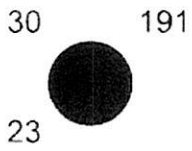


Name _____

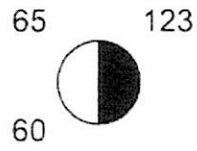
Period _____

- 1) A major piece of evidence supporting the Big Bang theory is the observation that wavelengths of light from stars in distant galaxies show a
- (1) redshift, appearing to be shorter
 - (2) redshift, appearing to be longer
 - (3) blueshift, appearing to be shorter
 - (4) blueshift, appearing to be longer
- 2) During the month of January, at which location in New York State is the Sun lowest in the sky at solar noon?
- (1) Massena
 - (2) Niagara Falls
 - (3) Utica
 - (4) New York City
- 3) Which process releases 2260 joules of heat energy per gram of water into the environment?
- (1) melting
 - (2) freezing
 - (3) condensation
 - (4) evaporation
- 4) Which characteristics best describe the star *Betelgeuse*?
- (1) reddish orange with low luminosity and high surface temperature
 - (2) reddish orange with high luminosity and low surface temperature
 - (3) blue white with low luminosity and low surface temperature
 - (4) blue white with high luminosity and high surface temperature
- 5) Since Denver's longitude is 105° W and Utica's longitude is 75° W, sunrise in Denver occurs
- (1) 2 hours earlier
 - (2) 2 hours later
 - (3) 3 hours earlier
 - (4) 3 hours later

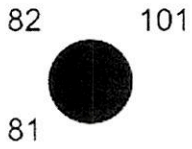
6) Which station model represents a location that has the greatest chance of precipitation?



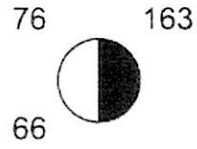
(1)



(3)

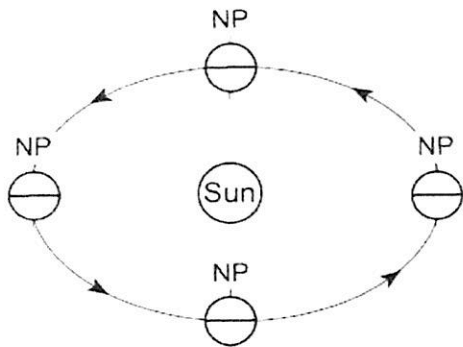


(2)

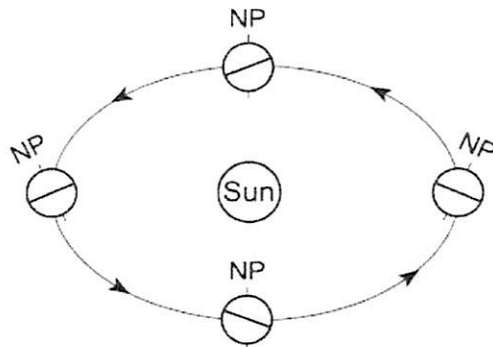


(4)

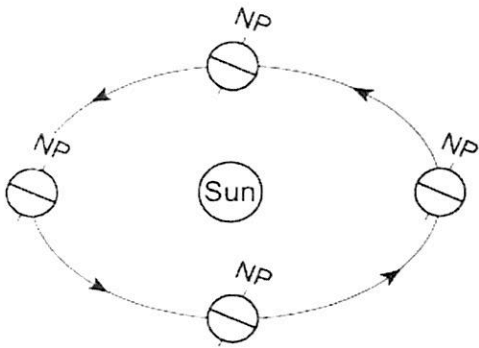
7) Which diagram best represents the correct orientation of the North Pole [NP] as Earth revolves around the Sun? [Diagrams are not drawn to scale.]



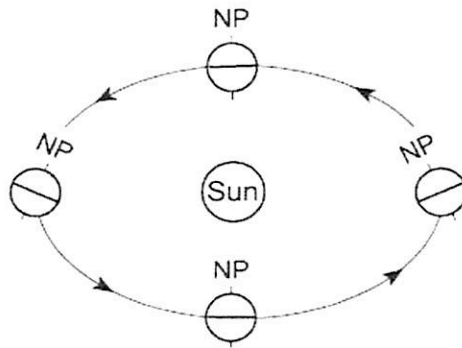
(1)



(3)

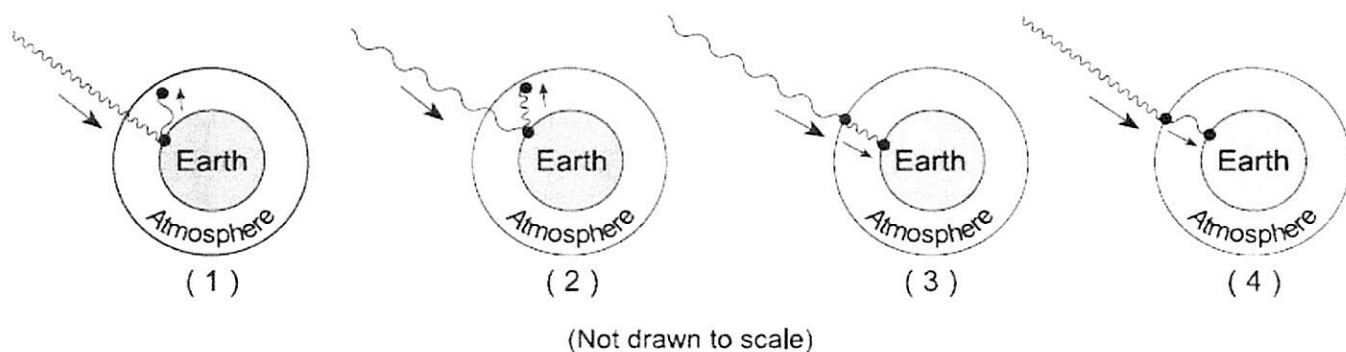
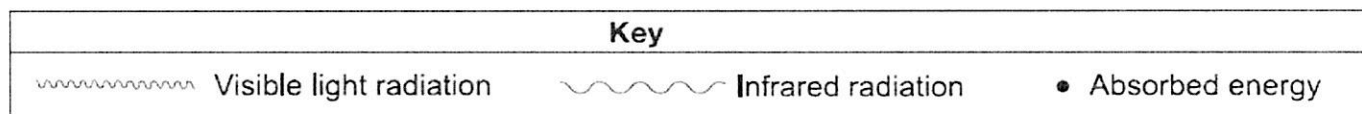


