

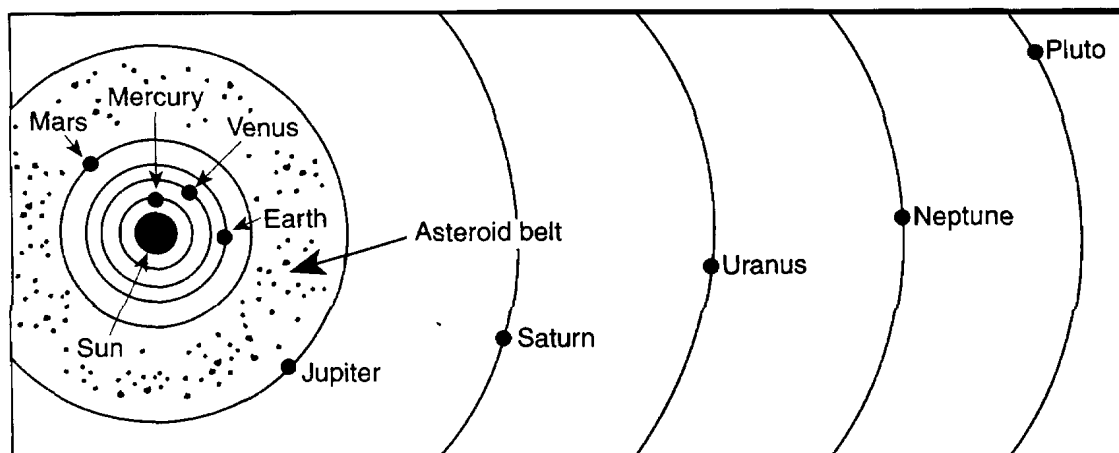
THE SOLAR SYSTEM

1. The atmosphere of Venus is composed primarily of

- A hydrogen and helium
- C methane

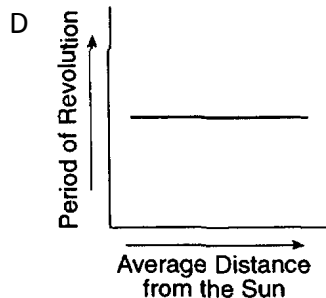
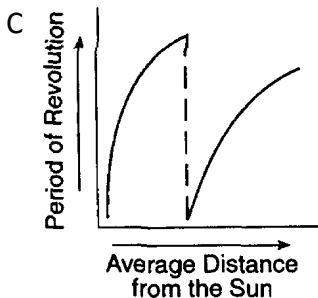
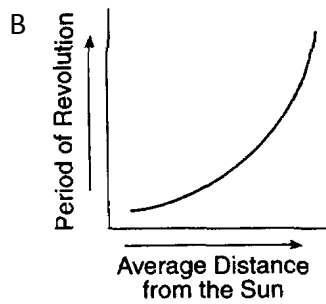
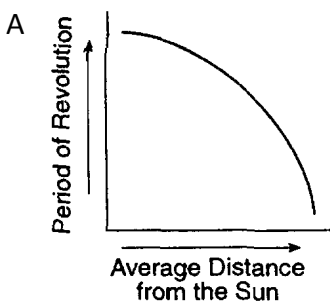
- B carbon dioxide
- D ammonia

Base your answers to questions 2 through 6 on the diagram below, which shows a portion of the solar system.



(Not drawn to scale)

2. Which graph best represents the relationship between a planet's average distance from the Sun and the time the planet takes to revolve around the Sun?



3. Which of the following planets has the *lowest* average density?

A Mercury

B Venus

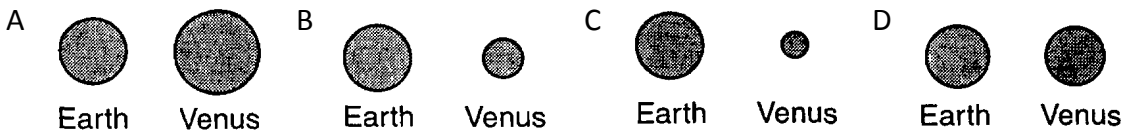
C Earth

D Mars

4. The actual orbits of the planets are

- A elliptical, with Earth at one of the foci
- B elliptical, with the Sun at one of the foci
- C circular, with Earth at the center
- D circular, with the Sun at the center

5. Which scale diagram best compares the size of Earth with the size of Venus?



6. Mercury and Venus are the only planets that show phases when viewed from Earth because both Mercury and Venus

- A revolve around the Sun inside Earth's orbit
- B rotate more slowly than Earth does
- C are eclipsed by Earth's shadow
- D pass behind the Sun in their orbit

