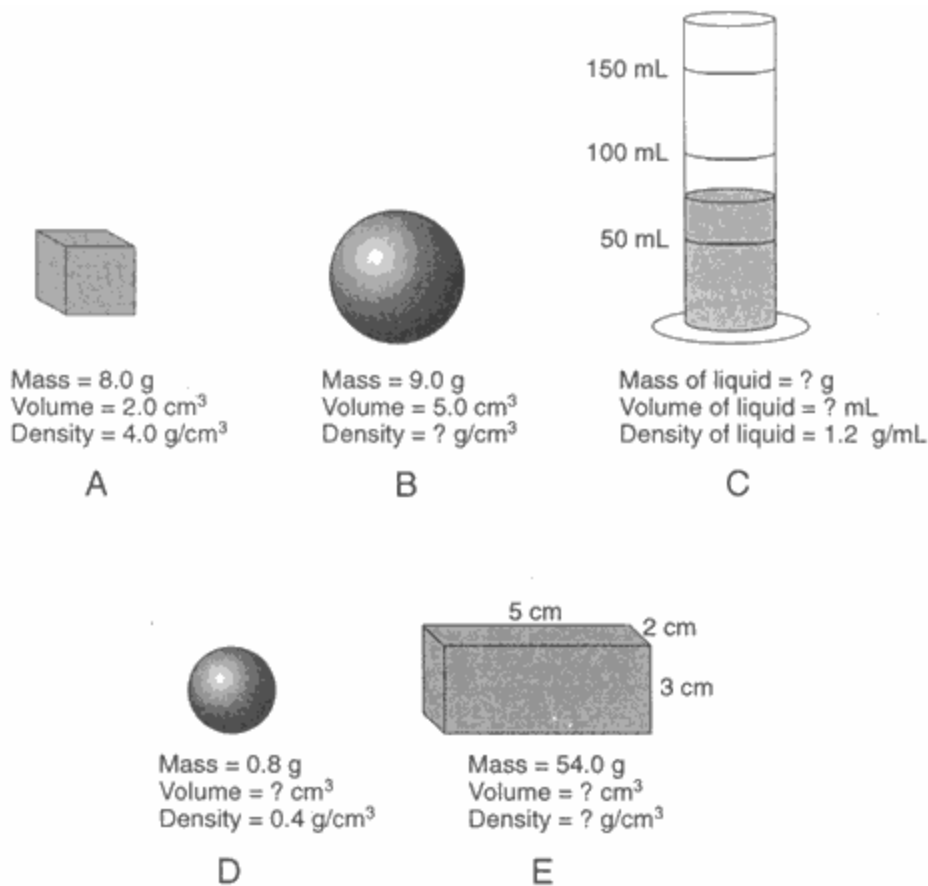

1. Which statement about a major hurricane is an inference?

- A) The windspeed is measured at 200 km/hr.
- B) The central air pressure is recorded at 946.0 mb.
- C) A rain gauge records three inches of rain in less than one hour.
- D) Damage from the storm is expected to be extensive.

2. Base your answer to the following question on "

the diagrams below, and your knowledge of Earth science. The diagrams represent five substances, *A* through *E*, at the same temperature. Some mass, volume, and density values are indicated for each substance. Substance *C* is a liquid in a graduated cylinder. [Note that 1 cubic centimeter = 1 milliliter. Objects are not drawn to scale.]



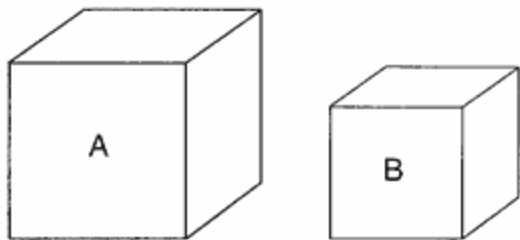
What is the volume of object *D*?

- A) 1.0 cm³
- B) 2.0 cm³
- C) 7.0 cm³
- D) 16.0 cm³

3. As air on the surface of Earth warms, the density of the air

- A) decreases
 - B) increases
 - C) remains the same
-

4. 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/cm³
 Volume of *A* = 64 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

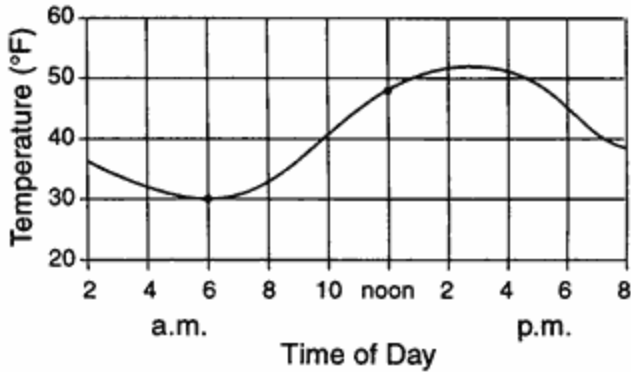
- A) less B) greater
 C) the same
5. Base your answer to the following question on the data table below, which lists some properties of four minerals that are used as ores of zinc (Zn).

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?

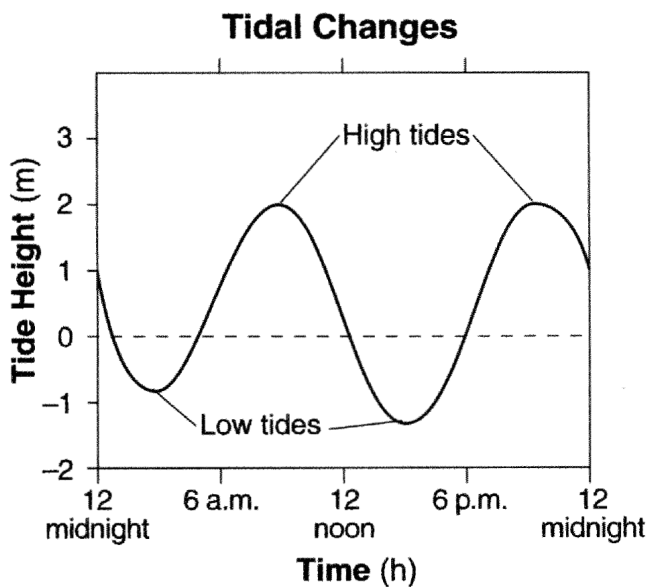
- A) 22.7 cm³ B) 31.4 cm³ C) 40.0 cm³ D) 44.0 cm³

6. The graph below shows temperature readings for a day in April.



The average rate of temperature change, in Fahrenheit degrees per hour, between 6 a.m. and noon was

- A) $6^\circ/\text{hr}$ B) $8^\circ/\text{hr}$
 C) $3^\circ/\text{hr}$ D) $18^\circ/\text{hr}$
7. The graph below shows the tidal changes in ocean water level, in meters, recorded at a coastal location on a certain day.



Approximately how many hours apart were the two high tides?

- A) 6 h B) 12 h C) 18 h D) 24 h

8. The Earth is slightly flattened from a perfect spherical shape because of

- A) its rotation
 B) the pull of the sun and moon
 C) storms on the sun's surface
 D) its molten core

9. The Earth's actual shape is most correctly described as

- A) a circle B) a perfect sphere
 C) an oblate sphere D) an eccentric ellipse

10. Which object best represents a true scale model of the shape of the Earth?

- A) a Ping-Pong ball B) a football
 C) an egg D) a pear

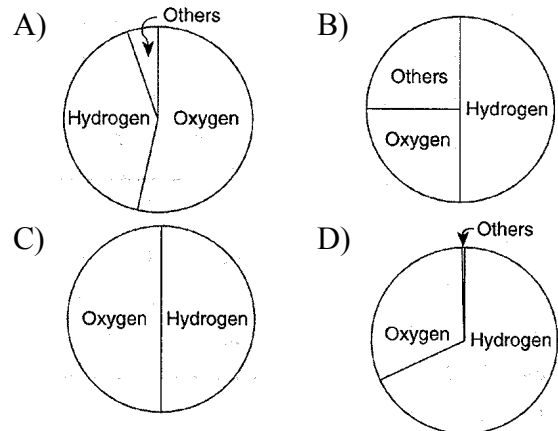
11. Which list contains three major greenhouse gases found in Earth's atmosphere?