(2)



(4)

8) Which diagram best represents how greenhouse gases in our atmosphere trap heat energy?

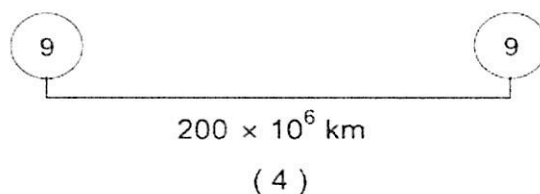
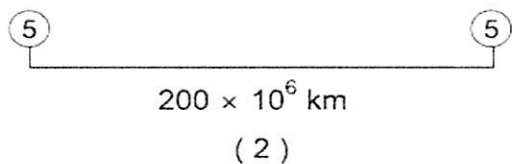
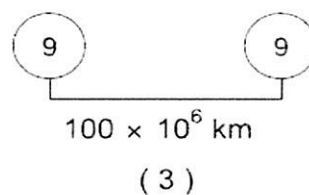
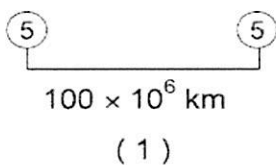


9) The symbols below represent two planets.

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

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

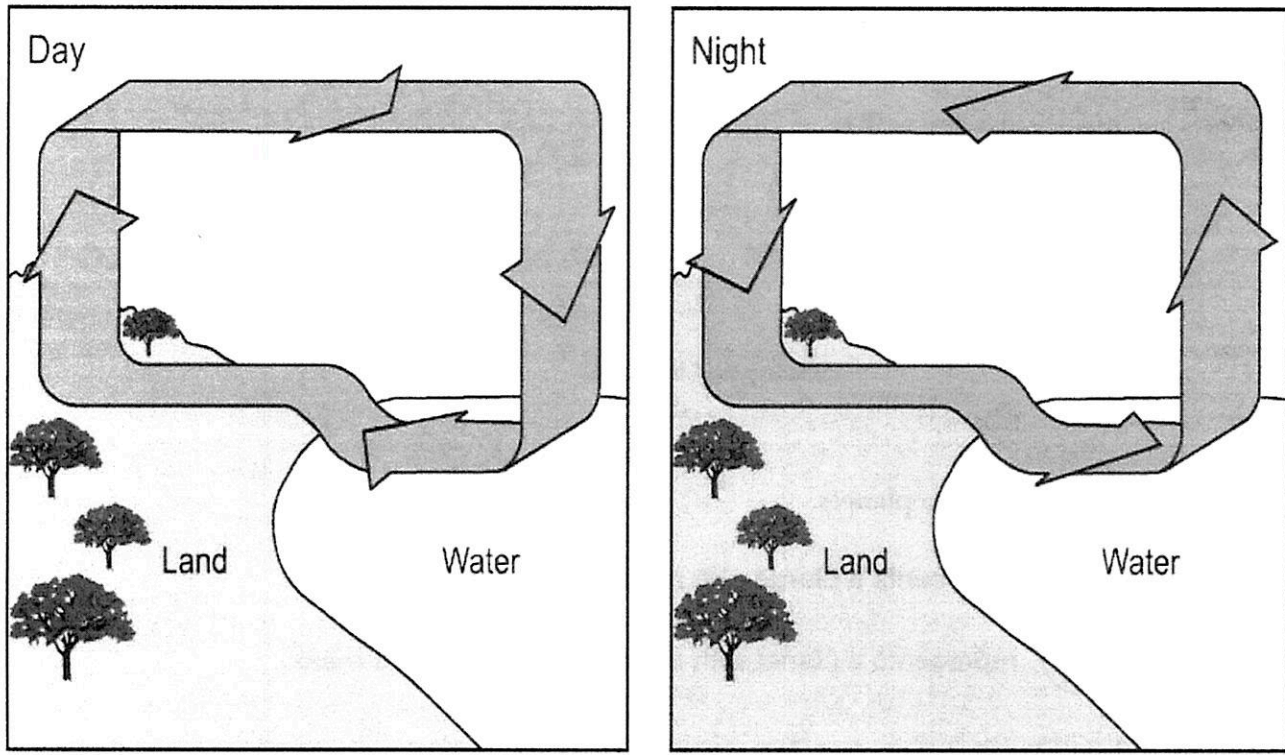
Which combination of planet masses and distances produces the greatest gravitational force between the planets?



10) Earth, the Sun, and billions of stars are contained within

- (1) a single constellation
- (2) the Milky Way galaxy
- (3) the solar system
- (4) a giant cloud of gas

i) The diagram below represents the circulation of air above Earth's surface at a coastal location during the day and at night.



