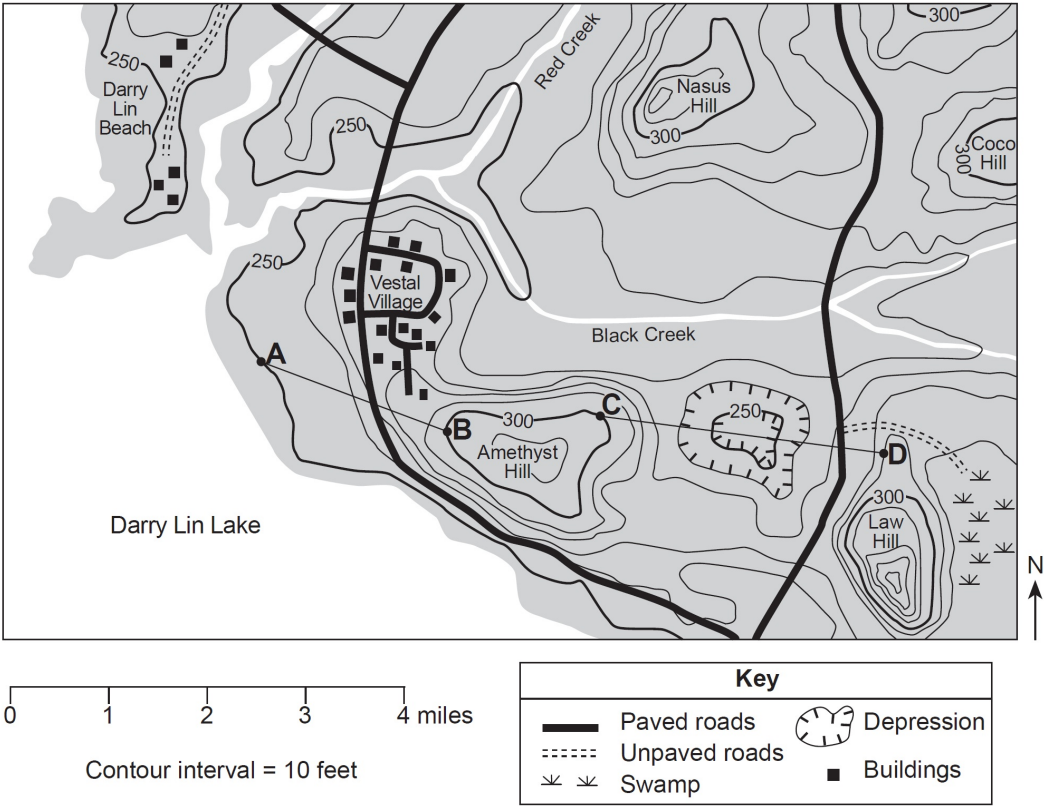
16. Which two factors cause the perpendicular rays of the Sun to move between  $23.5^{\circ}$  N and  $23.5^{\circ}$  S?

- A) tilt of Earth's axis and Earth's revolution
- B) tilt of Earth's axis and Earth's rotation
- C) eccentricity of Earth's orbit and Earth's revolution
- D) eccentricity of Earth's orbit and Earth's rotation

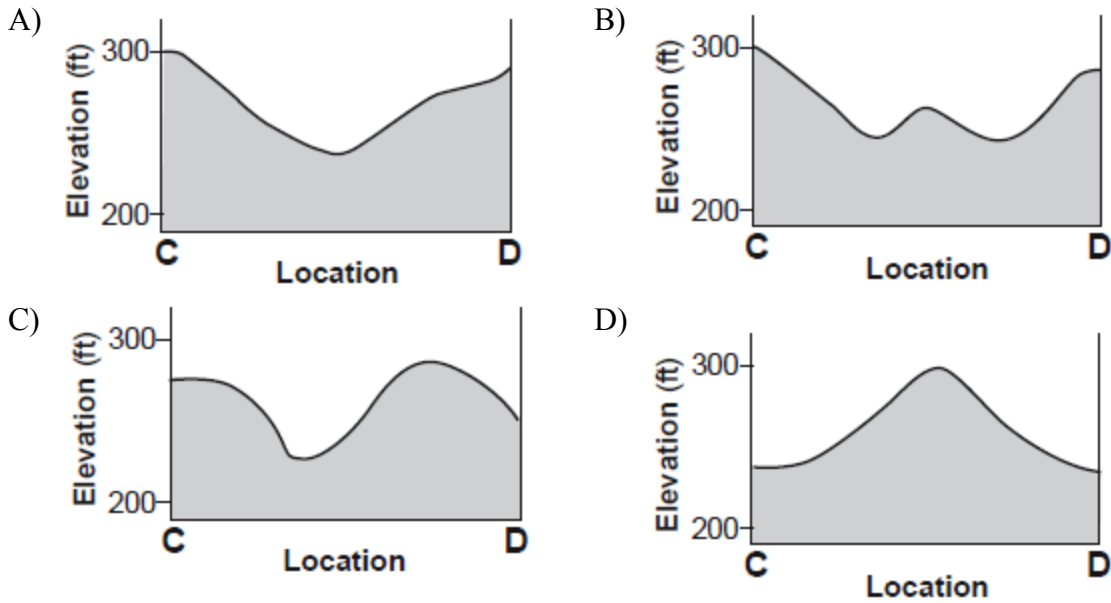
17. Compared to terrestrial planets, Jovian planets have

- A) smaller equatorial diameters and shorter periods of revolution
- B) smaller equatorial diameters and longer periods of revolution
- C) larger equatorial diameters and shorter periods of revolution
- D) larger equatorial diameters and longer periods of revolution

Base your answers to questions 18 through 21 on the topographic map below and on your knowledge of Earth Science. Points *A*, *B*, *C*, and *D* represent locations on the surface of Earth. Elevations are measured in feet.



18. Which cross section represents an accurate profile of the landscape between points *C* and *D*?



19. What is a possible elevation for the surface of Darry Lin Lake?

- A) 228 feet      B) 242 feet      C) 255 feet      D) 268 feet

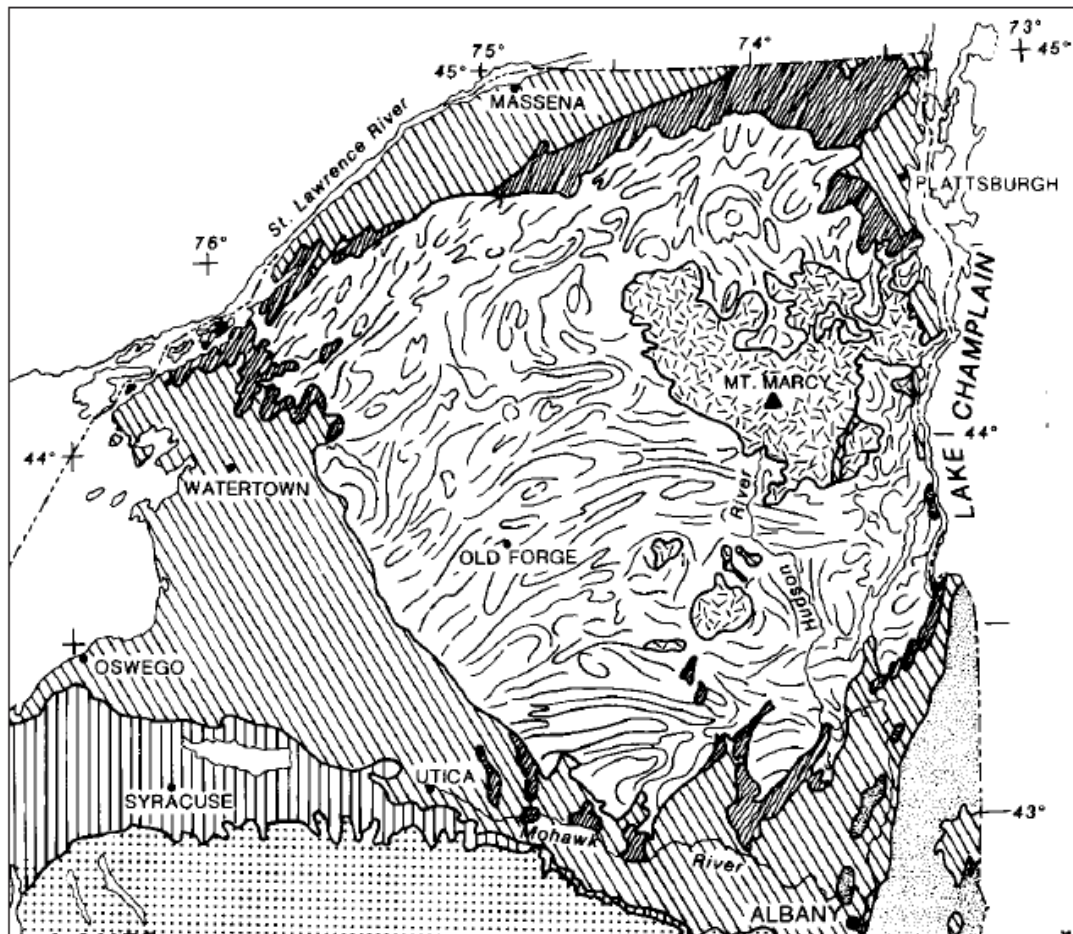
20. What is the approximate gradient from point *A* to point *B* on the map?

- A) 25 feet per mile
- B) 50 feet per mile
- C) 75 feet per mile
- D) 100 feet per mile

21. In which general direction does Red Creek flow?

- A) northeast
- B) southeast
- C) southwest
- D) northwest

22. Base your answer to the following question on the map below, which shows the generalized surface bedrock for a portion of New York State that appears in the Earth Science Reference Tables.



State the latitude and longitude of Plattsburgh, New York, to the nearest degree and minutes. The units and compass direction must be included in your answer.