- A) carbon dioxide, methane, and water vapor
 B) carbon dioxide, oxygen, and nitrogen
 C) hydrogen, oxygen, and methane
 D) hydrogen, water vapor, and nitrogen

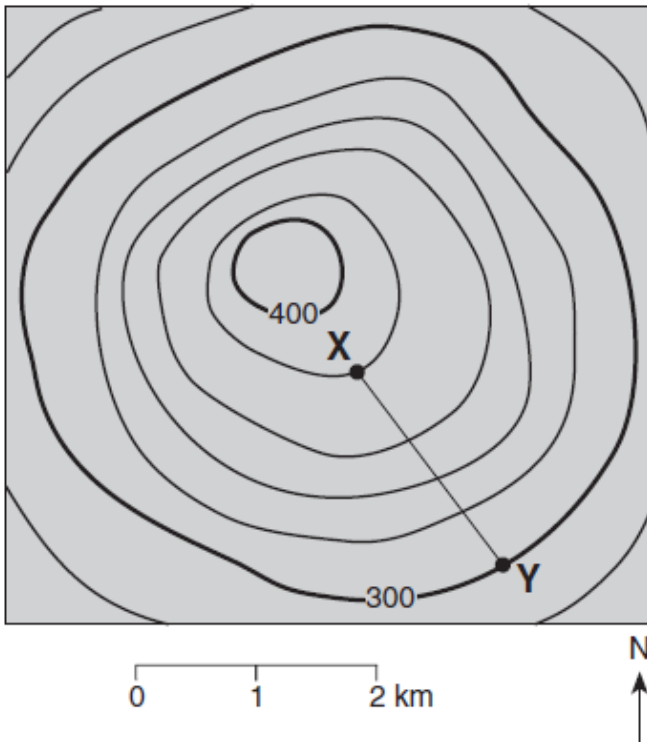
12. The ozone layer protects life on Earth by absorbing harmful ultraviolet radiation. The ozone layer is located between 17 kilometers and 35 kilometers above Earth's surface in which atmospheric temperature zone?

- A) troposphere B) stratosphere
 C) mesosphere D) thermosphere

13. Which graph best represents the percentage by volume of the elements making up the Earth's hydrosphere?



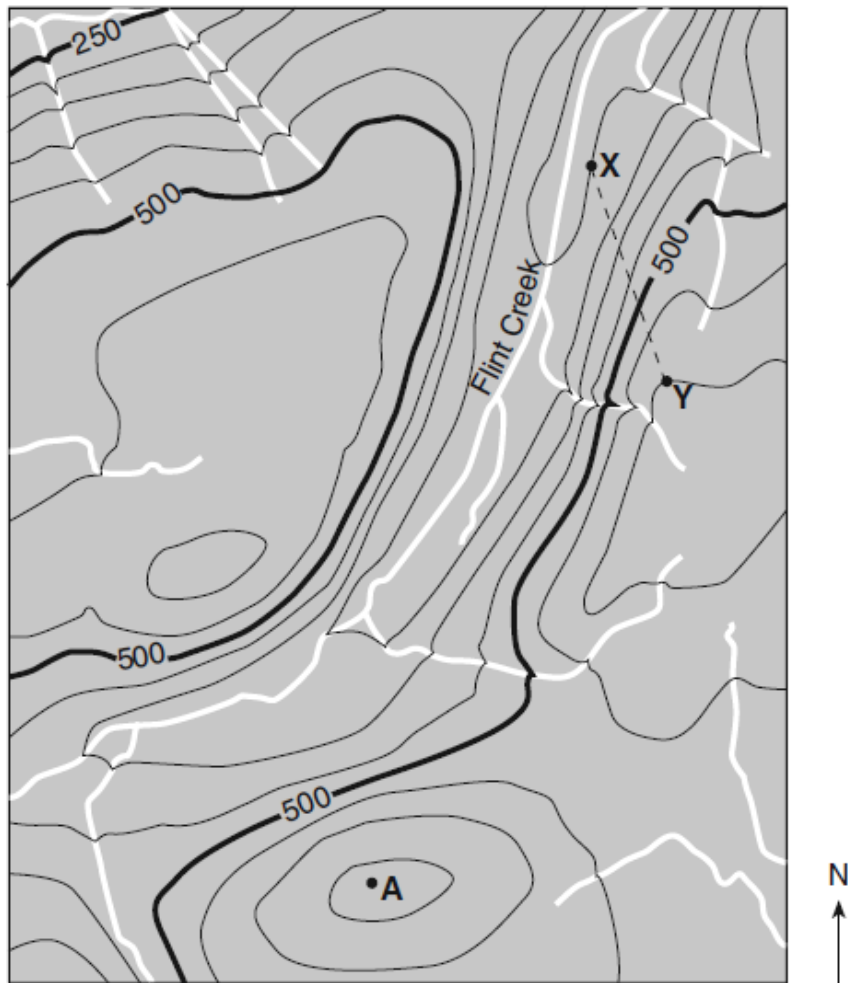
14. Which two elements make up the greatest percentages by mass in Earth's crust?
- A) oxygen and potassium
 - B) oxygen and silicon
 - C) aluminum and potassium
 - D) aluminum and silicon
15. On April 21, the altitude of *Polaris*, as viewed from a location in New York State, was measured as 41.3° . What will the altitude of *Polaris* be when viewed one month later, on May 21, from the same location?
- A) 23.5°
 - B) 41.3°
 - C) 66.7°
 - D) 90°
16. New York State's highest peak, Mt. Marcy, is located at approximately
- A) $44^\circ 10' \text{ N } 74^\circ 05' \text{ W}$
 - B) $44^\circ 05' \text{ N } 73^\circ 55' \text{ W}$
 - C) $73^\circ 55' \text{ N } 44^\circ 10' \text{ W}$
 - D) $74^\circ 05' \text{ N } 44^\circ 05' \text{ W}$
17. The topographic map below shows a hill. Points *X* and *Y* represent locations on the hill's surface. Elevations are shown in meters.



What is the gradient between points *X* and *Y*?

- A) 40 m/km
- B) 80 m/km
- C) 100 m/km
- D) 120 m/km

Base your answers to questions 18 and 19 on the topographic map below. Points *A*, *X*, and *Y* are reference points on the map.



Contour interval = 50 meters



18. What is the approximate gradient along the straight dashed line between points *X* and *Y*?

- A) 50 m/km B) 100 m/km C) 150 m/km D) 300 m/km

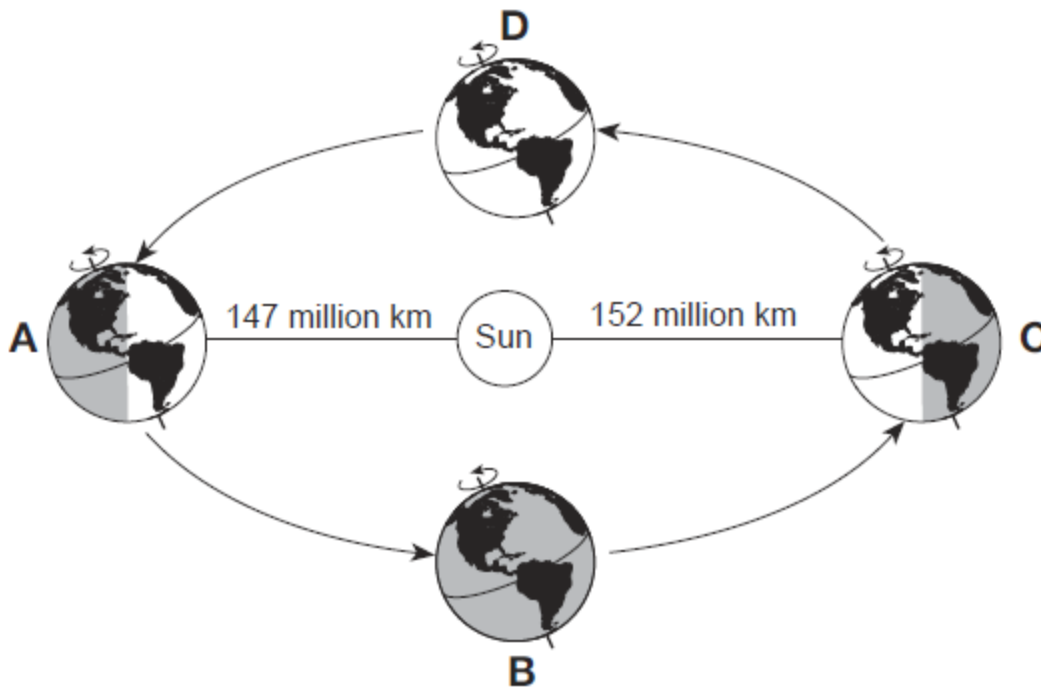
19. In which general direction does Flint Creek flow?