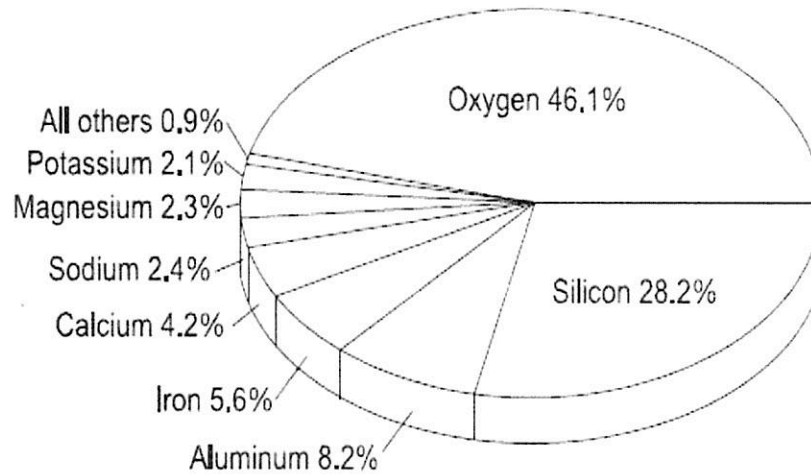
This local air movement is best described as an example of

- (1) conduction between Earth's surface and the atmosphere above it
- (2) condensation of water vapor during the day, and evaporation of water during the night
- (3) convection resulting from temperature and pressure differences above land and water
- (4) greater radiation from the warmer ocean during the day and from the warmer land at night

i2) A student using a sling psychrometer measured a wet-bulb temperature of 10°C and a dry-bulb temperature of 16°C . What was the dewpoint?

- (1) -10°C
- (2) 45°C
- (3) 6°C
- (4) 4°C

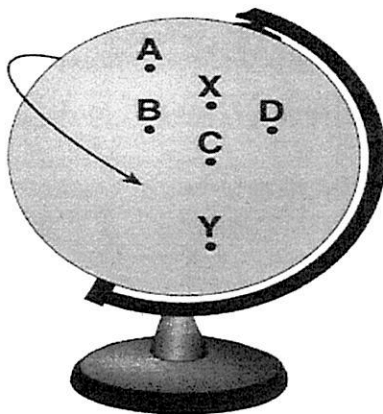
- 13) The pie graph below represents the composition, in percent by mass, of the chemical elements found in an Earth layer.



The composition of which Earth layer is represented by the pie graph?

- (1) crust (3) troposphere
(2) outer core (4) hydrosphere

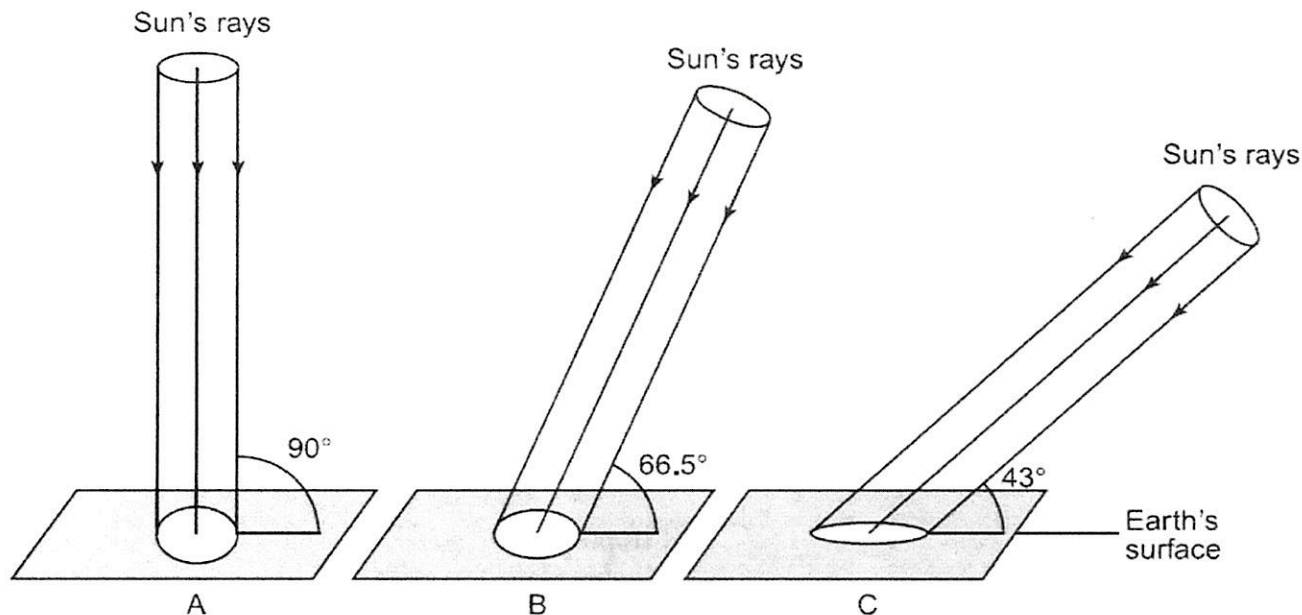
- 14) The diagram below represents a globe that is spinning to represent Earth rotating. The globe is spinning in the direction indicated by the arrow. Points A, B, C, D, X, and Y are locations on the globe.



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

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

Base your answers to questions 15 through 17 on the diagrams below and on your knowledge of Earth science. The diagrams, labeled A, B, and C, represent equal-sized portions of the Sun's rays striking Earth's surface at 23.5° N latitude at noon at three different times of the year. The angle at which the Sun's rays hit Earth's surface and the relative areas of Earth's surface receiving the rays at the three different angles of insolation are shown.