7. Which event takes the most time?

- A one revolution of Earth around the Sun
- B one revolution of Venus around the Sun
- C one rotation of the Moon on its axis
- D one rotation of Venus on its axis

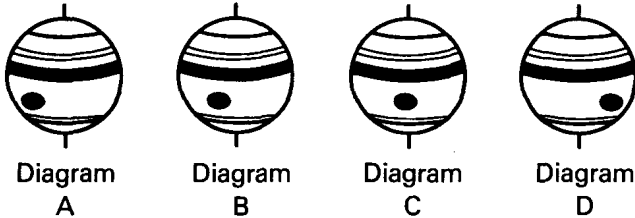
8. When the distance between the foci of an ellipse is increased, the eccentricity of the ellipse will

- A decrease
 - B increase
 - C remain the same
-

9. The modern heliocentric model of planetary motion states that the planets travel around

- A the Sun in slightly elliptical orbits
- B the Sun in circular orbits
- C Earth in slightly elliptical orbits
- D Earth in circular orbits

10. A planet was viewed from Earth for several hours. The diagrams below represent the appearance of the planet at four different times.



The best inference that can be made based on the diagrams is that this planet is

- A tilted on its axis
- B changing seasons
- C revolving
- D rotating

11. What is the inferred age of our solar system, in millions of years?

- A 544
- B 1300
- C 4600
- D 10,000

12. Compared to the Jovian planets, terrestrial planets are

- A more dense and more massive.
- B less dense and more massive.
- C more dense and less massive.
- D less dense and less massive.

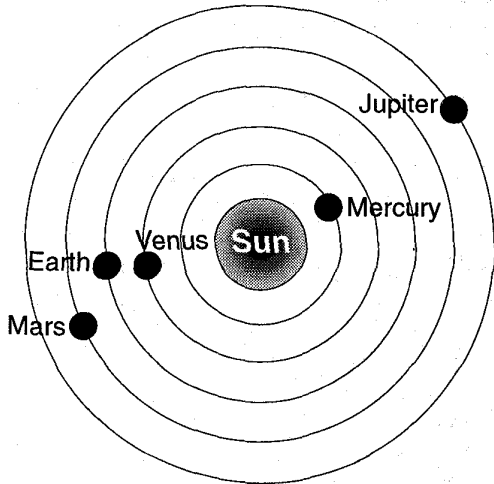
13. Which two characteristics do all Jovian planets have in common?

- A small diameters and low densities
- B small diameters and high densities
- C large diameters and low densities
- D large diameters and high densities

14. The primary chemical constituent of the Jovian planets is

- A iron
 - B oxygen
 - C hydrogen
 - D ammonia
-

15. The diagram below shows several planets at various positions in their orbits at a particular time.

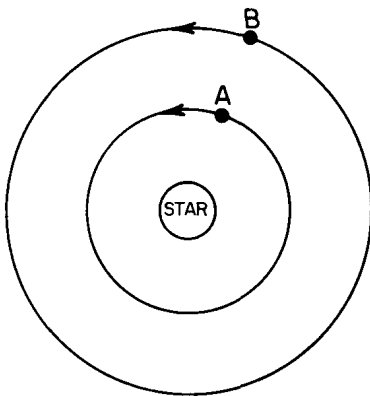


(Not drawn to scale)

Which planet would be visible from the Earth at night for the longest period of time when the planets are in these positions?

- A Mercury B Venus C Mars D Jupiter

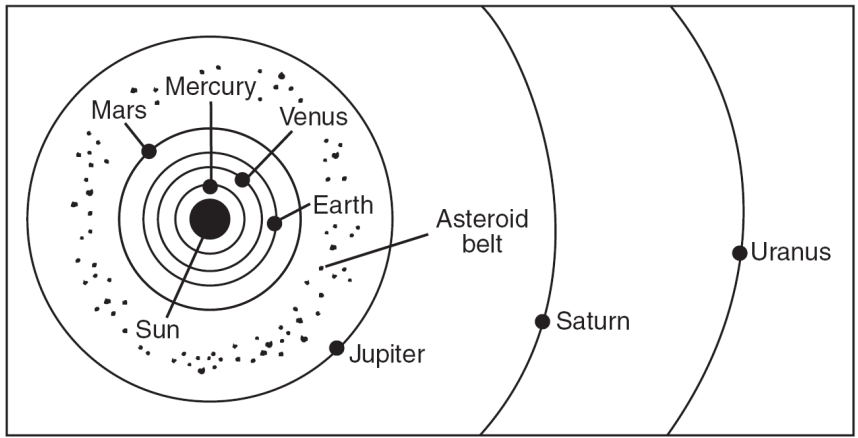
16. The diagram below shows the orbits of planets A and B in a star-planet system.