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

20. Earth's rate of revolution is approximately

- A) 1° per day B) 15° per day
C) 23.5° per day D) 360° per day

21. Base your answer to the following question 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*.

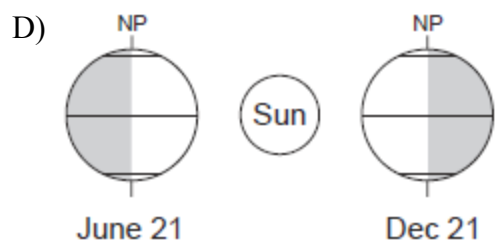
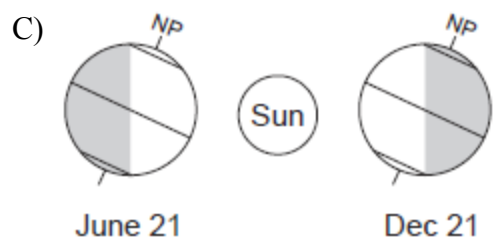
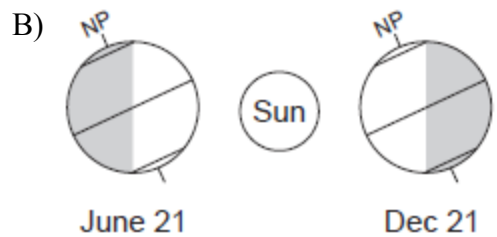
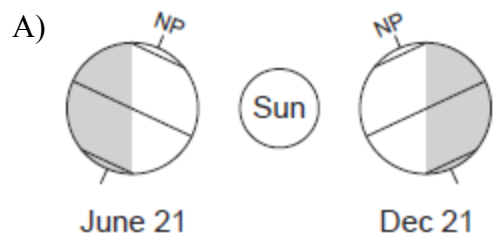


(Not drawn to scale)

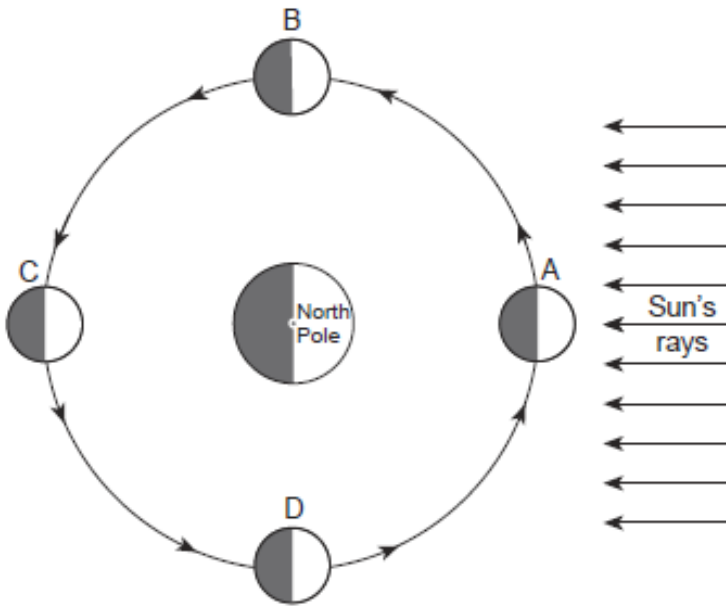
At all four positions, the northern end of Earth's axis points toward

- A) the Sun B) the Moon C) *Betelgeuse* D) *Polaris*

22. 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.]



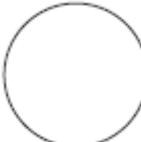


23. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the Moon at different positions, labeled *A*, *B*, *C*, and *D*, in its orbit around Earth.



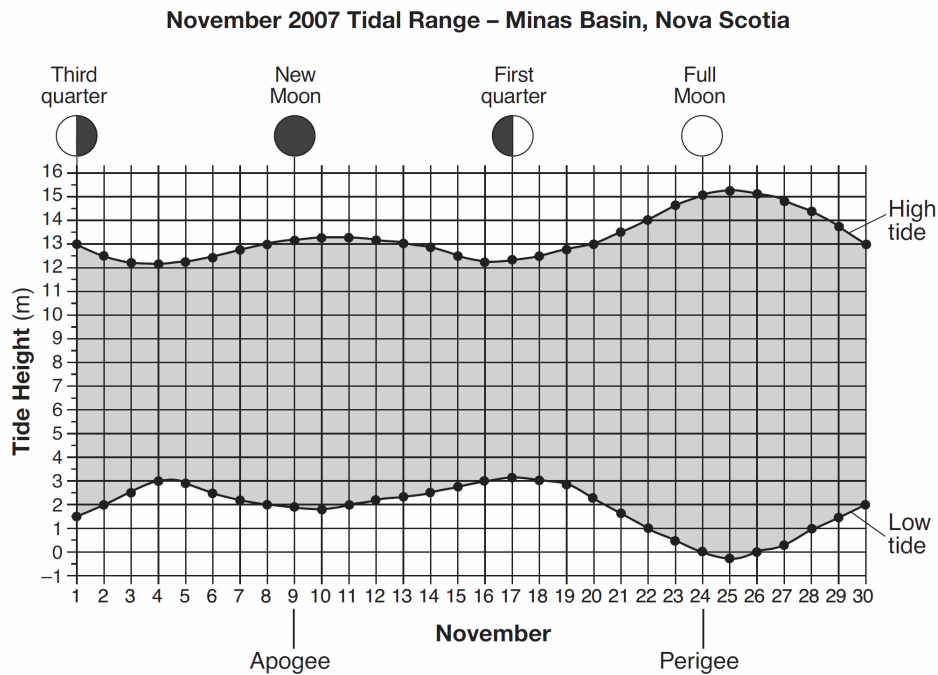
(Not drawn to scale)

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

- A)  B)  C)  D) 

24. Base your answer to the following question on the graph below and on your knowledge of Earth science.

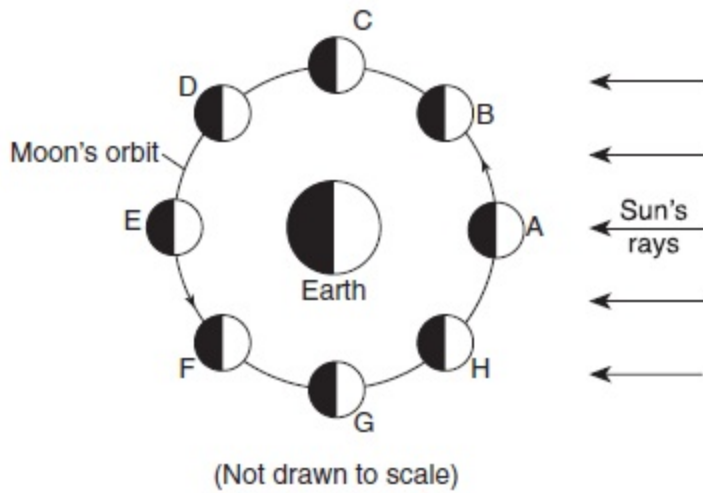
The graph shows the tidal range (the difference between the highest tide and the lowest tide) recorded in Minas Basin, Nova Scotia, during November 2007. The phase of the Moon on selected days is shown above the graph. The dates that the Moon was farthest from Earth (apogee) and closest to Earth (perigee) are indicated under the graph.