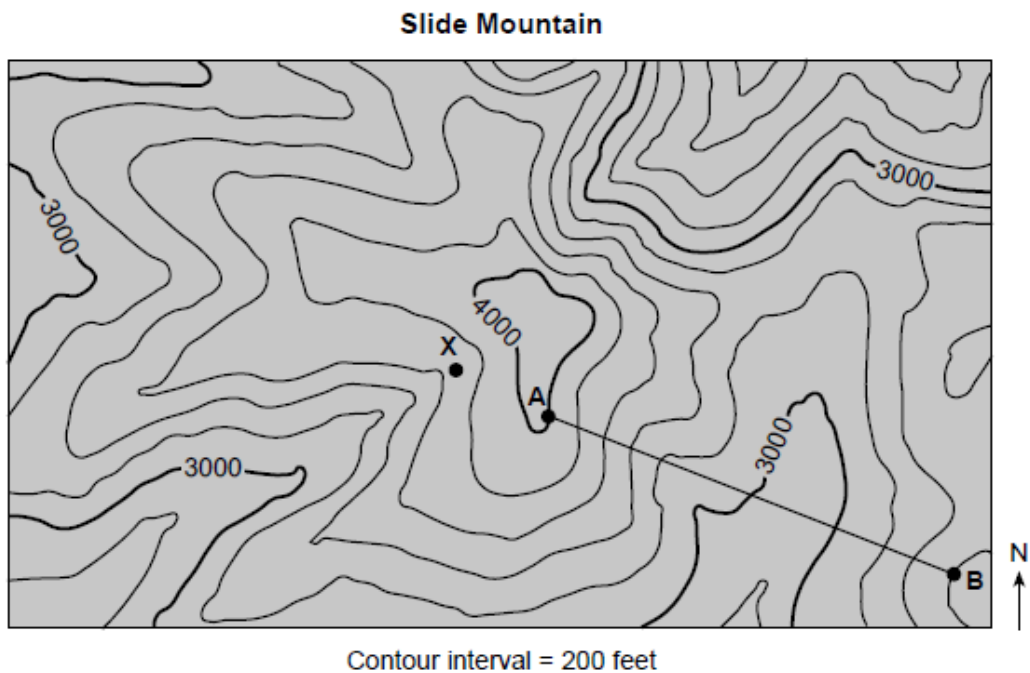
23. Which characteristic of the planets in our solar system increases as the distance from the Sun increases?

- A) equatorial diameter
- B) eccentricity of orbit
- C) period of rotation
- D) period of revolution

24. Which two stars are most similar in luminosity?

- A) *Betelgeuse* and *Barnard's Star*
- B) *Procyon B* and *Proxima Centauri*
- C) *Polaris* and the Sun
- D) *Alpha Centauri* and *Sirius*

Base your answers to questions **25** and **26** on the topographic map below and on your knowledge of Earth science. The map is centered on the peak of New York State's Slide Mountain at 42° North. Points *A*, *B*, and *X* represent locations on the map. Line *AB* is a reference line on the map. Elevations are shown in feet.

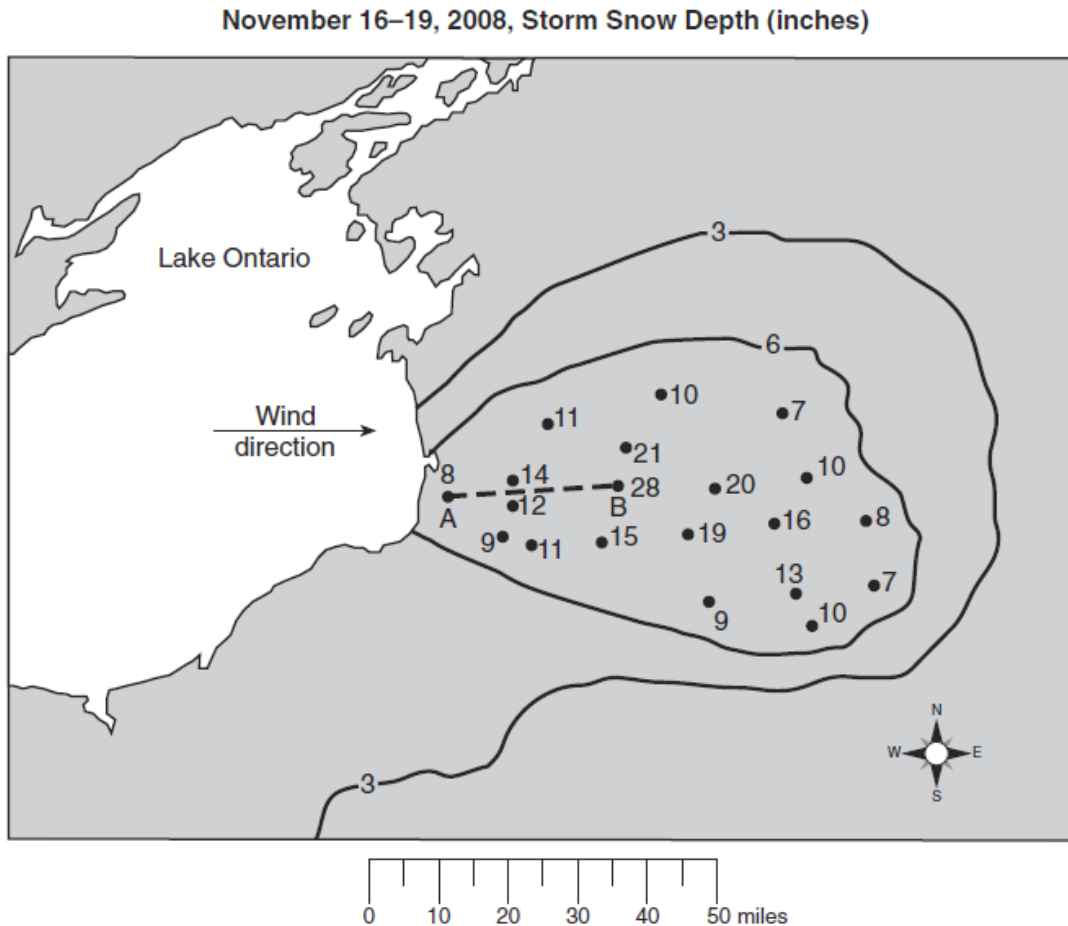


25. Describe *one* piece of evidence shown on the map that indicates that the northeastern side of Slide Mountain has the steepest slope.
26. On the grid below, construct a topographic profile along line *AB* by plotting the elevation of each contour line that crosses line *AB*. Points *A* and *B* have already been plotted. Connect all ten plots with a line, starting at *A* and ending at *B*, to complete the profile.



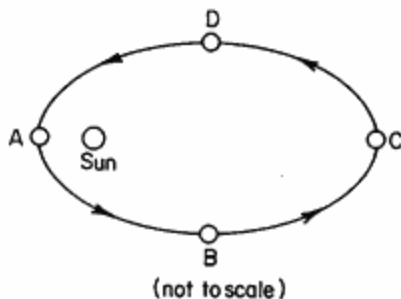
- |  |  |
|--|--|
| <p>27. Locations in California are warmest in summer because sunlight in summer is</p> <ul style="list-style-type: none"><li>A) least intense and of shortest duration</li><li>B) least intense and of longest duration</li><li>C) most intense and of shortest duration</li><li>D) most intense and of longest duration</li></ul> | <p>28. Which group of substances is arranged in order of <i>decreasing</i> specific heat values?</p> <ul style="list-style-type: none"><li>A) iron, granite, basalt</li><li>B) copper, lead, iron</li><li>C) dry air, water vapor, ice</li><li>D) liquid water, ice, water vapor</li></ul> |
|--|--|

29. Base your answer to the following question on the snowfall map of the Tug Hill Plateau region of New York State and your knowledge of Earth science. A lake-effect snowstorm occurred on November 16-19, 2008. Snow depths are indicated in inches at several points and by two labeled isoline. Dashed line  $AB$  is a reference line on the map between two recorded snow depths.



On the map, draw the 9-inch and 12-inch snow depth isolines.

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



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

- A)  $A$     B)  $B$     C)  $C$     D)  $D$

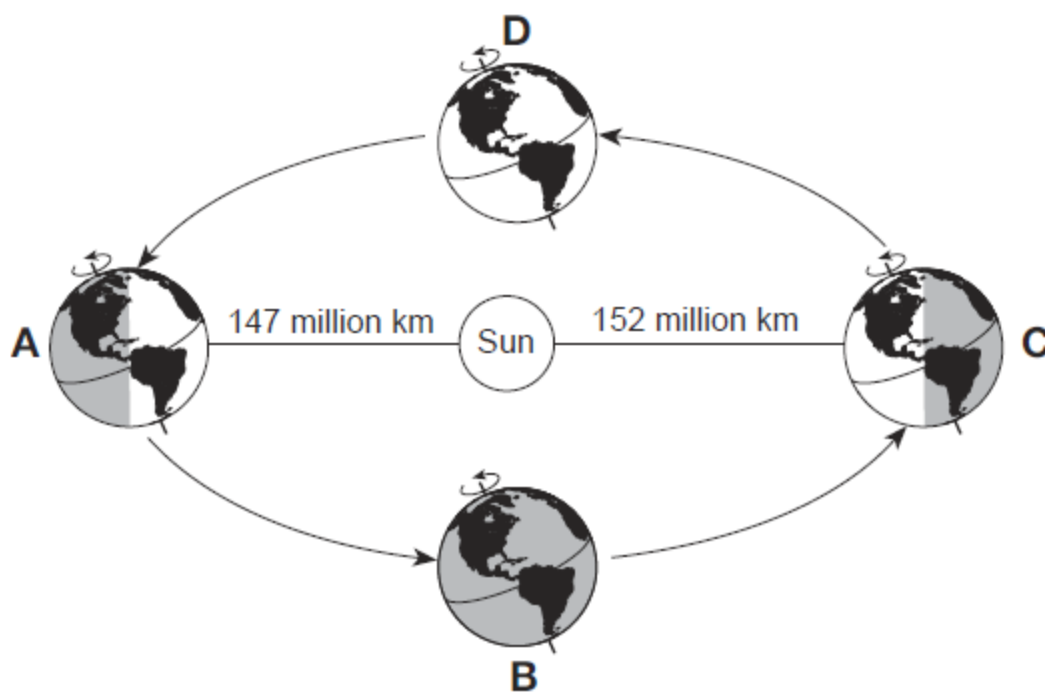
31. By which process is heat energy transferred when molecules within a substance collide?