The period of revolution for planet B is 40 days. The period of revolution for planet A most likely is

- A less than 40 days B greater than 40 days
C 40 days

17. Base your answer to the following question on the diagram below. This diagram shows a portion of the solar system.



(Not drawn to scale)

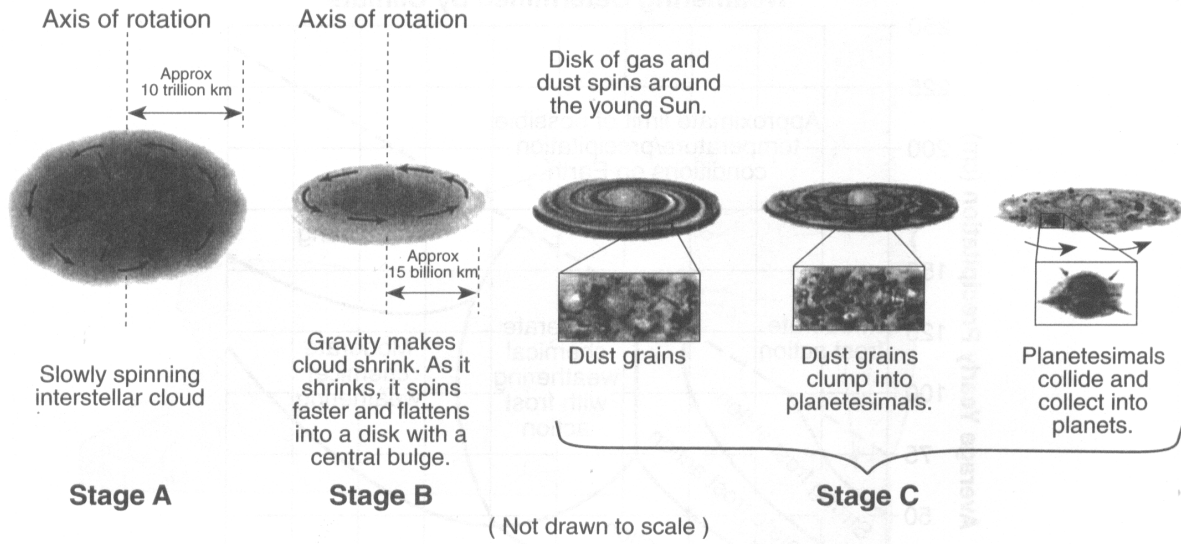
What is the average distance, in millions of kilometers, from the Sun to the asteroid belt?

- A 129 B 189 C 503 D 85

18. In describing a model for the origin of our solar system, which one of the following facts would not be included?

- A The planets' orbits lie pretty much in the same plane.
- B The planets revolve around the sun in the same direction.
- C The Solar system revolves around the center of our galaxy.
- D The planets' orbits are mostly close to being circular.

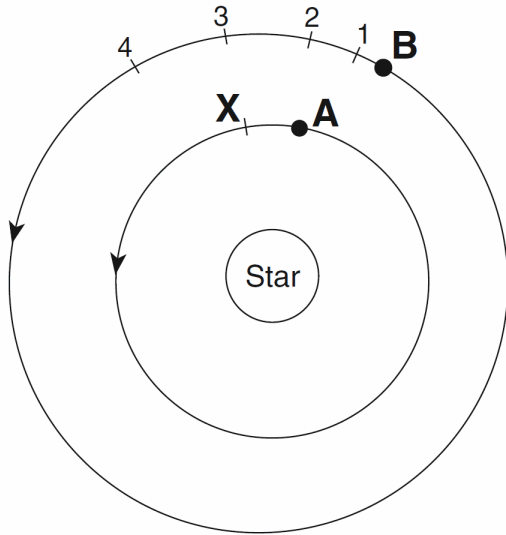
19. Base your answer to the following question on the diagram below, which shows an inferred sequence in which our solar system formed from a giant interstellar cloud of gas and debris. Stage A shows the collapse of the gas cloud, stage B shows its flattening, and stage C shows the sequence that led to the formation of planets.