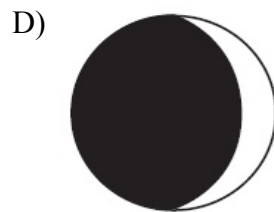
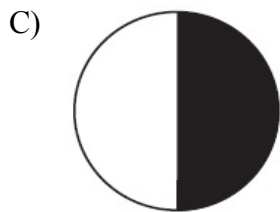
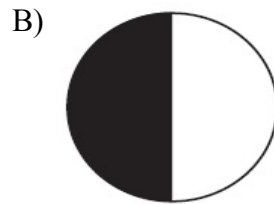
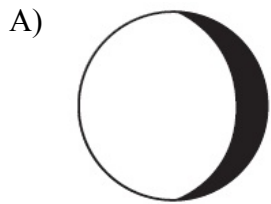
The tidal range on November 8 was approximately

- A) 11 m B) 2 m C) 13 m D) 15 m

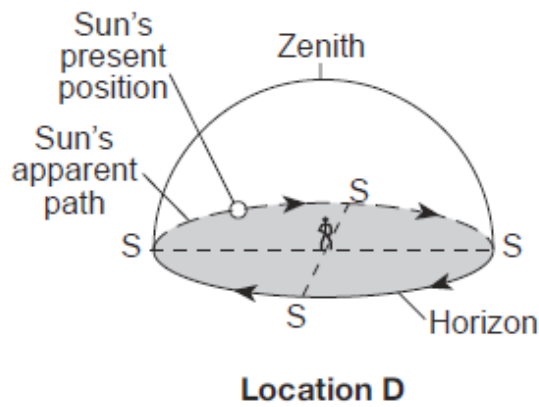
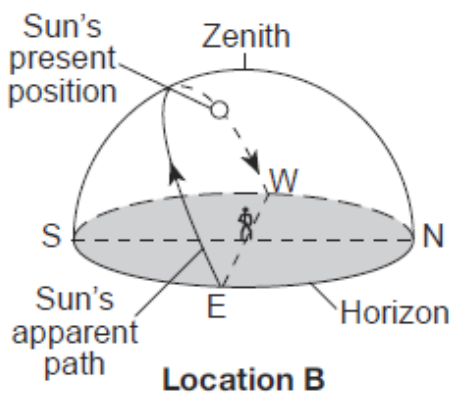
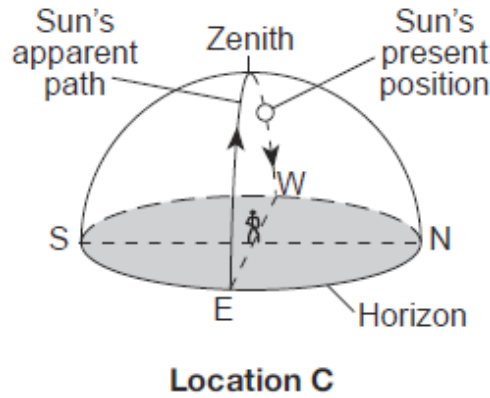
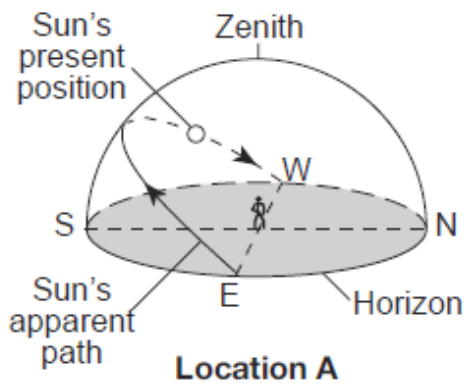
25. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the Moon in eight positions, *A* through *H*, in its orbit around Earth.



Which Moon phase is observed in New York State when the Moon is located at position *F*?



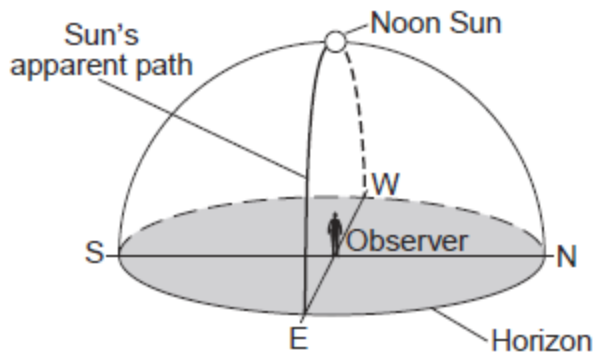
26. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents the apparent path of the Sun as observed at four locations, *A* through *D*, on Earth's surface on the same date. The present positions of the Sun represent the same time of day at each location. The zenith (the position directly overhead) is shown for an observer at each location. [Diagrams are not drawn to scale.]



Based on the Sun's apparent path, where is location *D*?

- A) equator
- B) Tropic of Cancer
- C) Tropic of Capricorn
- D) North Pole

27. The model below represents the apparent path of the Sun across the sky on March 21 as seen by an observer on Earth.

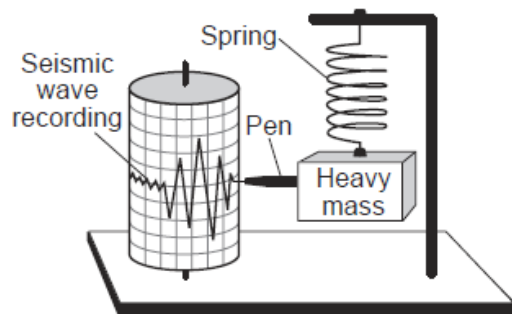


At which latitude is the observer located?

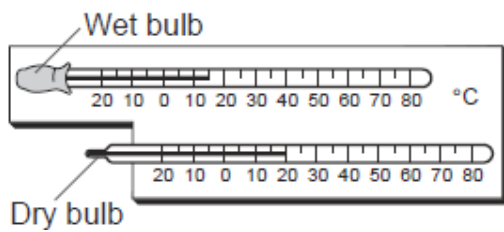
- A) 90° N
- B) 42° N
- C) 23.5° N
- D) 0°

28. Which device provides evidence that Earth rotates on its axis?

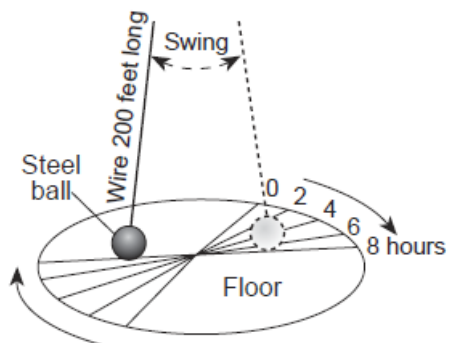
A)



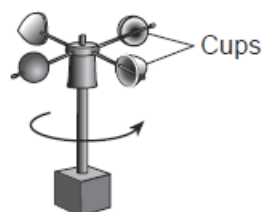
B)



C)



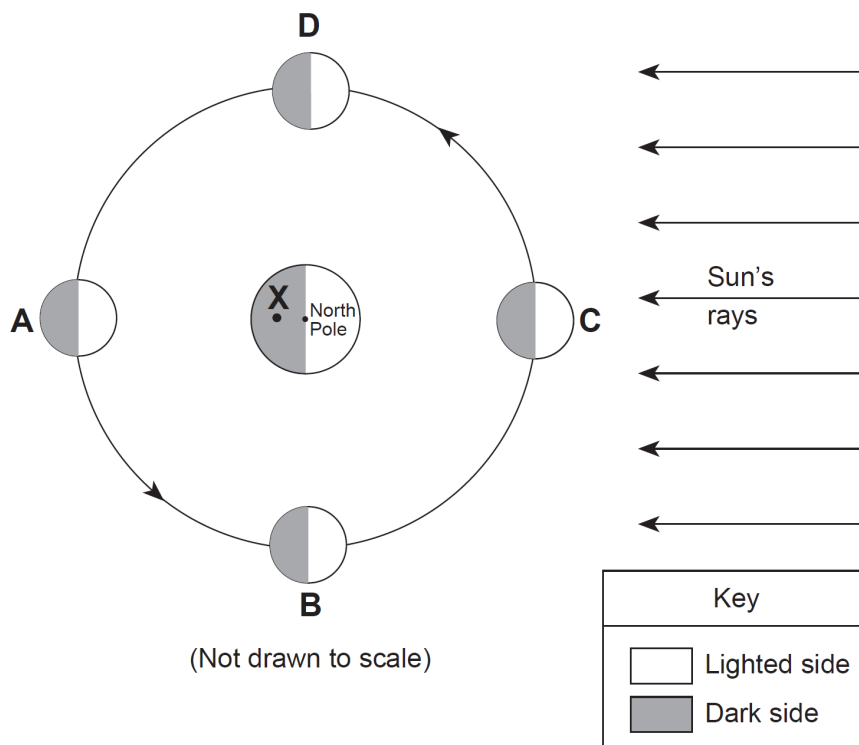
D)