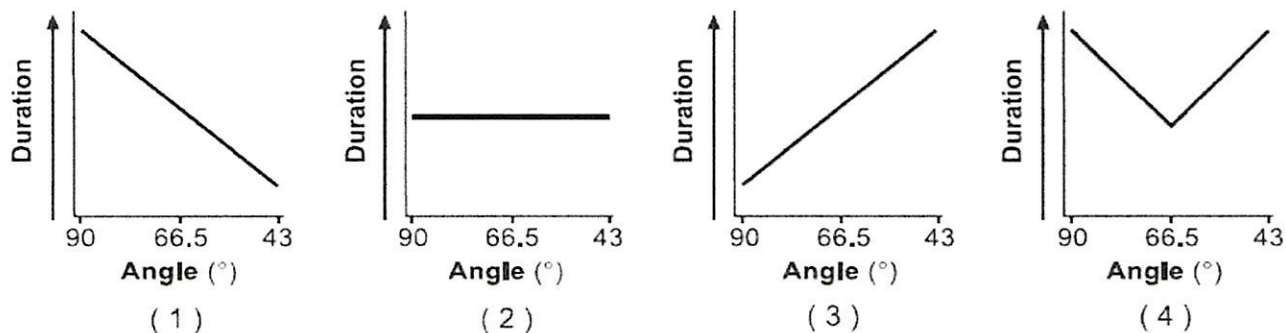
15) As viewed in sequence from A to B to C, these diagrams represent which months and which change in the intensity of insolation?

- (1) December → March → June; and decreasing intensity
- (2) December → March → June; and increasing intensity
- (3) June → September → December; and decreasing intensity
- (4) June → September → December; and increasing intensity

16) As the angle of the Sun's rays striking Earth's surface at noon changes from 90° to 43°, the length of a shadow cast by an object will

- (1) decrease
- (2) increase
- (3) decrease, then increase
- (4) increase, then decrease

17) Which graph best shows the duration of insolation at this location as the angle of insolation changes?



- 22) Most of the hurricanes that affect the east coast of the United States originally form over the
- (1) warm waters of the Atlantic Ocean in summer
 - (2) warm land of the southeastern United States in summer
 - (3) cool waters of the Atlantic Ocean in spring
 - (4) cool land of the southeastern United States in spring

- 23) Which object in space emits light because it releases energy produced by nuclear fusion?
- (1) Earth's Moon
 - (2) Halley's comet
 - (3) Venus
 - (4) *Polaris*

- 24) Which weather map symbol is associated with extremely low air pressure?



(1)



(2)



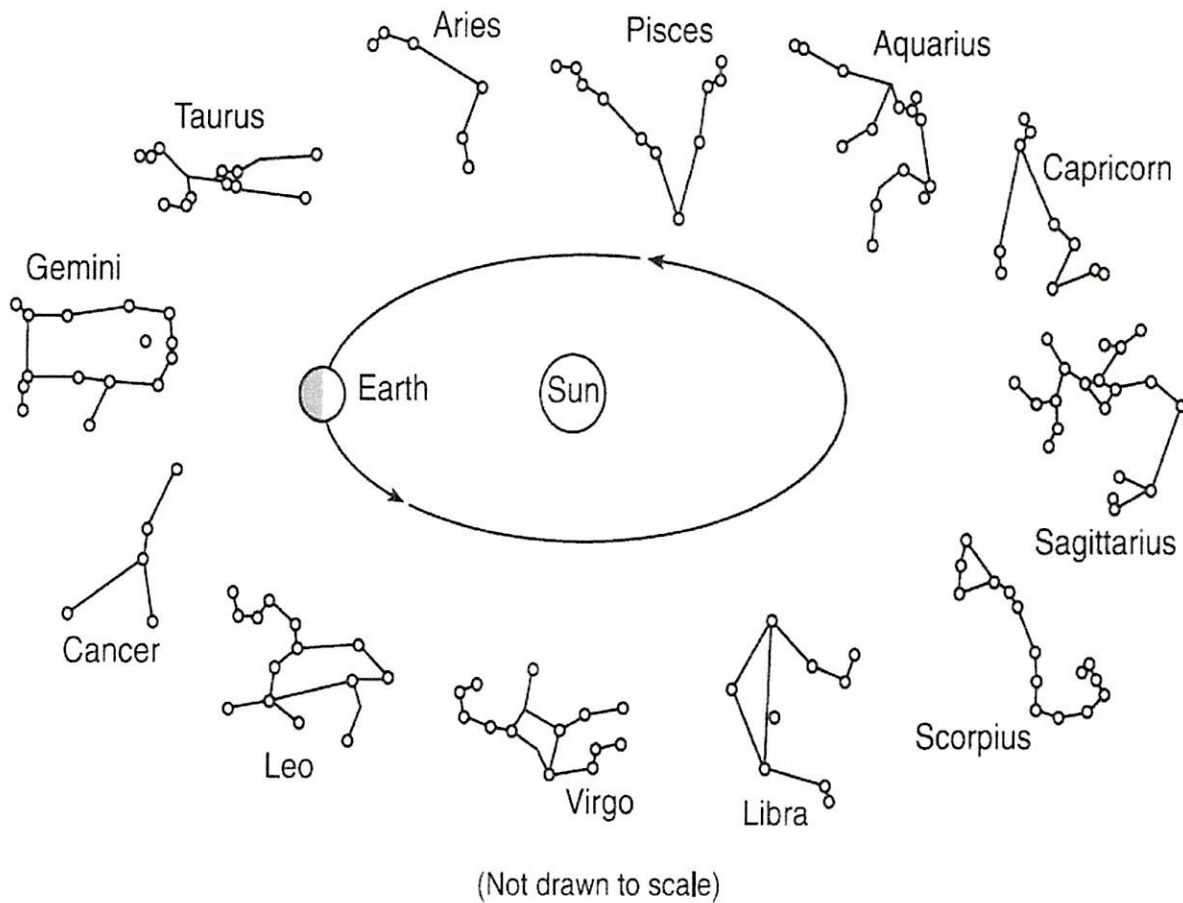
(3)



(4)

- 25) Compared to a light-colored rock with a smooth surface, a dark-colored rock with a rough surface will
- (1) both absorb and reflect less insolation
 - (2) both absorb and reflect more insolation
 - (3) absorb less insolation and reflect more insolation
 - (4) absorb more insolation and reflect less insolation

- 28) The diagram below represents some constellations and one position of Earth in its orbit around the Sun. These constellations are visible to an observer on Earth at different times of the year.