- A) conduction    B) convection  
C) radiation    D) sublimation

32. Which process transfers energy primarily by electromagnetic waves?

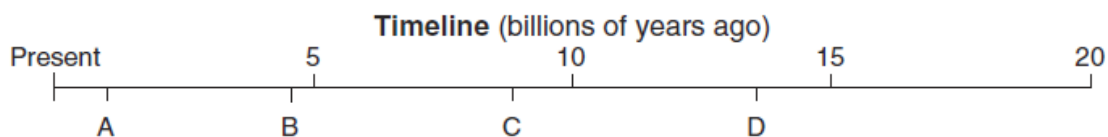
- A) radiation    B) evaporation  
C) conduction    D) convection

Base your answers to questions 33 and 34 on the diagram below and on your knowledge of Earth science. The diagram represents Earth in its orbit around the Sun. Locations *A* through *D* represent four positions of Earth in its orbit. Earth is closest to the Sun (perihelion) at position *A*, and farthest from the Sun (aphelion) at position *C*.



(Not drawn to scale)

33. Which change in seasons occurs in the Northern Hemisphere at position *D*?
- A) Winter is ending and spring is beginning.
  - B) Spring is ending and summer is beginning.
  - C) Summer is ending and fall is beginning.
  - D) Fall is ending and winter is beginning.
34. At which position is the gravitational attraction between the Sun and Earth the greatest?
- A) *A*                      B) *B*                      C) *C*                      D) *D*
- 
35. The timeline below represents time from the present to 20 billion years ago. Letters *A*, *B*, *C*, and *D* represent specific times.

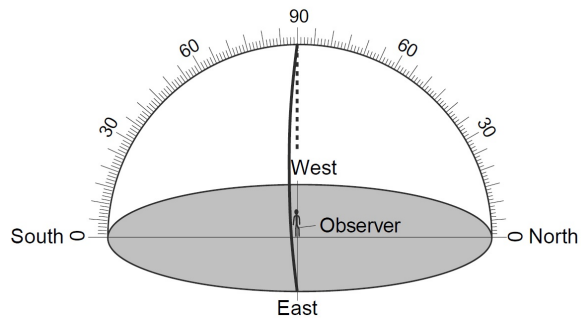


Which letter on the timeline best represents the time when scientists estimate that the Big Bang occurred?

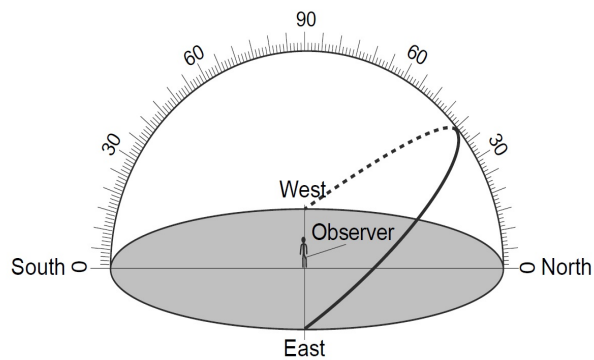
- A) *A*                      B) *B*                      C) *C*                      D) *D*

36. Which diagram represents the apparent path of the Sun on March 21 for an observer at the equator?

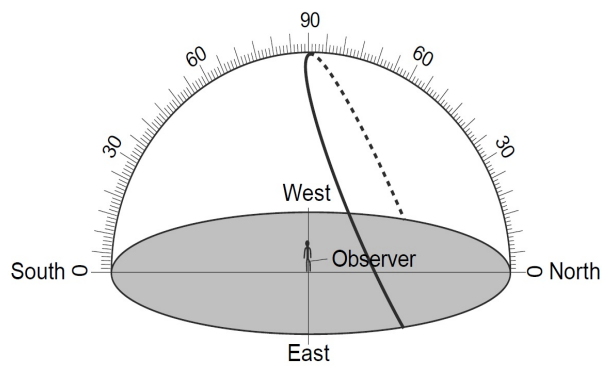
A)



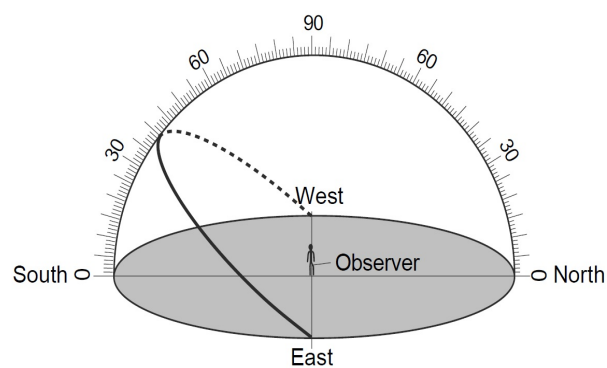
B)



C)



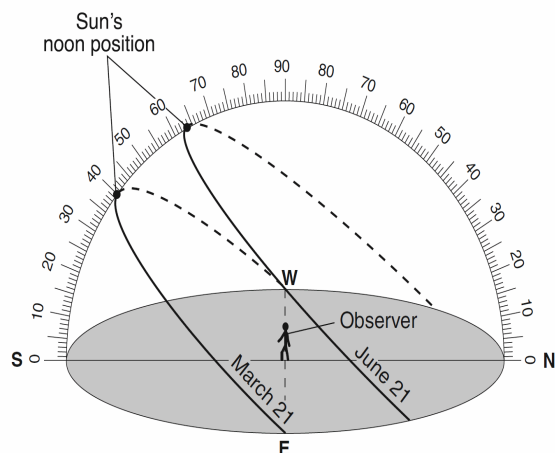
D)



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

- A) receives less insolation
- B) reflects less insolation
- C) has a higher density
- D) has a higher specific heat

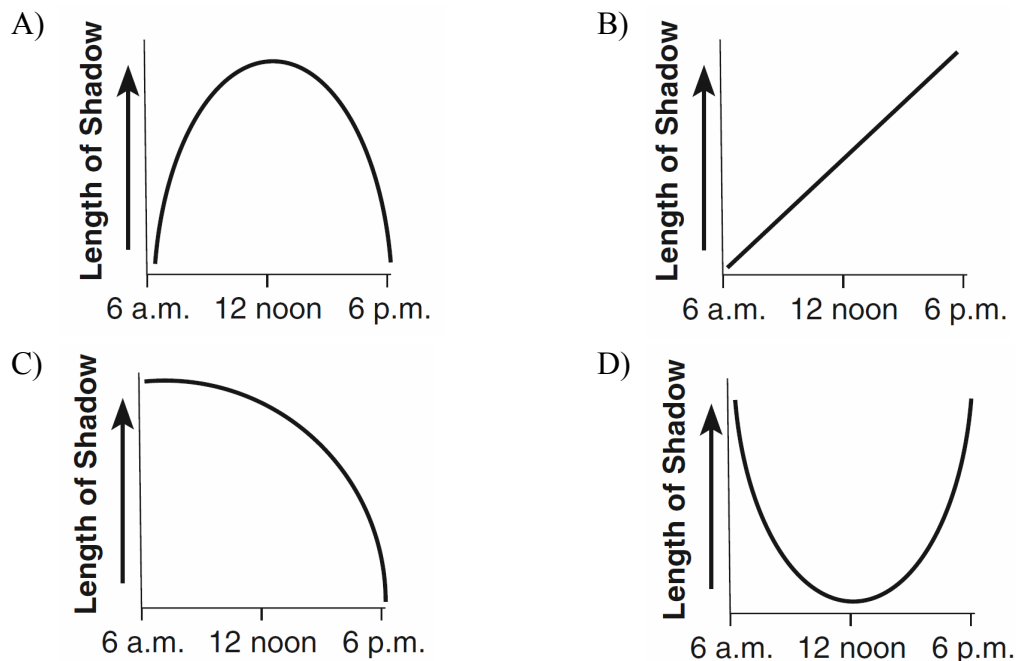
38. Base your answer to the following question on diagram and data table below. The diagram represents the Sun's apparent paths as viewed by an observer located at  $50^\circ$  N latitude on June 21 and March 21. The data table shows the Sun's maximum altitude for the same two dates of the year. The Sun's maximum altitude for December 21 has been left blank.



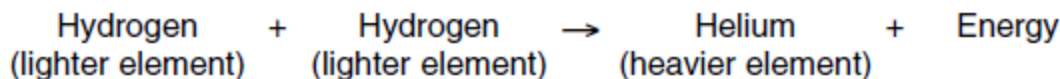
Data Table

Date	Sun's Maximum Altitude
June 21	$63.5^\circ$
March 21	$40^\circ$
December 21	

Which graph best represents the relationship between the time of day and the length of a shadow cast by the observer on March 21?



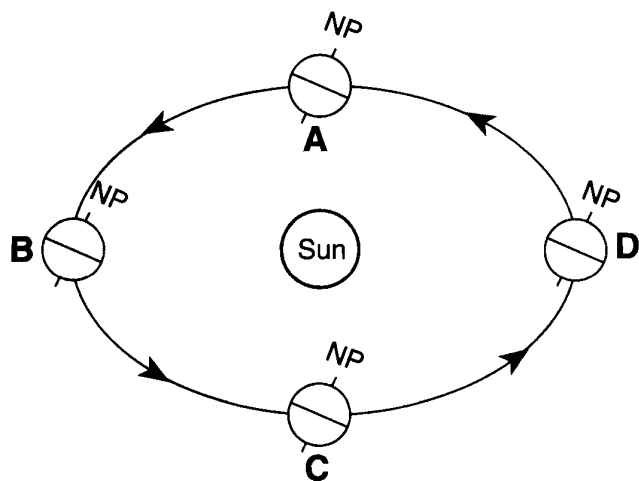
39. The reaction below represents an energy-producing process.