29. What causes many surface winds to deflect to the right in the Northern Hemisphere?

- A) rotation of Earth on its axis
- B) unequal heating of Earth's surface
- C) gravitational force of the Moon
- D) gravitational force of the Sun

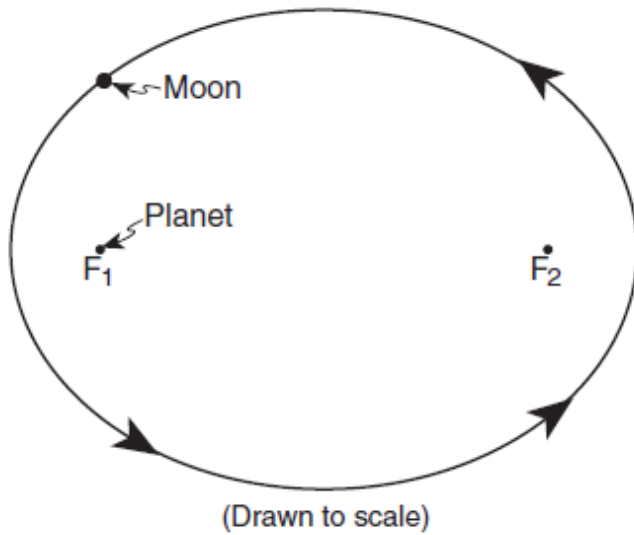
30. Base your answer to the following question on the diagram below, which shows Earth and the Moon in relation to the Sun. Positions *A*, *B*, *C*, and *D* show the Moon at specific locations in its orbit. Point *X* is a location on Earth's surface.



What is the time of day at point *X*?

- A) 6 a.m. B) noon C) 6 p.m. D) midnight

-
33. The diagram below represents the elliptical orbit of a moon revolving around a planet. The foci of this orbit are the points labeled F_1 and F_2 .



What is the approximate eccentricity of this elliptical orbit?

- A) 0.3 B) 0.5 C) 0.7 D) 1.4
34. 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
-

35. Base your answer to the following question on the passage below and on your knowledge of Earth science.

Comets and Asteroids

Since comets and asteroids orbit the Sun, both are part of our solar system. Asteroids are rocky objects that vary greatly in size. Most asteroids follow orbits between 3000 and 600 million kilometers from the Sun, but several have been pulled from this region by the gravitational attraction of nearby planets. Many of these dislodged asteroids have struck both Earth and the Moon, causing the large impact craters that are visible on the surface of both bodies.

Comets have often been described as "dirty snowballs" and occupy highly eccentric orbits, traveling from near the Sun to far beyond the orbits of the outer planets. As they move through space, comets leave a debris trail of mostly dust-sized particles. When Earth passes through this debris, a meteor shower occurs, often filling the night sky with "shooting star" trails as they burn up in the atmosphere 50 to 80 kilometers above Earth's surface.

Between which two planets are most asteroids located?

- A) Earth and Mars
B) Mars and Jupiter
C) Jupiter and Saturn
D) Saturn and Uranus

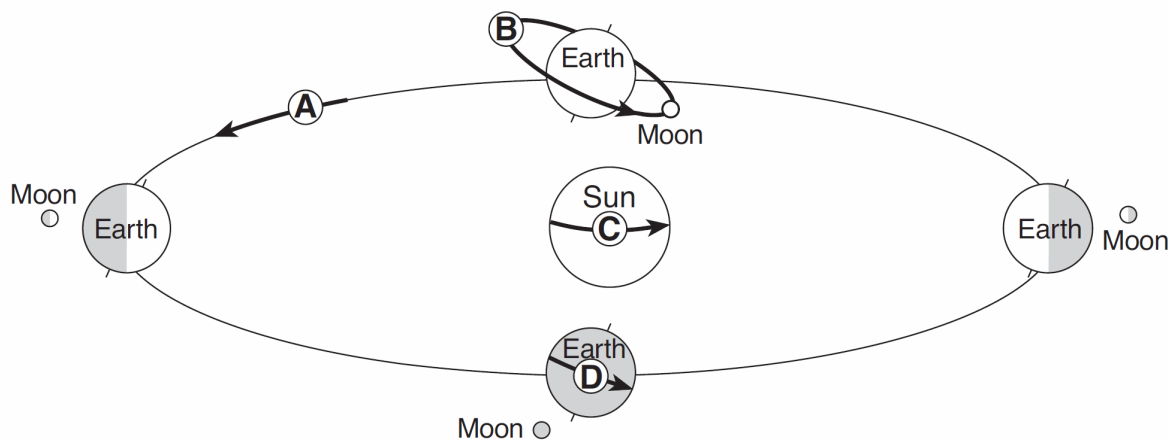
36. Scientists infer that most of Earth's earliest atmosphere was produced by

- A) a collision with a giant gas cloud
B) capturing gases from a nearby planet
C) vaporizing comets that impacted Earth's surface
D) the escape of gases from Earth's molten surface

38. Which evidence best supports scientists' inferences about the origin and age of the universe?

- A) the existence of planets
B) cosmic background radiation
C) formation of star constellations
D) similar composition of Earth and the Moon

37. 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 arrow represents a rate of movement of approximately 1° per day?

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

39. The red shift of light from most galaxies is evidence that

- A) most galaxies are moving away from Earth
- B) a majority of stars in most galaxies are red giants
- C) the light slows down as it nears Earth
- D) red light travels faster than other colors of light

40. The Sun is inferred to spend the greatest amount of time in its life cycle

- A) contracting from a gas cloud (nebula)
- B) as a main sequence star
- C) moving away from the main sequence and becoming a giant star
- D) changing from a giant star to a white dwarf star

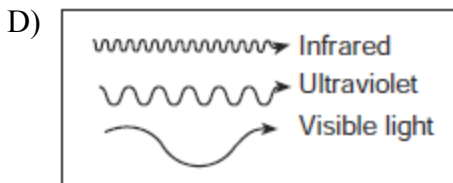
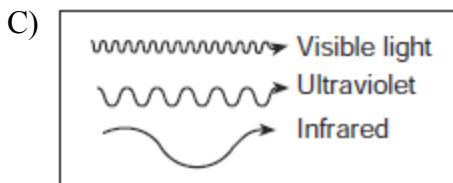
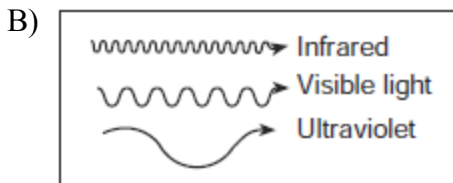
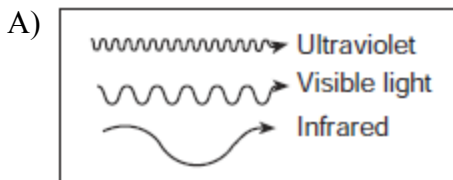
41. Which star is cooler and less luminous than the Sun?

- A) *Proxima Centauri*
- B) *Pollux*
- C) *Rigel*
- D) *40 Eridani B*

42. Which process combines lighter elements into heavier elements and produces energy within the Sun and other stars?

- A) fusion
- B) insolation
- C) conduction
- D) radioactive decay

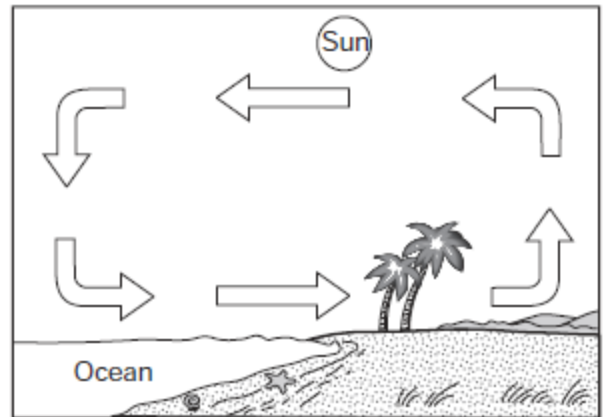
43. Which diagram best represents the relative wave-lengths of visible light, ultraviolet energy, and infrared energy?