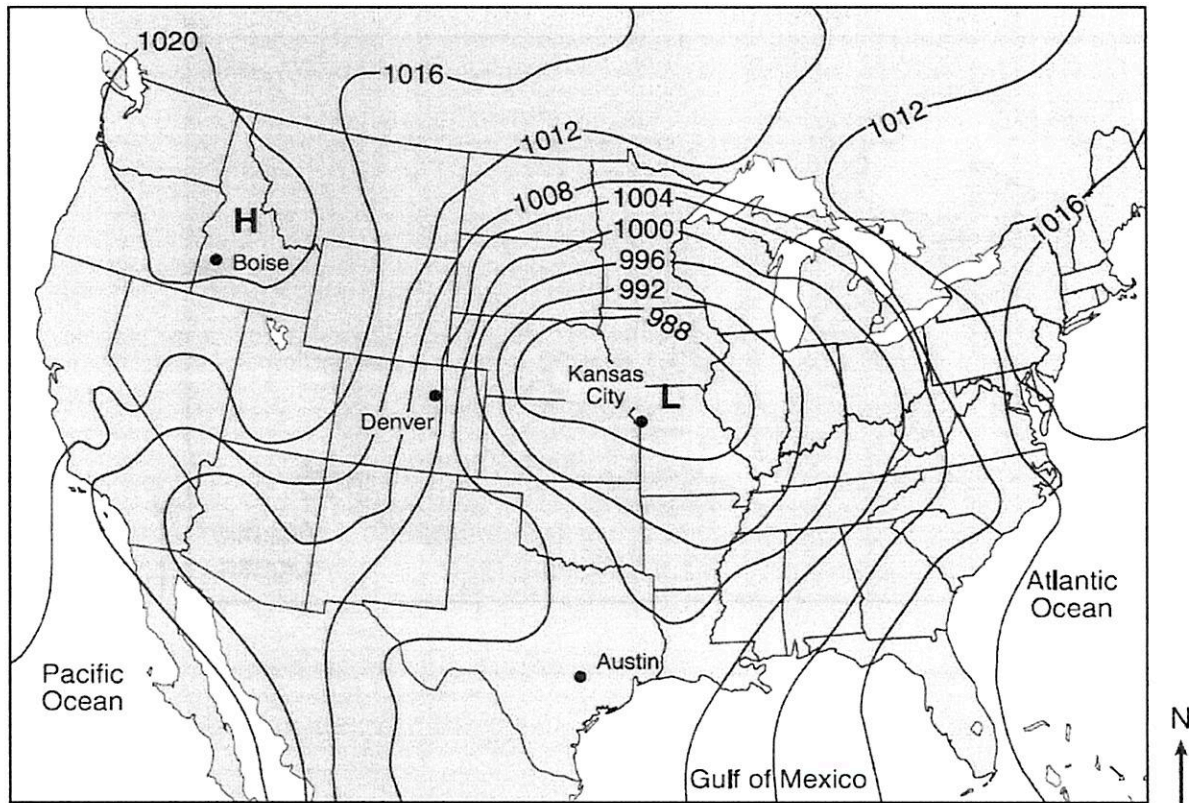
When Earth is located in the orbital position shown, two constellations that are both visible to an observer on Earth at midnight are

- | | |
|-----------------------|----------------------------|
| (1) Libra and Virgo | (3) Aquarius and Capricorn |
| (2) Gemini and Taurus | (4) Cancer and Sagittarius |

29) Compared to the terrestrial planets, the Jovian planets are

- (1) larger and less dense
- (2) smaller and more dense
- (3) closer to the Sun and less rocky
- (4) farther from the Sun and more rocky

30) The map below indicates an air-pressure field over North America. Isobar values are recorded in millibars.



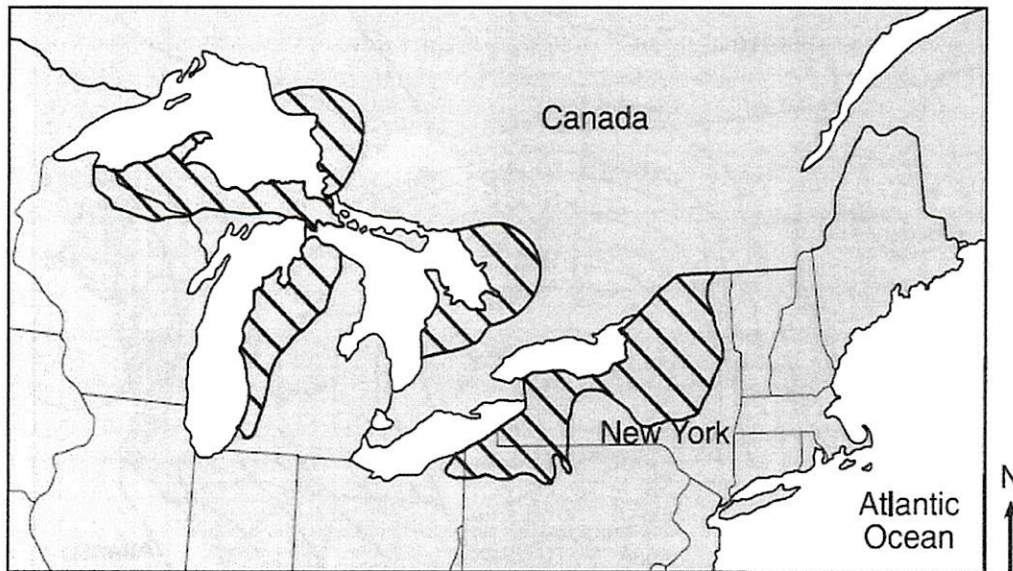
At which city was the greatest wind speed occurring?