The reaction represents how energy is produced

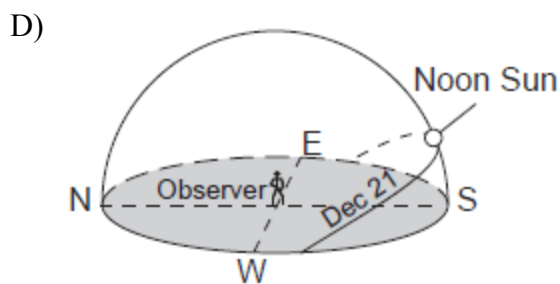
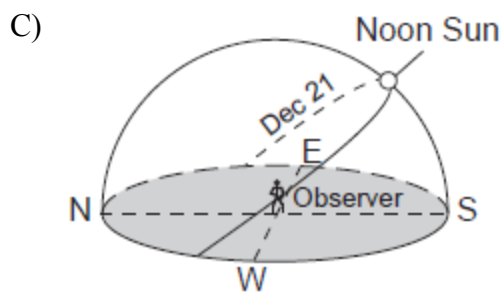
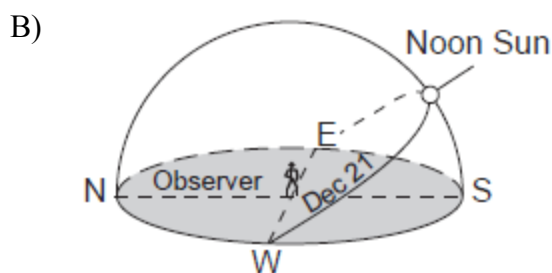
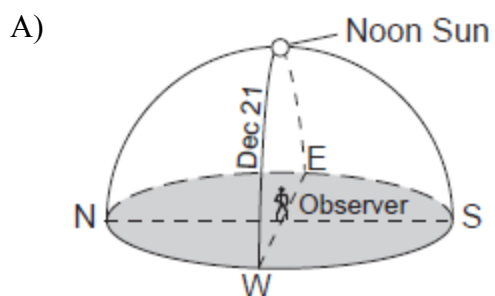
- A) in the Sun by fusion
- B) when water condenses in Earth's atmosphere
- C) from the movement of crustal plates
- D) during nuclear decay

Base your answers to questions 40 through 42 on the diagram below, which represents Earth revolving around the Sun. Letters *A*, *B*, *C*, and *D* represent Earth's location in its orbit on the first day of the four seasons. NP represents the North Pole.



(Not drawn to scale)

40. Which diagram best represents the Sun's apparent path as seen by an observer at  $43.5^\circ$  N latitude on December 21?



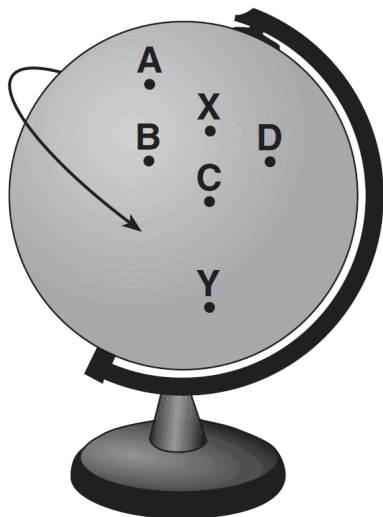
41. If the tilt of Earth's axis were decreased from  $23.5^\circ$  to  $15^\circ$ , New York State's winters would become

- A) warmer, and summers would become cooler
- B) warmer, and summers would become warmer
- C) cooler, and summers would become cooler
- D) cooler, and summers would become warmer

42. Which location in Earth's orbit represents the first day of summer in New York State?

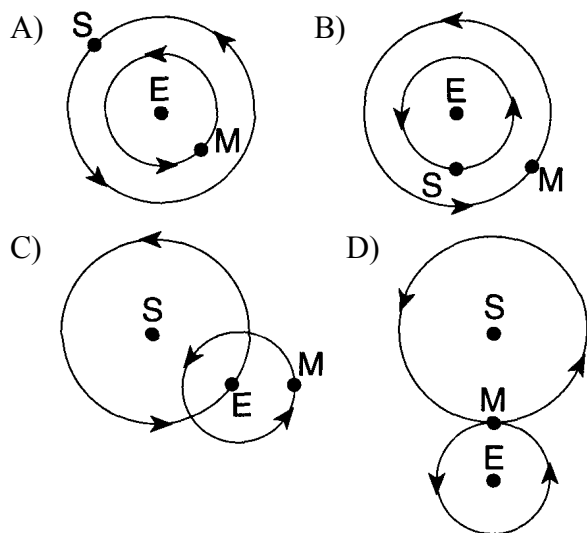
- A) *A*
- B) *B*
- C) *C*
- D) *D*

43. The diagram below represents a globe that is spinning to represent Earth rotating. The globe is spinning in the direction indicated by the arrow. Points *A*, *B*, *C*, *D*, *X*, and *Y* are locations on the globe.

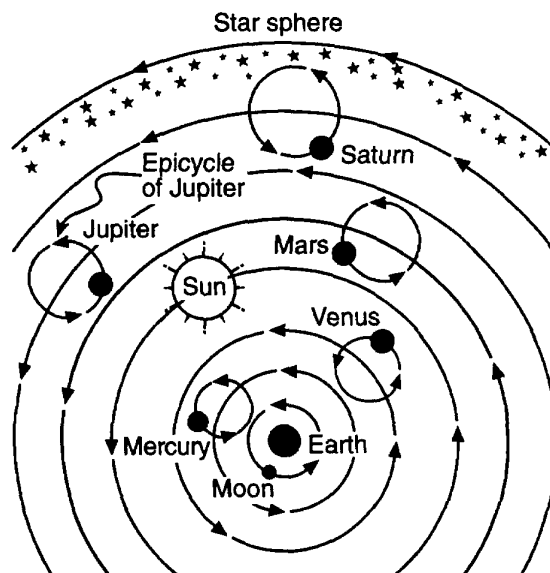


A student attempted to draw a straight line from point *X* to point *Y* on the spinning globe. Due to the Coriolis effect, the student's drawn line most likely passed through point

- A) *A*    B) *B*    C) *C*    D) *D*
44. Which diagram best represents a portion of the heliocentric model of the solar system? [*S* = Sun, *E* = Earth, and *M* = Moon]



45. The diagram below shows one model of a portion of the universe.



What type of model does the diagram best demonstrate?

- A) a heliocentric model, in which celestial objects orbit Earth  
 B) a heliocentric model, in which celestial objects orbit the Sun  
 C) a geocentric model, in which celestial objects orbit Earth  
 D) a geocentric model, in which celestial objects orbit the Sun
46. The diagram below represents the bright-line spectrum for an element.



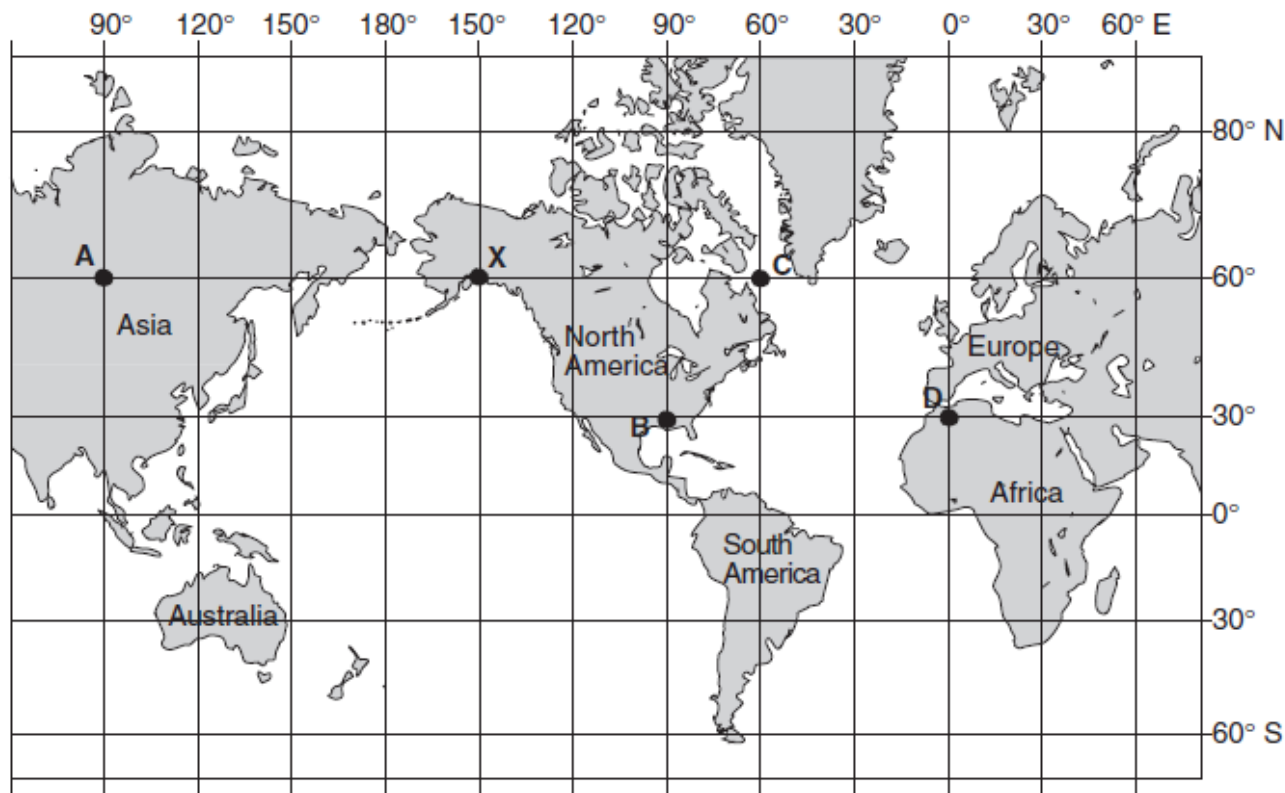
The spectrum of the same element observed in the light from a distant star is shown below.