44. Which process releases 334 Joules (J) of energy for each gram of water?

- A) melting
- B) freezing
- C) vaporization
- D) condensation

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



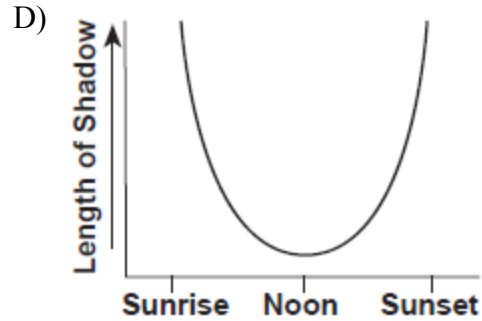
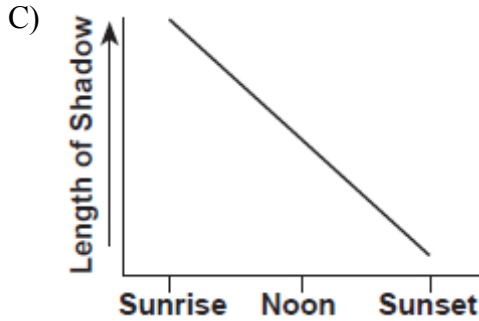
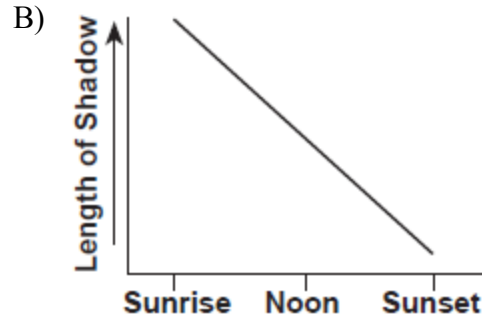
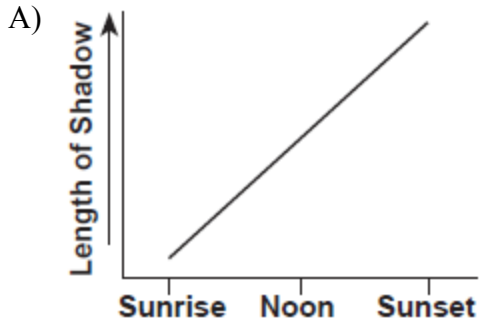
Which process primarily transfers heat by moving air?

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

46. Most of the electromagnetic energy radiated from Earth's surface is in the form of

- A) ultraviolet rays
- B) infrared rays
- C) gamma rays
- D) x rays

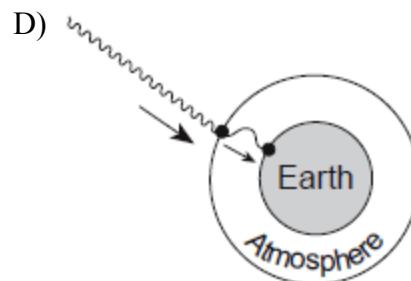
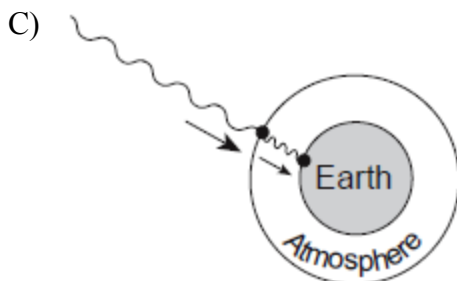
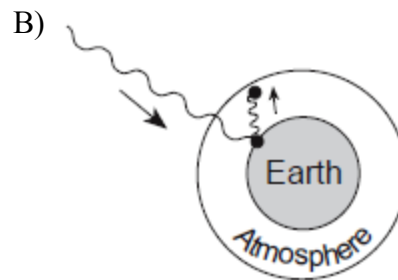
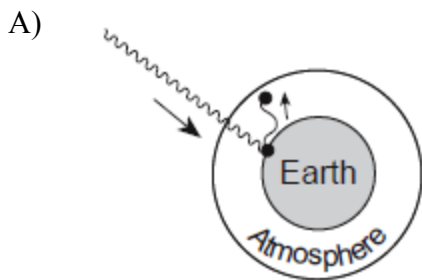
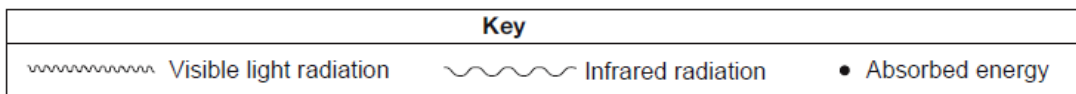
47. Which graph best shows the length of a shadow cast from sunrise to sunset by a flagpole in New York State?



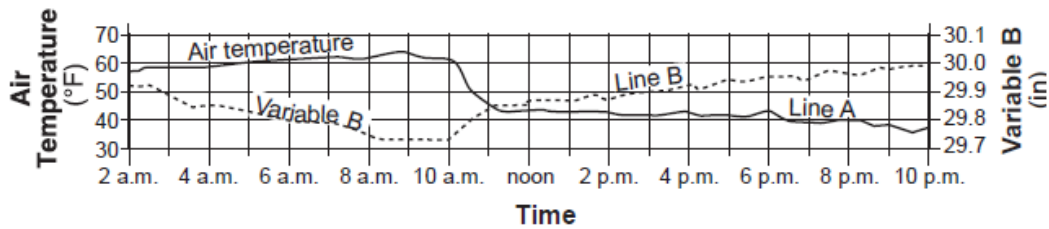
48. On June 21, some Earth locations have 24 hours of daylight. These locations are all between the latitudes of

- A) 0° and $23\frac{1}{2}^\circ$ N B) $23\frac{1}{2}^\circ$ N and 47° N
 C) 47° N and $66\frac{1}{2}^\circ$ N D) $66\frac{1}{2}^\circ$ N and 90° N

49. Which diagram best represents how greenhouse gases in our atmosphere trap heat energy?

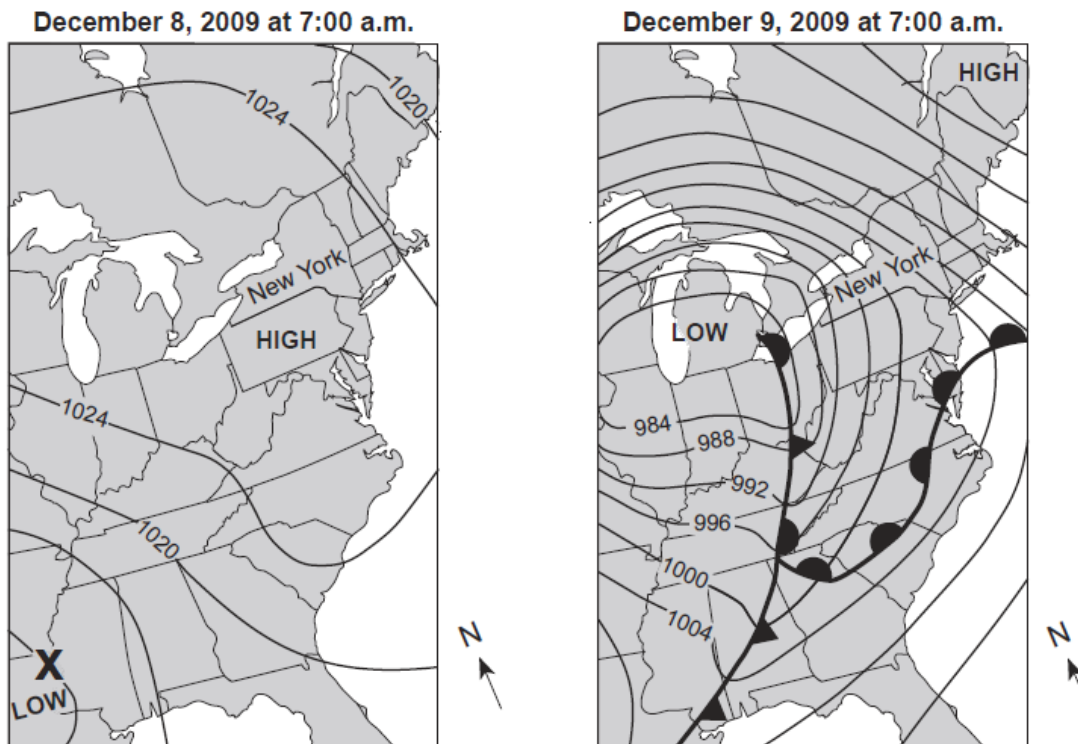


50. Data from two weather instruments have been recorded on the graph below. Line *A* on the graph represents air-temperature data. Line *B* was plotted using the scale for variable *B*.