After the young Sun formed, the disk of gas and dust

- A became spherical in shape
- B formed a central bulge
- C became larger in diameter
- D eventually formed into planets

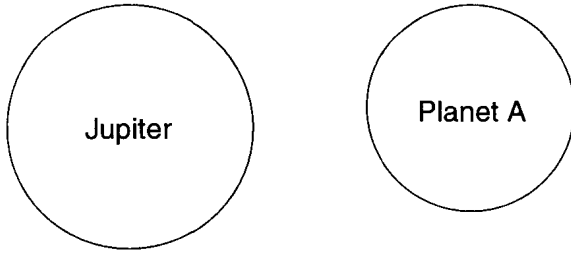
Base your answers to questions **20** and **21** on the diagram below, which represents the current locations of two planets, *A* and *B*, orbiting a star. Letter *X* indicates a position in the orbit of planet *A*. Numbers 1 through 4 indicate positions in the orbit of planet *B*.



(Not drawn to scale)

- _____ 20. If the diagram represents our solar system and planet *B* is Venus, which planet is represented by planet *A*?
- A Mercury B Jupiter C Earth D Mars
- _____ 21. As planet *A* moves in orbit from its current location to position *X*, planet *B* most likely moves in orbit from its current location to position
- A 1 B 2 C 3 D 4
-

25. The diagram below represents two planets in our solar system drawn to scale, Jupiter and planet A.



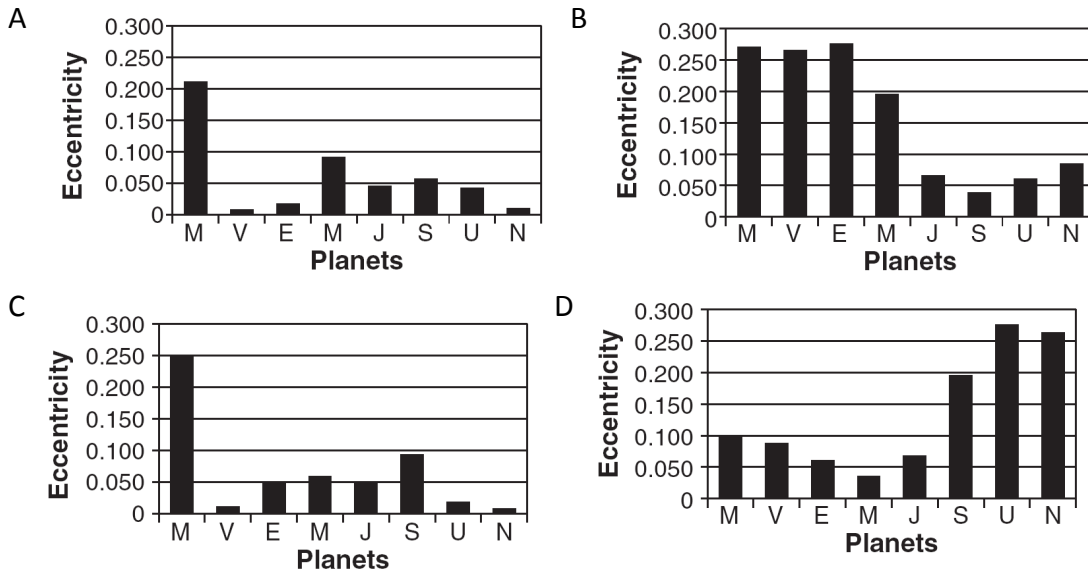
Planet A most likely represents

- A Earth B Venus C Saturn D Uranus

26. Which planet takes more time to complete one rotation on its axis than to complete one revolution around the Sun?

- A Mercury B Venus C Mars D Jupiter

27. Which bar graph correctly shows the orbital eccentricity of the planets in our solar system?



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

- A changes in the orbital velocity of the Earth
 B tilting of the Earth's axis
 C the oblate spheroid shape of the Earth
 D the phases of the Moon

29. One factor responsible for the strength of gravitational attraction between a planet and the Sun is the

- A degree of tilt of the planet's axis
- B distance between the planet and the Sun
- C planet's period of rotation
- D amount of insolation given off by the Sun

30. Why are some constellations visible to New York State observers at midnight during April, but *not* visible at midnight during October?

- A Constellations move within our galaxy.
- B Constellations have elliptical orbits.
- C Earth revolves around the Sun.
- D Earth rotates on its axis.

Base your answers to questions 31 and 32 on the diagrams below. The diagrams represent the events that occur when a large meteor, such as the one believed to have caused the extinction of many organisms, impacts Earth's surface. Diagram A shows the meteor just before impact. Diagram B represents the crater forming, along with the vapor and ejecta (the fragmented rock and dust) thrown into the atmosphere.