The shift in the spectral lines indicates that the star is moving

- A) toward Earth  
 B) away from Earth  
 C) in an elliptical orbit around the Sun  
 D) in a circular orbit around the Sun

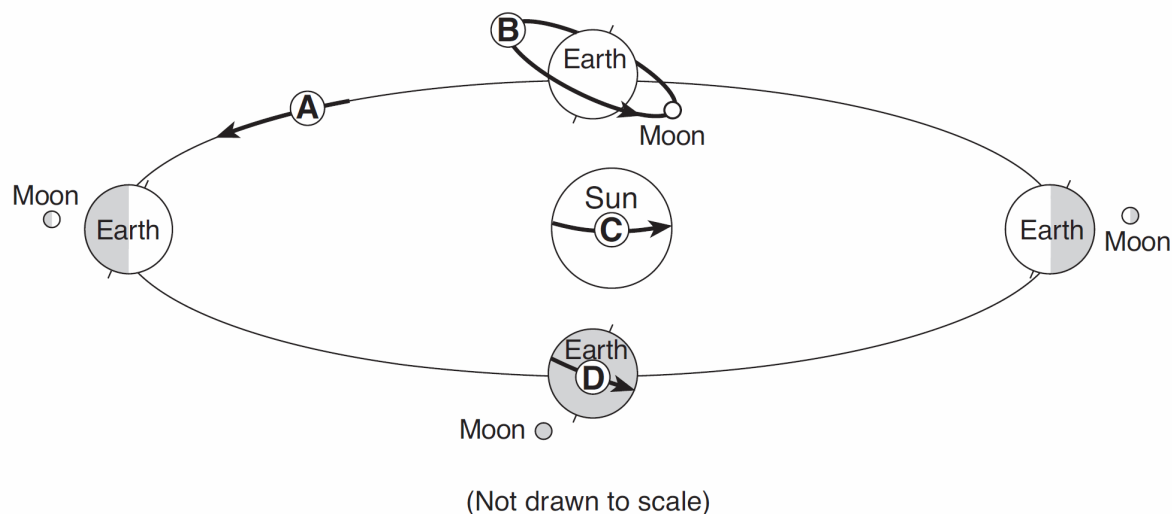
47. Letters A, B, C, D, and X on the map below represent locations on Earth. The map shows the latitude-longitude grid.



Solar time is based on the position of the Sun. What is the solar time of location C, if the solar time at location D is 12 p.m.?

- A) 10 a.m.      B) 8 a.m.      C) 4 p.m.      D) 2 p.m.

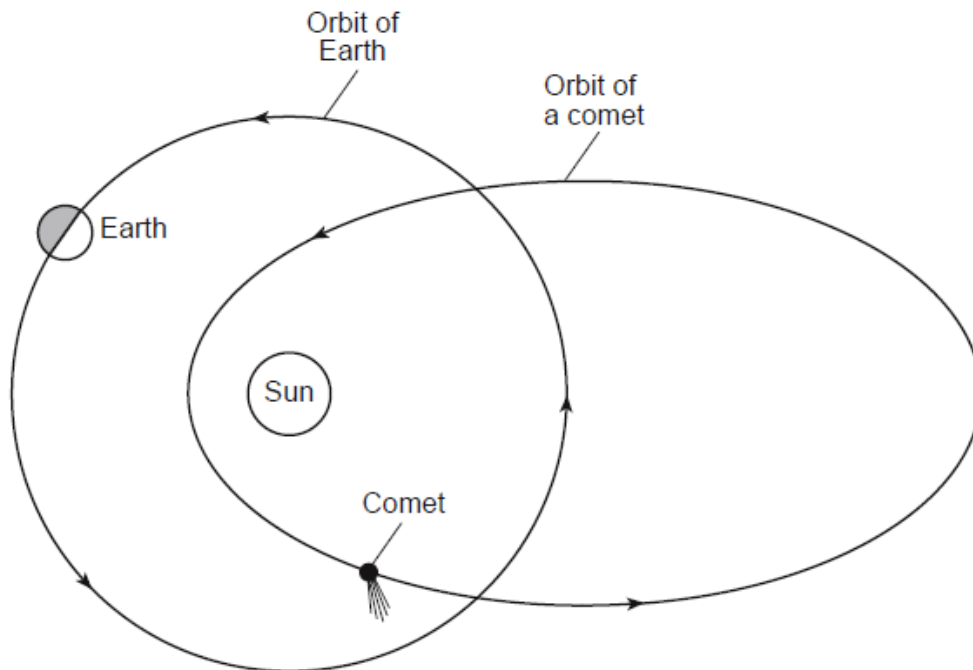
48. The diagram below shows Earth and the Moon in four locations during their orbits. Arrows A through D represent different motions of Earth, the Moon, and the Sun.



Which arrow represents a rate of movement of approximately  $1^\circ$  per day?

- A) A      B) B      C) C      D) D




49. The diagram below represents the position of Earth in its orbit and the position of a comet in its orbit around the Sun.



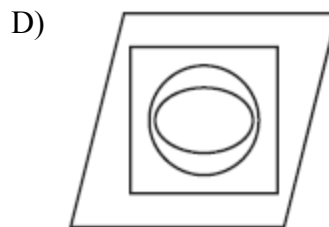
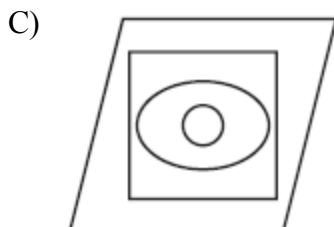
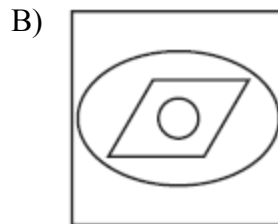
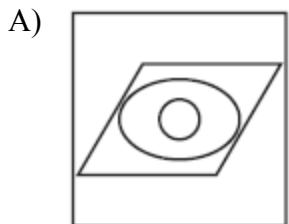
(Not drawn to scale)

Which inference can be made about the comet's orbit, when it is compared to Earth's orbit?

- A) Earth's orbit and the comet's orbit have the same distance between foci.
  - B) Earth's orbit has a greater distance between foci than the comet's orbit.
  - C) The comet's orbit has one focus, while Earth's orbit has two foci.
  - D) The comet's orbit has a greater distance between foci than Earth's orbit.
50. The symbols below are used to represent different regions of space.

Universe =  Earth =  Galaxy =  Solar system = 

Which diagram shows the correct relationship between these four regions? [If one symbol is within another symbol, that means it is part of, or included in, that symbol.]

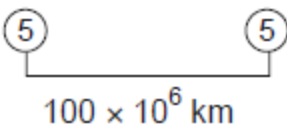
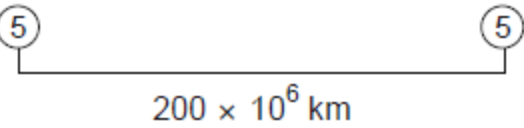
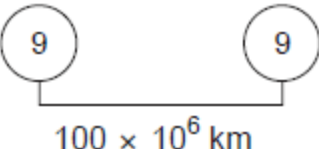
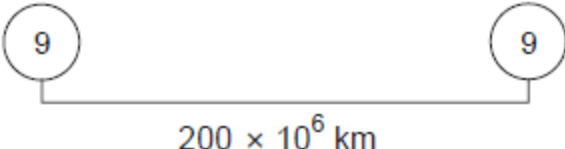


51. The symbols below represent two planets.

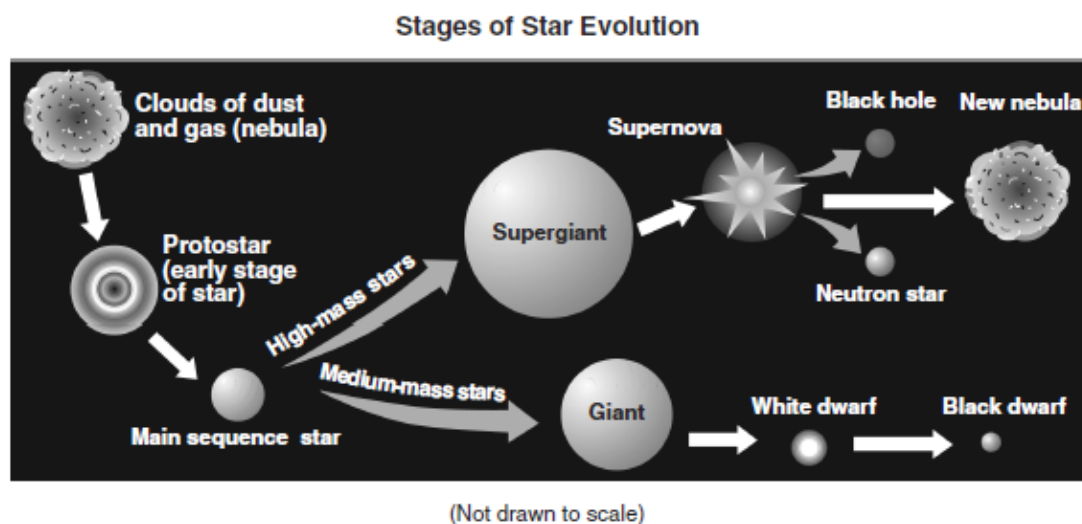
⑤ represents a planet with a mass 5 times Earth's mass.