- | | |
|------------|-----------------|
| (1) Boise | (3) Kansas City |
| (2) Denver | (4) Austin |

31) 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?

- | | |
|------------------|------------------|
| (1) troposphere | (3) mesosphere |
| (2) stratosphere | (4) thermosphere |

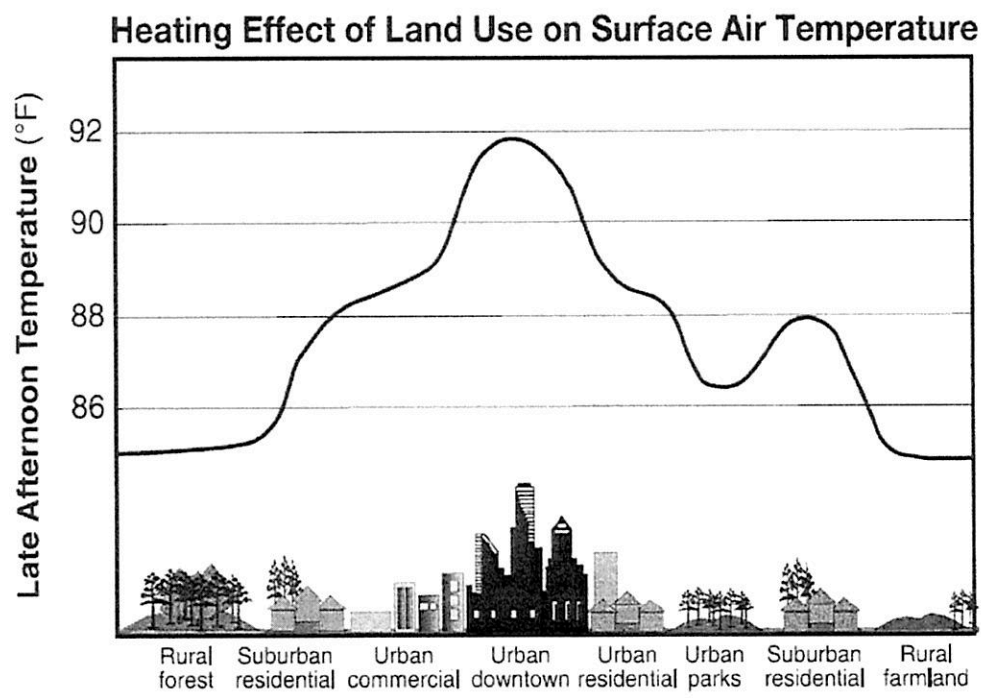
- 32) The striped areas on the map below show regions along the Great Lakes that often receive large amounts of snowfall due to lake-effect storms.



These storms generally develop when

- (1) cold air moves to the east over warmer lake water
 - (2) cold air moves to the west over warmer land regions
 - (3) warm air moves to the east over colder lake water
 - (4) warm air moves to the west over colder land regions
- 33) If the tilt of Earth's axis were increased from 23.5° to 30° , summers in New York State would become
- (1) cooler, and winters would become cooler
 - (2) cooler, and winters would become warmer
 - (3) warmer, and winters would become cooler
 - (4) warmer, and winters would become warmer
- 34) Which motion occurs at a rate of approximately one degree per day?
- (1) the Moon revolving around Earth
 - (2) the Moon rotating on its axis
 - (3) Earth revolving around the Sun
 - (4) Earth rotating on its axis

35) The graph below shows the heating effect that different land uses have on surface air temperatures on a summer afternoon.



Source: US Global Change Research Program (adapted)

Which land use results in the *least* heating effect in urban areas?

- (1) commercial
- (2) downtown
- (3) residential
- (4) parks

2016 Earth Science Midterm: Free Response

Base your answers to questions 1 through 4 on the graph in your answer booklet and on your knowledge of Earth science. The graph shows planet equatorial diameters and planet mean distances from the Sun. Neptune is *not* shown.