Line *B* on the graph represents data from which weather instrument?

- A) thermometer B) barometer C) psychrometer D) anemometer
51. Base your answer to the following question on the weather maps below and on your knowledge of Earth science. The weather maps show the eastern United States on two consecutive days. Some isobars are labeled in millibars (mb). Letter *X* represents a location on Earth's surface on December 8, 2009.



Which information shown on the weather maps best indicates that wind speeds in New York State were greater on December 9 than on December 8?

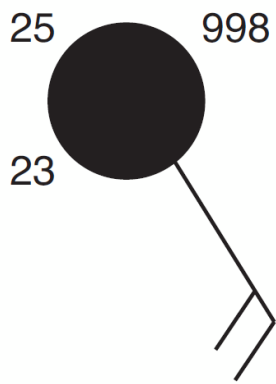
- A) The isobars were closer together on December 9.
 B) The fronts were closer together on December 9.
 C) The air pressure over New York State was lower on December 9.
 D) The air pressure over New York State was higher on December 9.

52. The weather station model shown below indicated that winds are coming from the





- A) southeast at 10 knots
- B) northwest at 10 knots
- C) southeast at 20 knots
- D) northwest at 20 knots

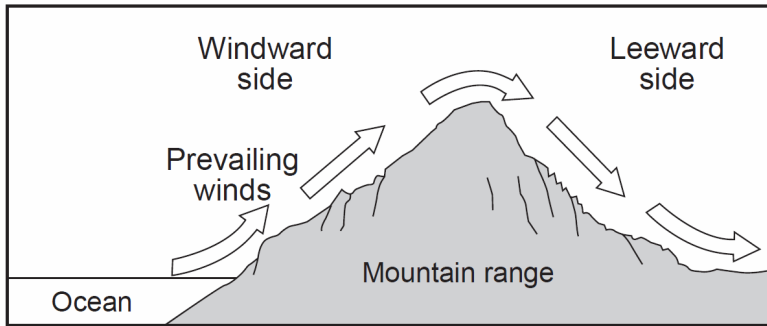
53. A weather station model is shown below.



Which information shown on the station model is most closely associated with measurements from an anemometer?

- A) 25
- B) 998
- C) 
- D) 

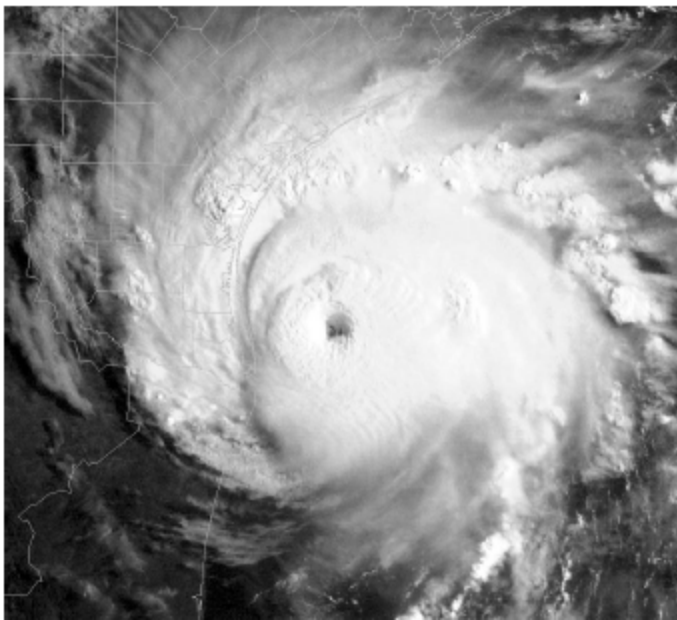
54. The cross section below represents a prevailing wind flow that causes different climates on the windward and leeward sides of a mountain range.



Compared to the temperature and moisture of the air rising on the windward side, the temperature and moisture of the air descending at the same altitude on the leeward side will be

- A) warmer and drier
- B) warmer and more moist
- C) cooler and drier
- D) cooler and more moist

Base your answers to questions 55 and 56 on " the satellite image below, which shows a Northern Hemisphere hurricane.



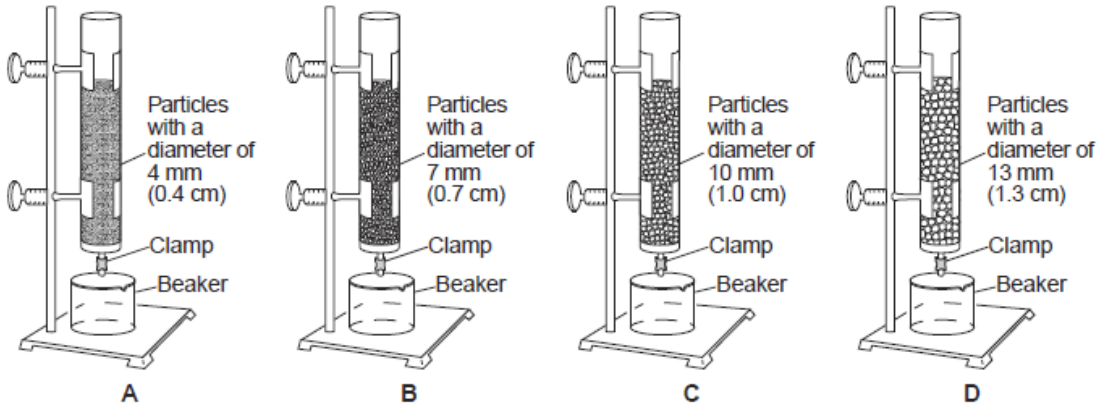
55. Clouds form in the hurricane because the air is

- A) sinking, expanding, and cooling
- B) sinking, compressing, and warming
- C) rising, expanding, and cooling
- D) rising, compressing, and warming

56. What is the usual surface wind pattern around the eye of Northern Hemisphere hurricanes?

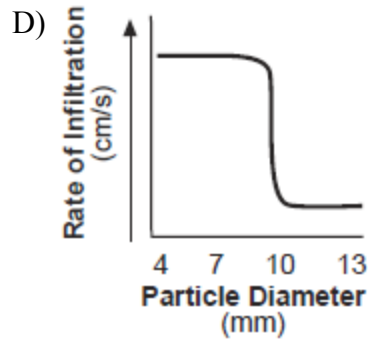
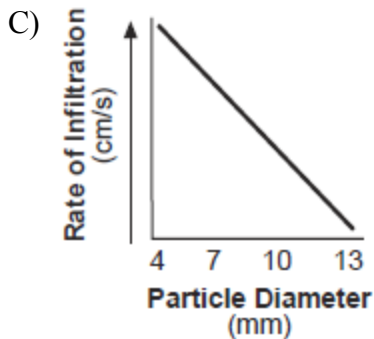
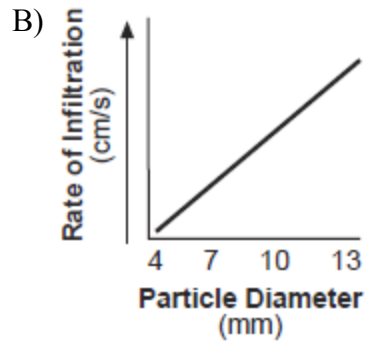
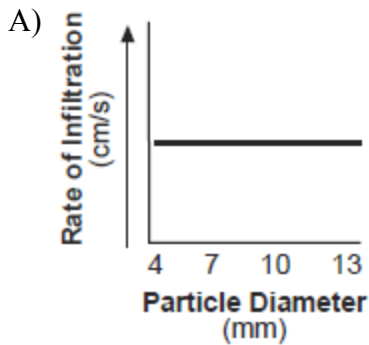
- A) clockwise and outward
- B) clockwise and inward
- C) counterclockwise and outward
- D) counterclockwise and inward

57. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents setups of laboratory equipment, labeled *A*, *B*, *C*, and *D*. This equipment was used to test the infiltration rate and water retention of four different particle sizes. Each column was filled to the same level with uniform-sized dry, spherical particles. Water was poured into each column until the water level rose to the top of the particles. Then, the clamp was opened to allow the water to drain into the beaker beneath each column.