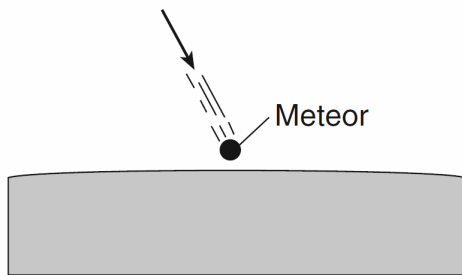


Diagram A: Before Impact

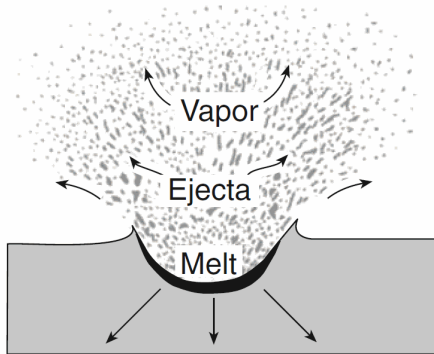


Diagram B: During Impact

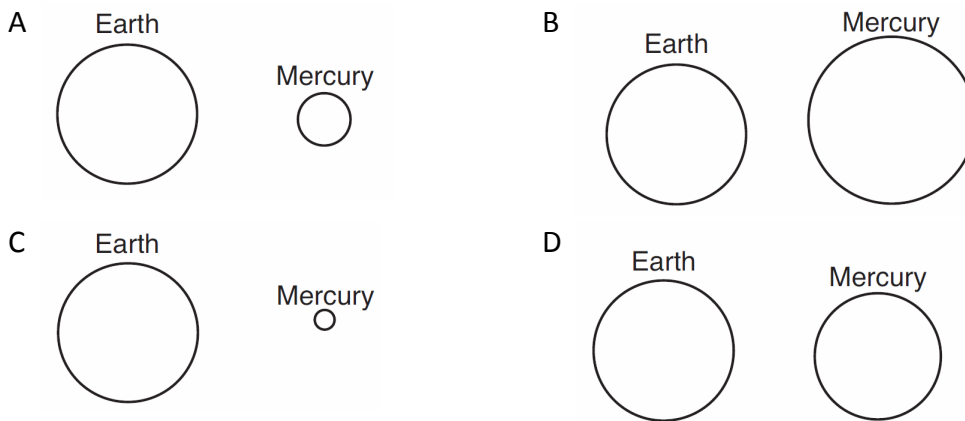
31. Many meteors are believed to be fragments of celestial objects normally found between the orbits of Mars and Jupiter. These objects are classified as

- A stars
 - B asteroids
 - C planets
 - D moons
-

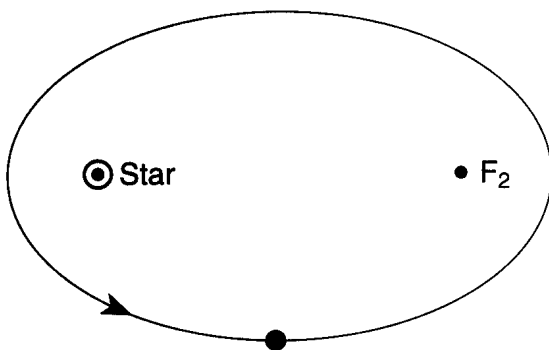
32. Which statement best explains how global climate would most likely be affected after this large meteor impact?

- A Large quantities of ejecta in the atmosphere would block insolation and lower global temperatures.
 - B An increase in vapor and ejecta would allow radiation to escape Earth's atmosphere and lower global temperatures.
 - C Ejecta settling in thick layers would increase the absorption of insolation by Earth's surface and raise global temperatures.
 - D Forest fires produced from the vapor and ejecta would raise global temperatures.
-

33. Which diagram most accurately represents the relative diameters of Earth and Mercury?



34. The diagram below shows the elliptical orbit of a planet revolving around a star. The star and F_2 are the foci of this ellipse.



What is the approximate eccentricity of this ellipse?

- A 0.22
 - B 0.47
 - C 0.68
 - D 1.47
-

35. Compared to Pluto, Mercury moves more rapidly in its orbit because Mercury

- A is larger
- B is more dense
- C is closer to the Sun
- D has a more elliptical orbit

Base your answers to questions 36 and 37 on the data table below, which provides information about the Moon, based on current scientific theories.