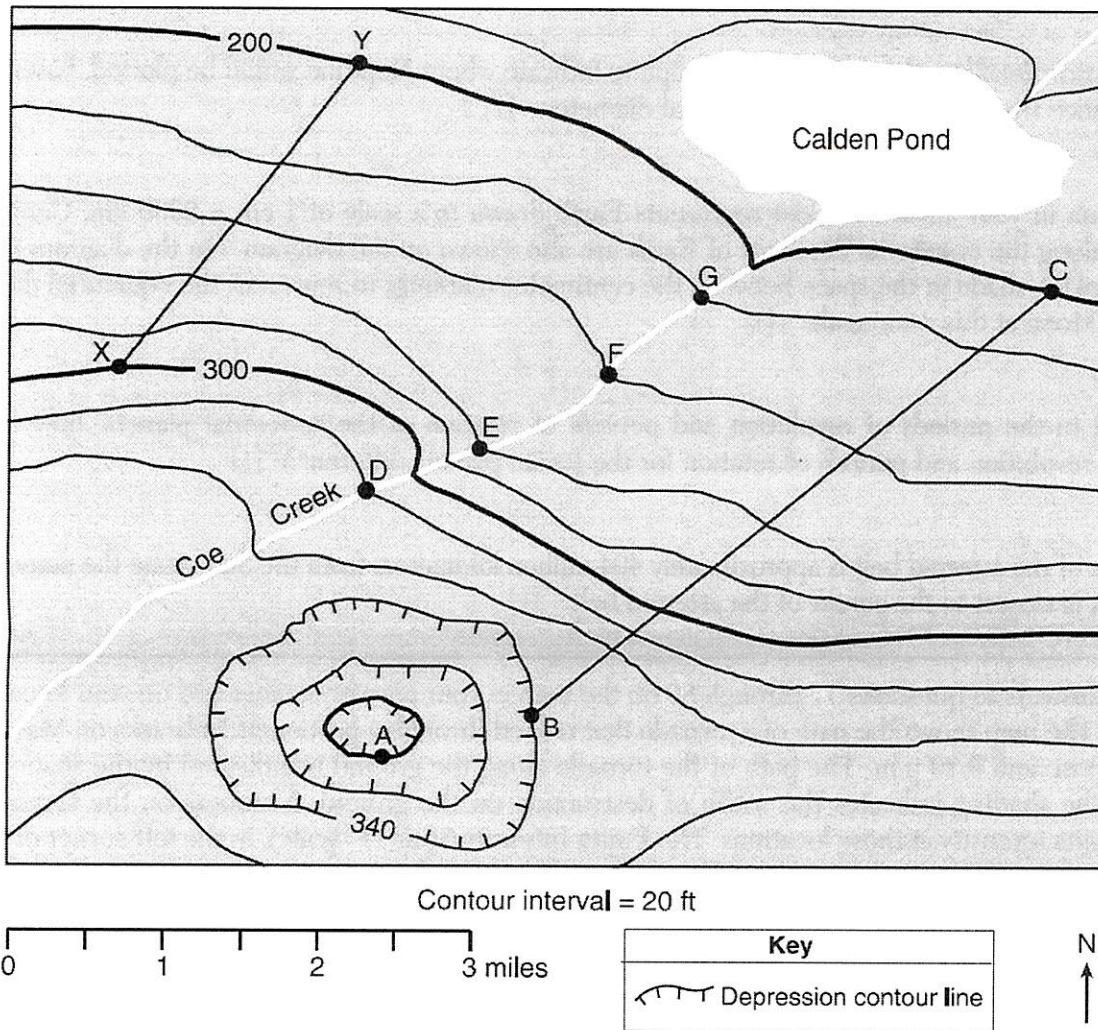
- 1) In your answer booklet, place an **X** on the graph to indicate where Neptune would be plotted, based on its mean distance from the Sun and its equatorial diameter. [1]
- 2) The diagram in your answer booklet represents Earth drawn to a scale of 1 cm = 2000 km. Centimeter markings along the equatorial diameter of Earth are also shown on the diagram. On the diagram in your answer booklet, shade in the space between the centimeter markings to represent the equatorial diameter of Earth's Moon at this same scale. [1]
- 3) Compared to the periods of revolution and periods of rotation of the terrestrial planets, how are the periods of revolution and periods of rotation for the Jovian planets different? [1]
- 4) The center of the asteroid belt is approximately 404 million kilometers from the Sun. State the name of the planet that is closest to the center of the asteroid belt. [1]

Base your answers to questions 5 through 8 on the map in your answer booklet and on your knowledge of Earth science. The map shows the path of a tornado that moved through a portion of Nebraska on May 22, 2004 between 7:30 p.m. and 9:10 p.m. The path of the tornado along the ground is indicated by the shaded region. The width of the shading indicates the width of destruction on the ground. Numbers on the tornado's path indicate the Fujita intensity at those locations. The Fujita Intensity Scale (F-Scale), in the left corner of the map, provides information about wind speed and damage at various F-Scale intensities.

- 5) On the map in your answer booklet, place an **X** at a location where the tornado damage was greatest. [1]
 - 6) State a possible wind speed of the tornado, in kilometers per hour (km/h), when it was moving through the town of Bennet. [1]
 - 7) Identify the weather instrument usually used to measure wind speed. [1]
 - 8) Describe *one* safety precaution that should be taken if a tornado has been sighted approaching your home. [1]
-
- 9) Record, to the nearest whole degree, the altitude of *Polaris* when it is viewed from the top of New York State's Mt. Marcy. [1]

2016 Earth Science Midterm: Free Response

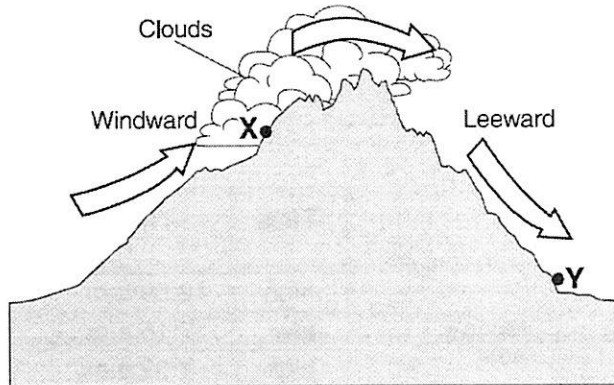
Base your answers to questions 10 through 14 on the topographic map below and on your knowledge Earth science. Point A represents a location on Earth's surface. Lines BC and XY are reference lines on the map. Points D, E, F, and G represent locations along Coe Creek. Elevations are shown in feet.