⑨ represents a planet with a mass 9 times Earth's mass.

Which combination of planet masses and distances produces the greatest gravitational force between the planets?

- A) 
- B) 
- C) 
- D) 

52. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents two possible sequences in the evolution of stars.

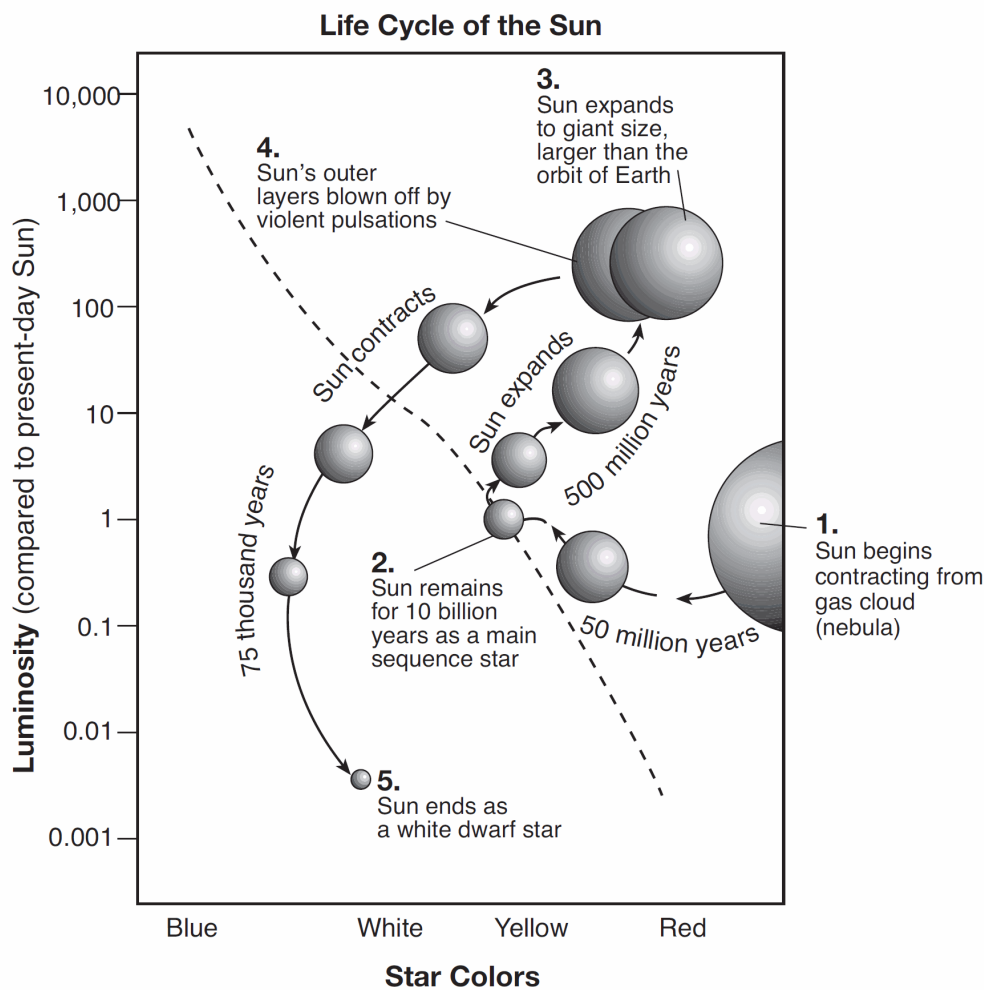


Which property primarily determines whether a giant star or a supergiant star will form?

- A) mass                      B) color                      C) shape                      D) composition

53. Base your answer to the following question on the diagram below and on your knowledge of Earth science.

The diagram represents the inferred changes to the luminosity and color of the Sun throughout its life cycle. The diagonal dashed line represents the main sequence stars. The numbers 1 through 5 represent stages in the life cycle of the Sun.

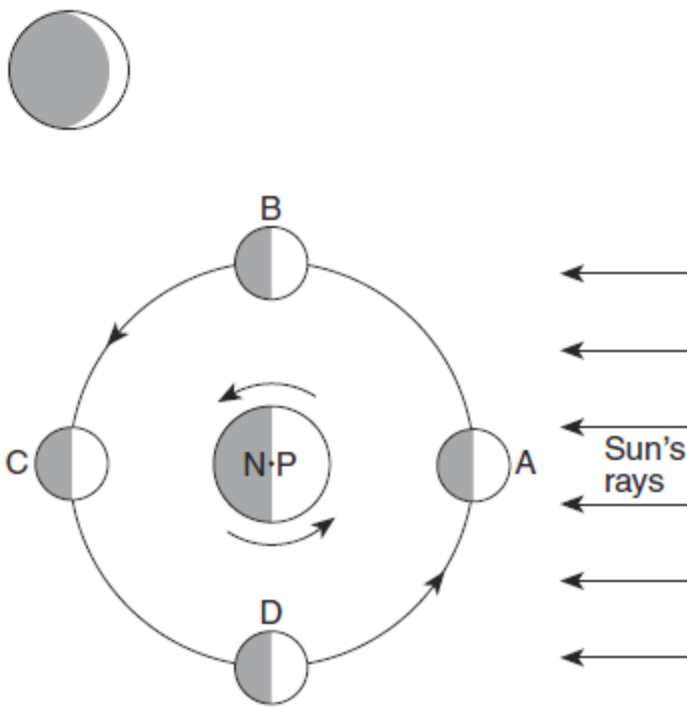


For other stars in our galaxy that go through a similar life cycle to our Sun, which star is currently in the late stage of its life cycle?

- A) *Alpha Centauri*
- B) *Procyon B*
- C) *Barnard's Star*
- D) *Polaris*

Base your answers to questions 54 and 55 on the diagram and on your knowledge of Earth science. The diagram represents the Moon at four positions, *A* through *D*, in its orbit around Earth as viewed from above the North Pole (NP). The shaded parts of the Moon and Earth represent darkness.

The Moon phase shown below was seen by an observer in New York State.



(Not drawn to scale)

54. Describe the effect on the heights of Earth's high and low tides when the Moon moves from Neap Tide at position *D* to Spring Tide at position *A*.
- Height of High Tide \_\_\_\_\_
- Height of Low Tide \_\_\_\_\_
55. Calculate the number of days from the Moon phase at position *C* to the Moon phase at position *A* as seen from Earth. \_\_\_\_\_

56. 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?

A)

Type of Heat Transfer	Change in Air Density
conduction	density increases

B)

Type of Heat Transfer	Change in Air Density
conduction	density decreases

C)

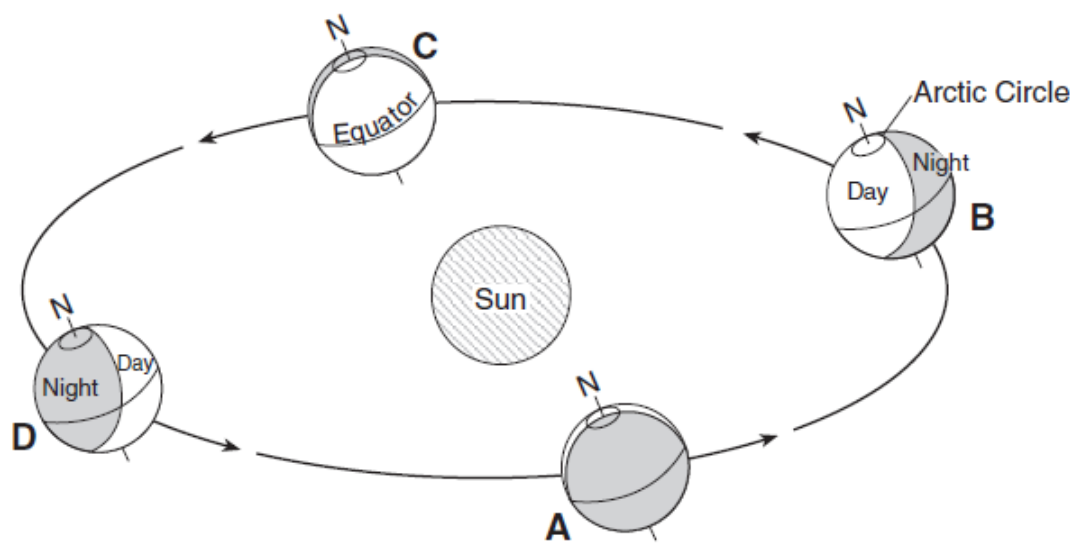
Type of Heat Transfer	Change in Air Density
convection	density increases

D)

Type of Heat Transfer	Change in Air Density
convection	density decreases

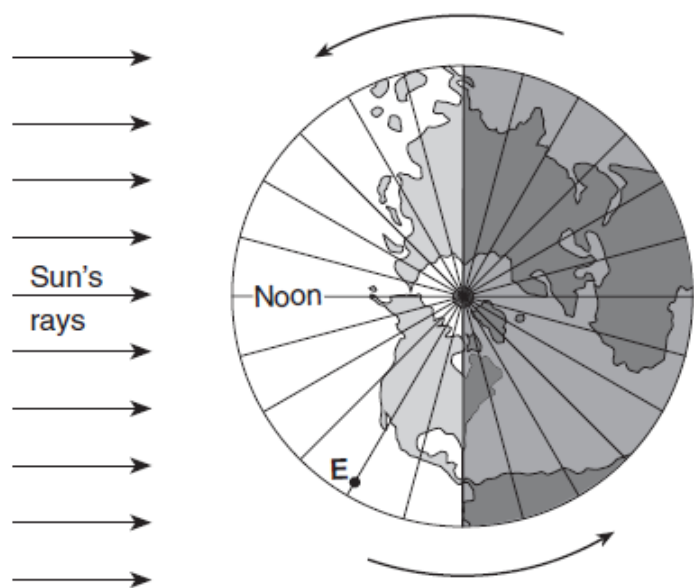
Base your answers to questions 57 through 59 on the diagram below. Diagram 1 shows Earth's location in its orbit on the first day of each of the four seasons, labeled A through D. Diagram 2 shows a north polar view of Earth on March 21. Point E represents a location on Earth's surface. Longitude lines are shown at 15° intervals.