Information About the Moon

Subject	Current Scientific Theories
Origin of the Moon	Formed from material thrown from a still-liquid Earth following the impact of a giant object 4.5 billion years ago
Craters	Largest craters resulted from an intense bombardment by rock objects around 3.9 billion years ago
Presence of water	Mostly dry, but water brought in by the impact of comets may be trapped in very cold places at the poles
Age of rocks in terrae highlands	Most are older than 4.1 billion years; highland anorthosites (igneous rocks composed almost totally of feldspar) are dated at 4.4 billion years
Age of rocks in maria plains	Varies widely from 2 billion to 4.3 billion years
Composition of terrae highlands	Wide variety of rock types, but all contain more aluminum than rocks of maria plains
Composition of maria plains	Wide variety of basalts
Composition of mantle	Varying amounts of mostly olivine and pyroxene

36. Which Moon feature is an impact structure?

- A crater
- B maria plain
- C terrae highland
- D mantle

37. Which statement is supported by the information in the table?

- A The Moon was once a comet.
 - B The Moon once had saltwater oceans.
 - C Earth is 4.5 billion years older than the Moon.
 - D Earth was liquid rock when the Moon was formed.
-

Base your answers to questions 38 and 39 on on the data table below, which shows information about the four largest asteroids found in our solar system.

Data Table

Name	Average Diameter (kilometers)	Period of Revolution (years)
Ceres	848.4	4.60
Pallas	498.1	4.61
Juno	247.0	4.36
Vesta	468.3	3.63

38. Compared to the diameter of Earth's Moon, the diameter of Ceres is about

- A one-fourth of the Moon's diameter B one-half of the Moon's diameter
C twice the diameter of the Moon D four times the diameter of the Moon

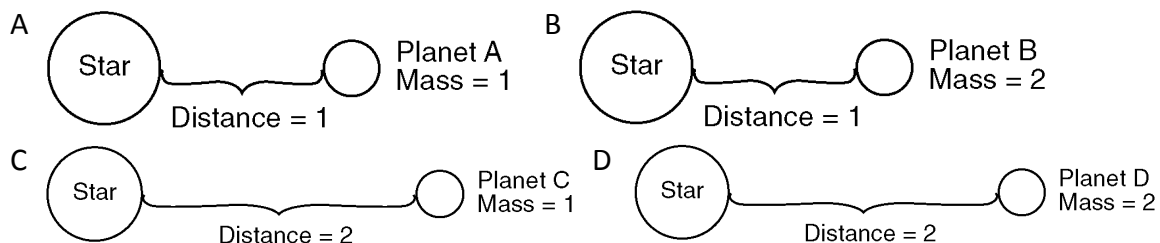
39. The asteroids shown in the data table are located between the orbits of

- A Venus and Earth B Earth and Mars
C Mars and Jupiter D Jupiter and Saturn

40. Which list of three planets and Earth's Moon is arranged in order of increasing equatorial diameter?

- A Earth's Moon, Pluto, Mars, Mercury B Pluto, Earth's Moon, Mercury, Mars
C Mercury, Mars, Earth's Moon, Pluto D Mars, Mercury, Pluto, Earth's Moon

41. In each diagram below, the mass of the star is the same. In which diagram is the force of gravity greatest between the star and the planet shown?



42. 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

43. Which of the following planets is a terrestrial planet?

- A Jupiter
- B Saturn
- C Mars
- D Neptune

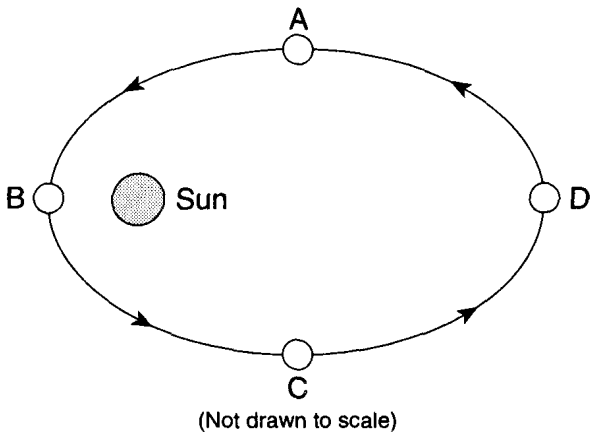
44. Most of a Earth's atmosphere comes from

- A the gas surrounding Earth at the time of its formation
- B gas released from the interior of our planet
- C gas captured as Earth passed through a gas cloud
- D escaped gas from the sun