- 10) What is the elevation of location A? [1]
- 11) On the grid in your answer booklet, construct a topographic profile of the land surface along the line from point B to point C. Plot the elevation of each contour line that crosses line BC. Connect all nine plots with a line to complete the profile. [1]
- 12) Describe the evidence shown on the map that indicates Coe Creek flows toward the northeast. [1]
- 13) Describe how the contour lines indicate that Coe Creek flows faster between locations D and E than between locations F and G. [1]
- 14) Calculate the gradient along line XY. Label your answer with the correct units. [1]

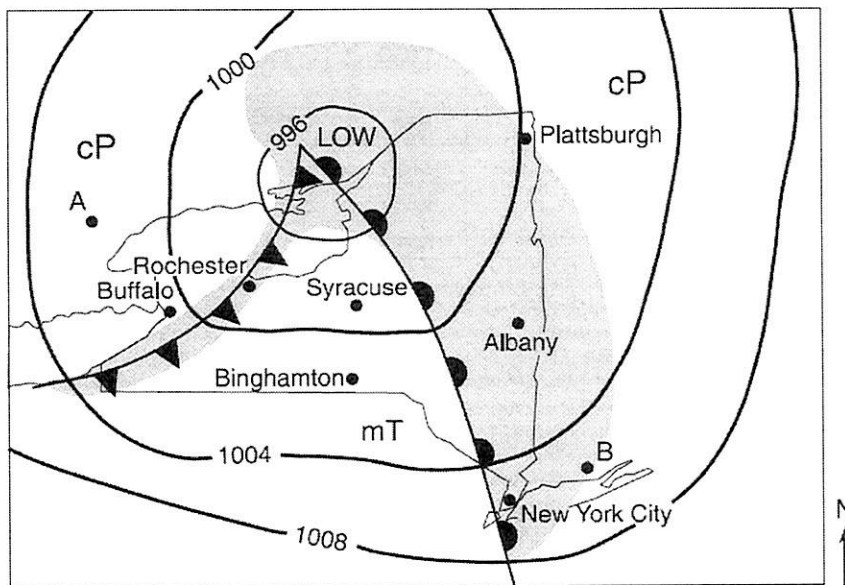
2016 Earth Science Midterm: Free Response

- 15) The cross section below represents the windward and leeward sides of a mountain range. Arrows show the movement of air over a mountain. Points X and Y represent locations on Earth's surface.



Describe how the air's temperature and water vapor content at point X is different from the air's temperature and water vapor content at point Y. [1]

Base your answers to questions 16 and 17 on the weather map below and on your knowledge of Earth science. The map indicates the location of a low-pressure system over New York State during late summer. Isobar values are recorded in millibars. Shading indicates regions receiving precipitation. The air masses are labeled mT and cP. The locations of some New York State cities are shown. Points A and B represent other locations on Earth's surface.

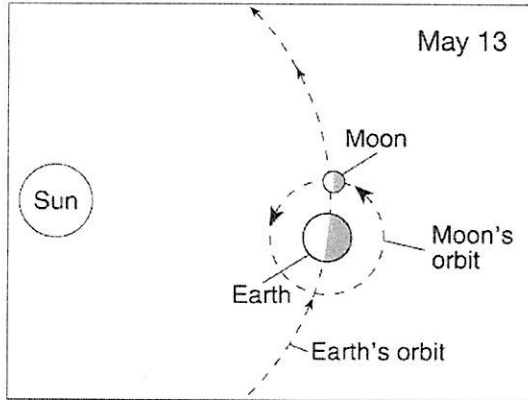


- 16) An air mass acquires the characteristics of the surface over which it forms. In your answer booklet, circle the type of Earth surface (land or ocean) and describe the relative temperature of the surface over which the mT air mass most likely formed. [1]
- 17) The cross section in your answer booklet represents the atmosphere along the dashed line from A to B on the map. The warm frontal boundary is already shown on the cross section. Draw a curved line to represent the shape and location of the cold frontal boundary. [1]

2016 Earth Science Midterm: Free Response

Base your answers to questions 18 through 20 on the diagrams and tables below and on your knowledge of Earth science. Each diagram represents the Moon's orbital position and each table lists times of high and low tides and tide heights, in meters, at New York City for the date shown.

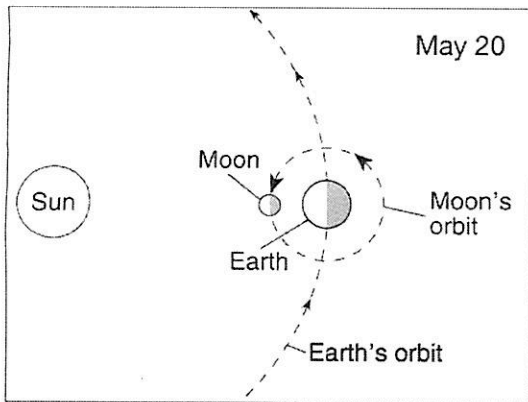
Moon's Orbital Position and Tide Data on May 13



(Not drawn to scale)

Tide	Time	Height (m)
high	12:59 a.m.	1.92
low	7:15 a.m.	0.37
high	1:32 p.m.	2.07
low	7:59 p.m.	0.27

Moon's Orbital Position and Tide Data on May 20



(Not drawn to scale)

Tide	Time	Height (m)
low	1:22 a.m.	0.06
high	7:50 a.m.	2.47
low	2:10 p.m.	0.09
high	8:10 p.m.	2.21

- 18) Determine the length of time between the two high tides shown for May 13. [1]
- 19) On the diagram *in your answer booklet*, shade the portion of the Moon that is in darkness to observers in New York City on May 13. [1]
- 20) On the diagram *in your answer booklet*, place an **X** on the Moon's orbit to represent the location of the Moon on May 28. [1]