Diagram 1



(Not drawn to scale)

Diagram 2

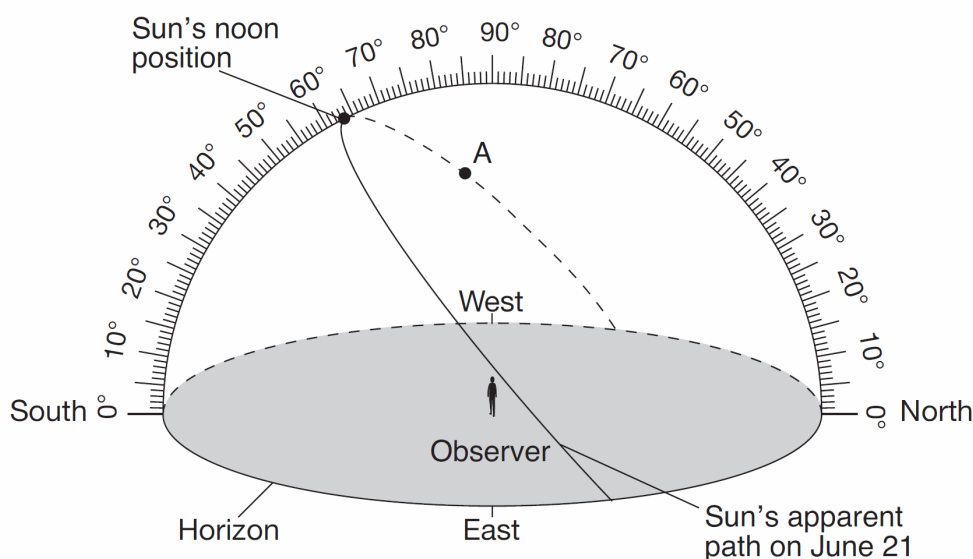


March 21

57. Where is the sun directly overhead when the Earth is at position C that causes the duration of insolation to be 12 hours every location on Earth? Explain why the duration of insolation is 12 hours at both the Arctic Circle and the equator when Earth is at position C.

- 
58. How does the altitude of the Sun at solar noon appear to change each day for an observer in New York State as Earth moves from position *A* to position *B* to position *C*?
59. Describe one piece of evidence shown in the diagram which indicates that the Northern Hemisphere is experiencing winter at position *D*.
- 

Base your answers to questions **60** and **61** on the diagram in your answer booklet and on your knowledge of Earth science. The diagram is a model of the sky (celestial sphere) for an observer at  $50^{\circ}$  N latitude. The Sun's apparent path on June 21 is shown. Point *A* is a position along the Sun's apparent path. Angular distances above the horizon are indicated.

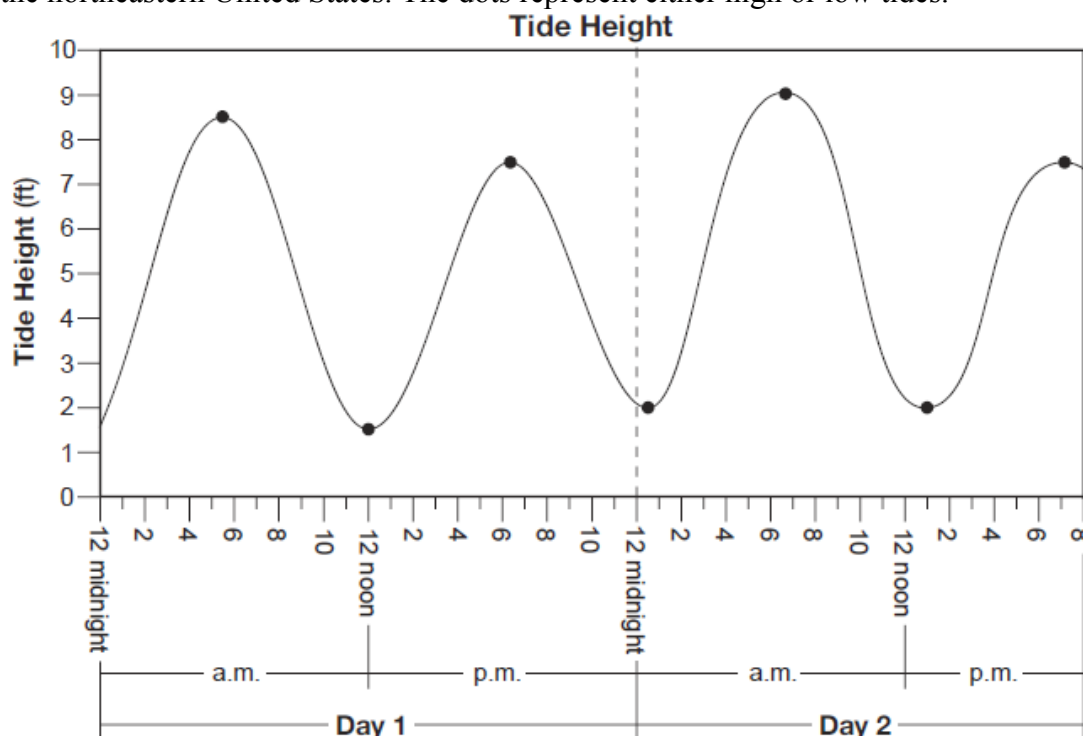


60. On the diagram above, draw the apparent path of the Sun across the sky on September 23rd, and December 21st from sunrise to sunset. Make sure you indicate the correct altitude of the solar noon sun (put degree value on diagram) and the correct position of sunrise and sunset represented by **each** apparent path of the sun.
61. The Sun travels  $30^{\circ}$  in its apparent path between the noon position and point *A*. Identify the time when the Sun is at point *A*. Include a.m. or p.m. with your answer.

Time \_\_\_\_\_

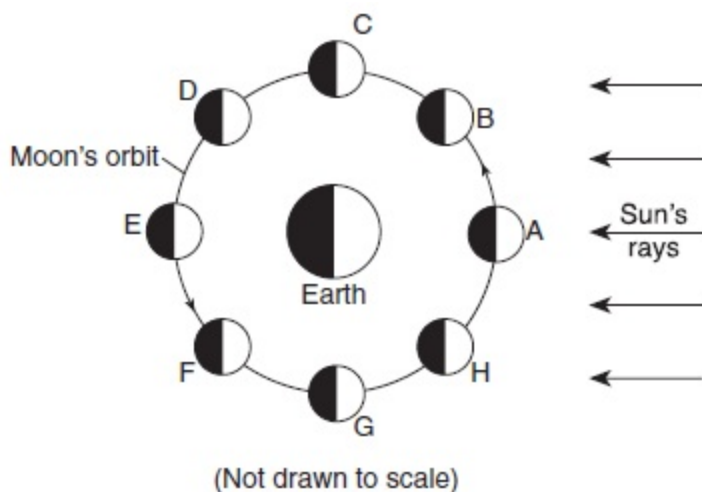
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62. The graph below shows ocean tide height in feet (ft) over a 44-hour period for a coastal location in the northeastern United States. The dots represent either high or low tides.



If the pattern shown continued, the next low tide occurred on Day 3 at approximately

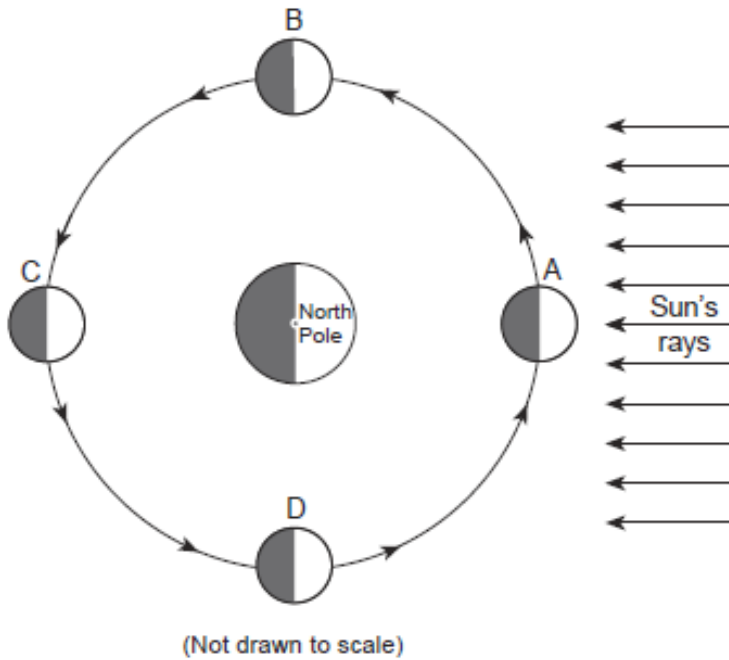
- A) 12 midnight    B) 1:30 a.m.    C) 1:00 p.m.    D) 6:00 p.m.
63. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the Moon in eight positions, *A* through *H*, in its orbit around Earth.



How many days are required for the Moon to complete a cycle of phases from the new Moon position represented in the diagram to the new Moon the following month?