45. Whether a planet or moon has an atmosphere depends mostly upon its

- A orbital speed
- B mass
- C distance from the sun
- D temperature

46. The diagram below shows four positions of a planet in its orbit around the Sun.



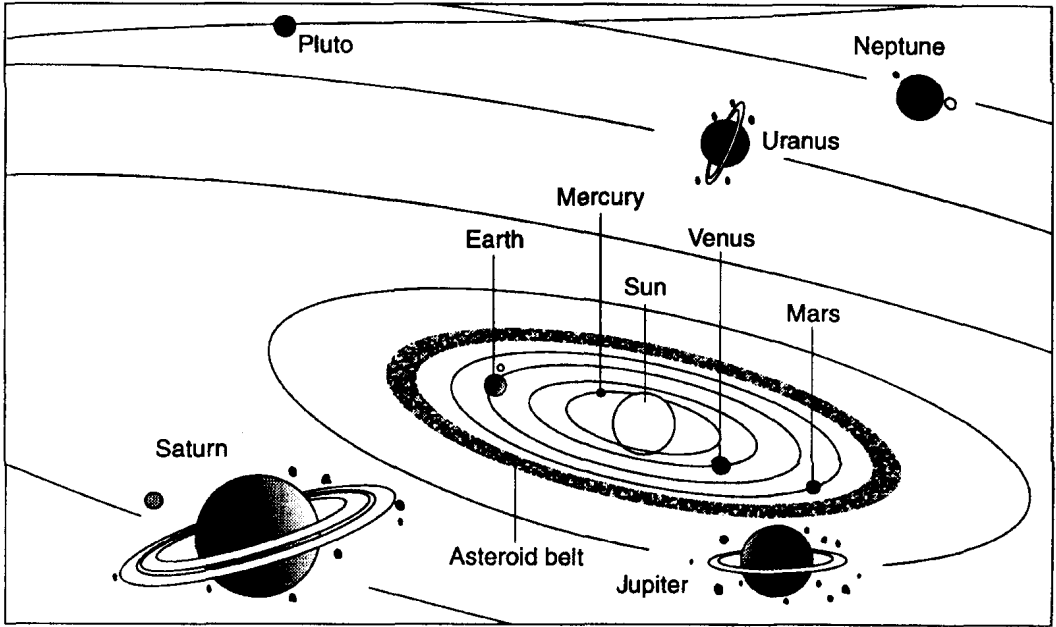
At which position is the planet's orbital speed greatest?

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

47. The terrestrial planets differ from the Jovian planets because the terrestrial planets are

- A less dense and larger
- B less dense and smaller
- C more dense and larger
- D more dense and smaller

Base your answers to questions 48 through 52 on the diagram of the solar system below.



(Not drawn to scale)

48. If the Earth's distance from the Sun were doubled, the gravitational attraction between the Sun and Earth would be

- A one-ninth as great
- B nine times as great
- C one-fourth as great
- D four times as great

49. Which planet has the most eccentric orbit?

- A Venus
- B Mars
- C Saturn
- D Pluto

50. On which planet would a measuring instrument placed at the planet's equator record the longest time from sunrise to sunset?

- A Mercury
- B Venus
- C Earth
- D Mars

51. Which kind of model of the solar system is represented by the diagram?

- A heliocentric model
- B geocentric model
- C sidereal model
- D lunar model

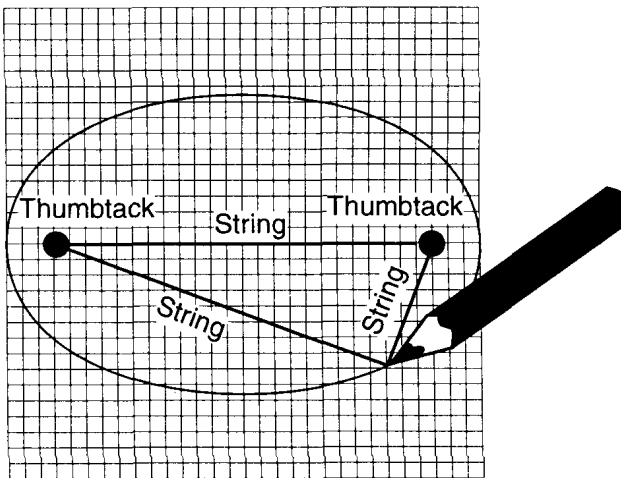
52. According to Kepler's Harmonic Law of Planetary Motion, the farther a planet is located from the Sun, the

- A shorter its period of rotation
- B shorter its period of revolution
- C longer its period of rotation
- D longer its period of revolution

53. Which statement provides the best evidence that Earth revolves around the Sun?

- A The Sun follows an apparent daily path, rising in the east and setting in the west.
- B A Foucault pendulum appears to shift its direction of swing in a predictable manner.
- C The stars appear to follow circular paths around the North Star (*Polaris*).
- D The seasons of spring, summer, fall, and winter repeat in a pattern.

54. The diagram below represents a student's constructed laboratory drawing.



(Not drawn to scale)

The student's drawing best represents the

- A shape of Earth's Moon
 - B shape of an elliptical orbit
 - C path of an earthquake wave
 - D path of a projectile deflected by Earth's rotation
-

55. Why are impact structures more obvious on the Moon than on Earth?

- A The Moon's gravity is stronger than Earth's gravity.
- B The Moon has little or no atmosphere.
- C The rocks on the Moon are weaker than those on Earth.
- D The Moon rotates at a slower rate than Earth does.