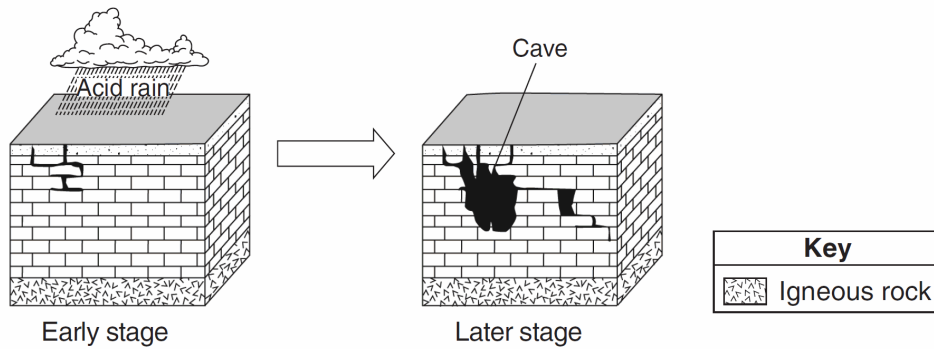


(Not drawn to scale)

Which graph best shows the rate of infiltration of water through the particles in these four columns?



58. The two block diagrams below represent the formation of caves.



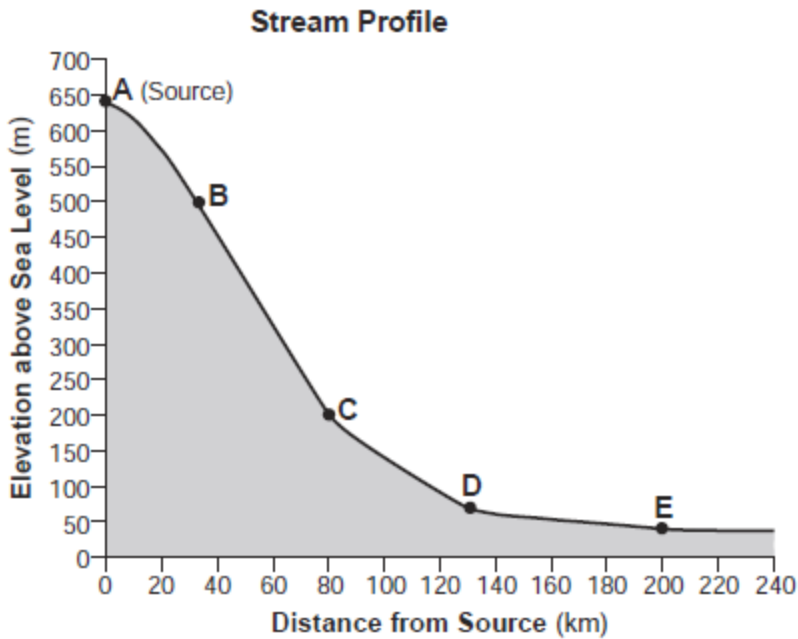
Which types of weathering and erosion are primarily responsible for the formation of caves?

- A) chemical weathering and groundwater flow
- B) chemical weathering and runoff
- C) physical weathering and groundwater flow
- D) physical weathering and runoff

59. Which factor has the most influence on the development of soil?

- A) climate
 - B) longitude
 - C) amount of rounded sediment
 - D) slope of the landscape
-

60. Base your answer to the following question on the cross section and data table below and on your knowledge of Earth science. The cross section shows the profile of a stream that is flowing down a valley from its source. Points *A* through *E* represent locations in the stream. The data table shows the average stream velocity at each location. The volume of water in the stream remains the same at all locations.



Location in Stream	Average Stream Velocity (cm/s)
A	10
B	110
C	130
D	20
E	15

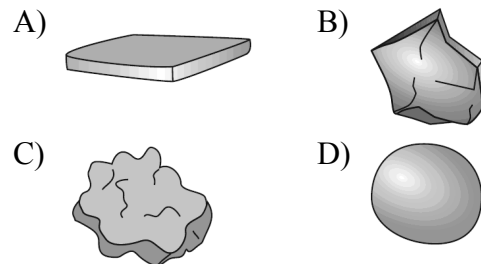
What is the largest type of sediment that could be transported at location *B*?

- A) silt B) sand C) pebbles D) cobbles

61. Which agent of erosion is most likely responsible for the deposition of sandbars along ocean shorelines?

- A) glaciers B) mass movement
C) wave action D) wind action

62. Each of the rock particles below has the same density and volume. Which particle will most likely settle at the fastest rate in moving water?



63. Which rock would be the best source of the mineral garnet?

- A) basalt
- B) limestone
- C) schist
- D) slate

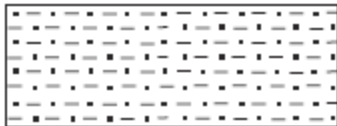
64. Which characteristic do samples of the mineral pyroxene normally exhibit?

- A) yellow to amber color
- B) bubbling in hydrochloric acid
- C) cleaves at 56° and 124°
- D) hardness of 5 to 6

65. What are the rock name and map symbol used to represent the sedimentary rock that has a grain size of 0.006 to 0.2 centimeters?

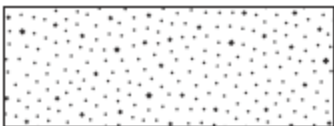
A) Rock name: Siltstone

Map symbol:



B) Rock name: Siltstone

Map symbol:



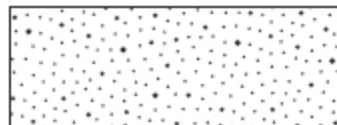
C) Rock name: Sandstone

Map symbol:

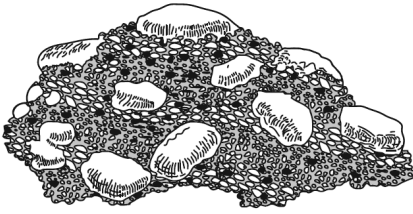


D) Rock name: Sandstone

Map symbol:

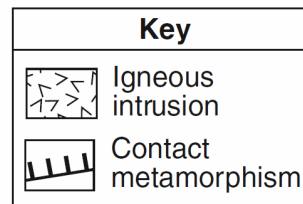
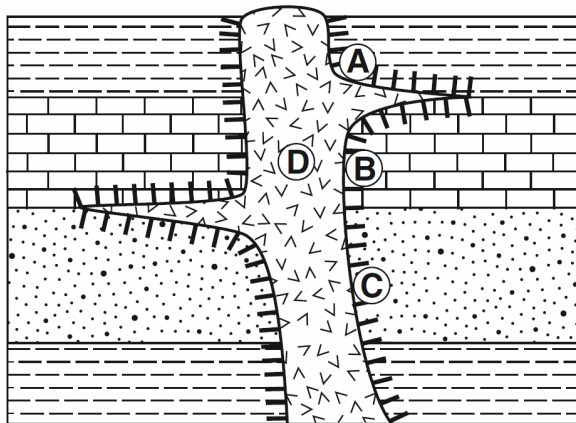


66. Base your answer to the following question on the diagram below, which represents a rock composed of cemented pebbles and sand.



This rock should be classified as

- A) an intrusive igneous rock
B) an extrusive igneous rock
C) a bioclastic sedimentary rock
D) a clastic sedimentary rock
67. The cross section below represents a portion of Earth's crust. Letters *A* through *D* are locations within the rock units.



At which location is quartzite most likely found?

- A) *A* B) *B* C) *C* D) *D*
-
68. Which statement about the formation of a rock is best supported by the rock cycle?
- A) Magma must be weathered before it can change to metamorphic rock.
B) Sediment must be compacted and cemented before it can change to sedimentary rock.
C) Sedimentary rock must melt before it can change to metamorphic rock.
D) Metamorphic rock must melt before it can change to sedimentary rock.