- A) 2.2 d    B) 27.3 d    C) 29.5 d    D) 365.26 d

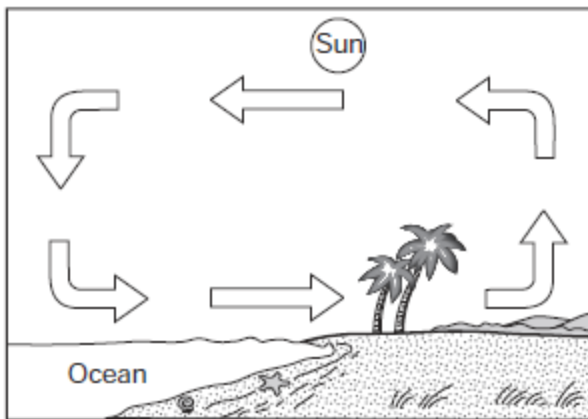
64. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the Moon at different positions, labeled *A*, *B*, *C*, and *D*, in its orbit around Earth.



During which Moon phase could an observer on Earth see a lunar eclipse occur?

- A)  B)  C)  D) 

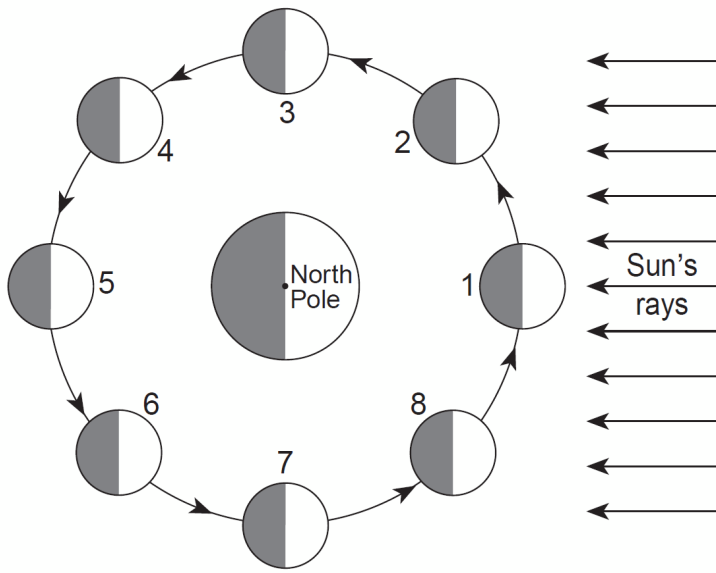
65. Arrows in the diagram below represent the daytime flow of air over a coastal region.



Which process primarily transfers heat by moving air?

- A) conduction      B) convection  
C) radiation      D) transpiration

66. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents eight numbered positions of the Moon in its orbit around Earth.

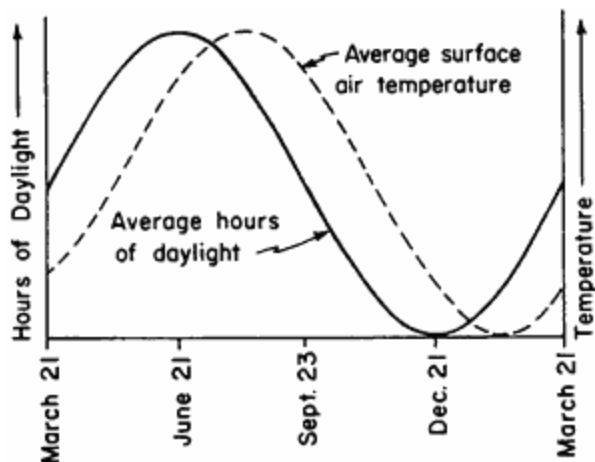


(Not drawn to scale)

Which phase of the Moon will be observed in New York State when the Moon is at position 8?

- A)  B)  C)  D) 

67. The graph below indicates the average number of daylight hours and the average surface air temperature over a 12-month period at a specific location on the Earth.

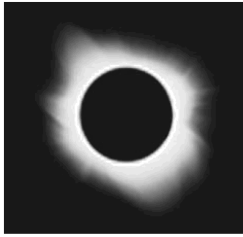


Based on the graph, the highest average surface air temperature occurs

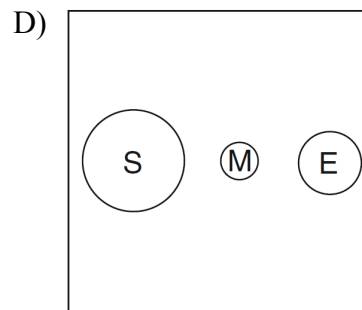
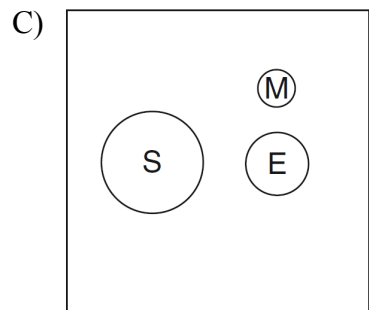
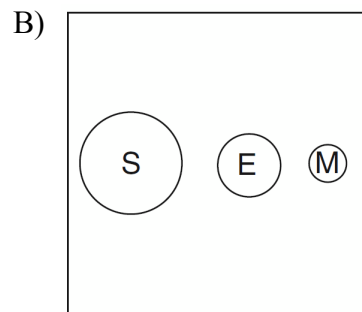
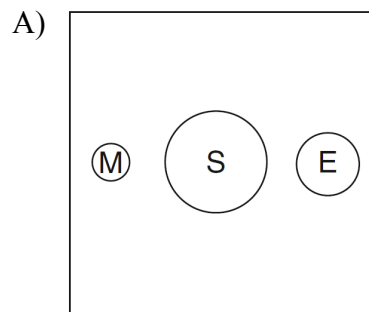
- A) on June 21
- B) between June 21 and September 23
- C) on December 21
- D) between December 21 and March 21

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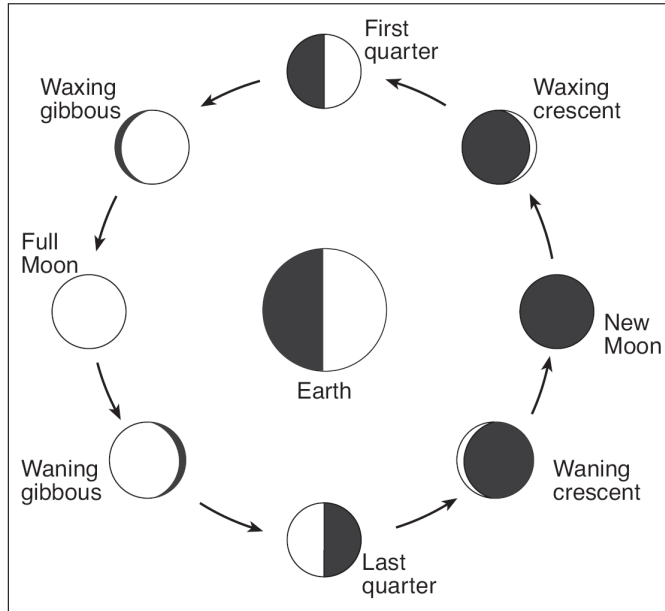
68. The diagram below represents a total solar eclipse as seen from Earth.



Which diagram correctly represents the relative positions of the Sun (*S*), Earth (*E*), and the Moon (*M*) in space during a total solar eclipse? [The diagrams are not drawn to scale.]



69. Base your answer to the following question on the diagram below, which shows positions of the Moon in its orbit and phases of the Moon as viewed from New York State.

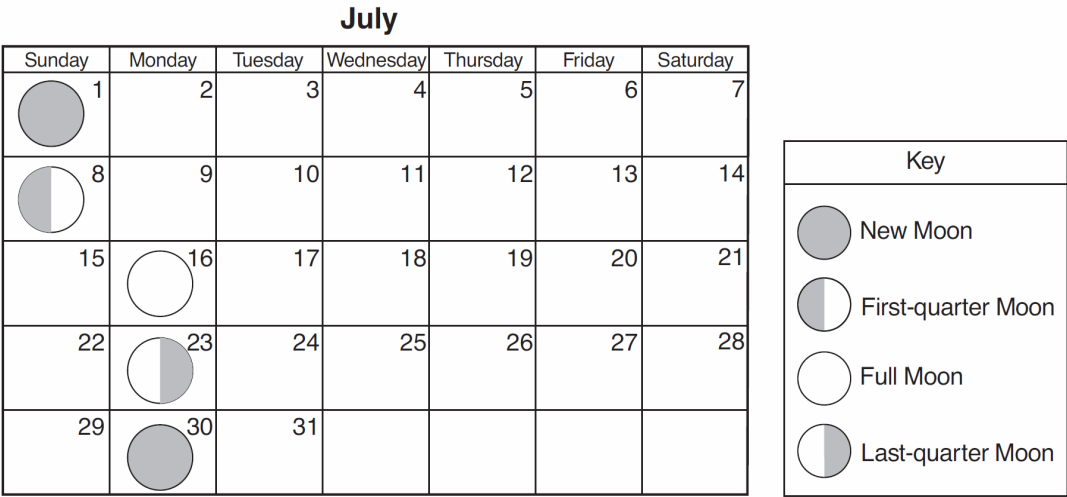


(Not drawn to scale)

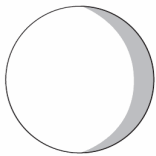
Which statement best explains why the same side of the Moon is viewed from Earth as the Moon goes through its phases?

- A) The Moon does not rotate as it revolves around Earth.
- B) The Moon's period of rotation equals Earth's period of rotation.
- C) The Moon's period of rotation equals Earth's period of revolution around the Sun.
- D) The Moon's period of rotation equals the Moon's period of revolution around Earth.

70. Base your answer to the following question on the calendar below, which shows the month of July of a recent year. The dates of major Moon phases, as seen in New York State, are shown.



The diagram below represents the phase of the Moon observed from New York State one night during the month of July.



- Eclipses do *not* occur every month because the Moon's
- A) rate of rotation is 15° each hour
  - B) orbit is inclined to Earth's orbit
  - C) period of revolution is 27.3 days
  - D) period of rotation and period of revolution are the same