56. In what way are the planets Mars, Mercury, and Earth similar?

- A They have the same period of revolution.
- B They are perfect spheres.
- C They exert the same gravitational force on each other.
- D They have elliptical orbits with the Sun at one focus.

57. The solar system object in the photograph below is 56 kilometers long.



The object in the photograph is most likely

- A an asteroid
- B Neptune
- C Earth's Moon
- D Mercury

58. What is the approximate average density of the Earth?

- A 2.80 g/cm³
 - B 5.52 g/cm³
 - C 9.55 g/cm³
 - D 12.0 g/cm³
-

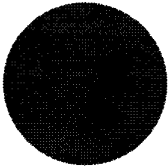
59. Which statement correctly compares the size, composition, and density of Neptune to Earth?

- A Neptune is smaller more gaseous, and less dense.
- B Neptune is larger, more gaseous, and less dense,
- C Neptune is smaller, more solid, and more dense.
- D Neptune is larger, more solid, and more dense.

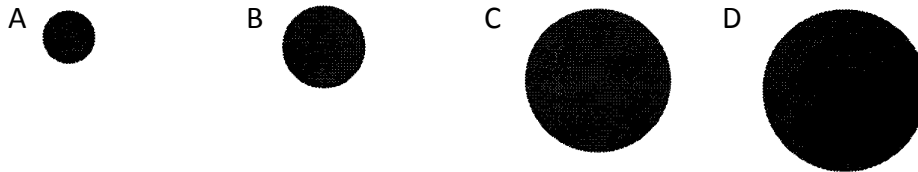
60. Three planets known as gas giants because of their large size and low density are

- A Venus, Neptune, and Jupiter
- B Jupiter, Saturn, and Venus
- C Jupiter, Saturn, and Uranus
- D Venus, Uranus, and Jupiter

61. The diagram below represents Earth.



Which diagram best represents Mars, drawn to the same scale?



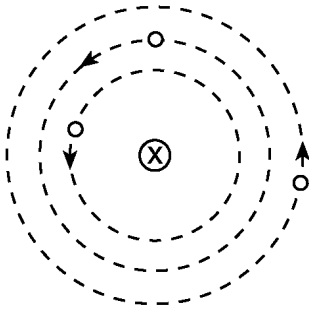
62. Compared to Jovian planets, terrestrial planets have a

- A more rocky composition.
- B lower density.
- C more rapid rotation.
- D larger size.

63. Which planet's day (period of rotation) is longer than its year (period of revolution)?

- A Mercury
 - B Venus
 - C Jupiter
 - D Saturn
-

64. The diagram below represents a simple geocentric model. Which object is represented by the letter X?



(Not drawn to scale)

- A Earth B Sun C Moon D Polaris

65. Which planet has an orbit with an eccentricity most similar to the eccentricity of the Moon's orbit around Earth?

- A Earth B Jupiter C Pluto D Saturn

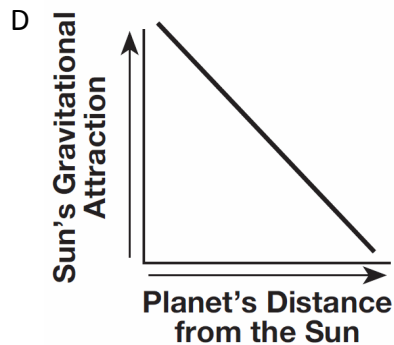
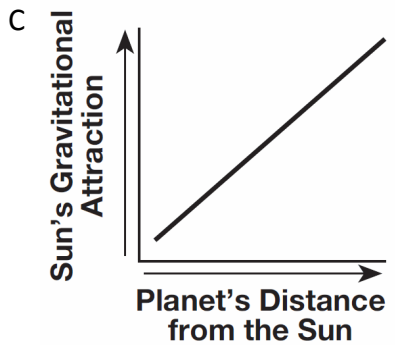
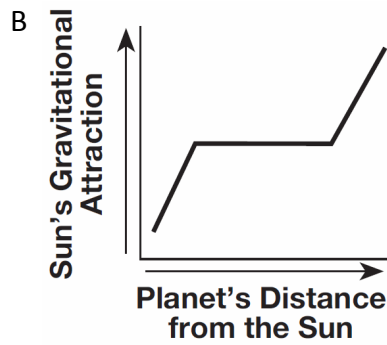
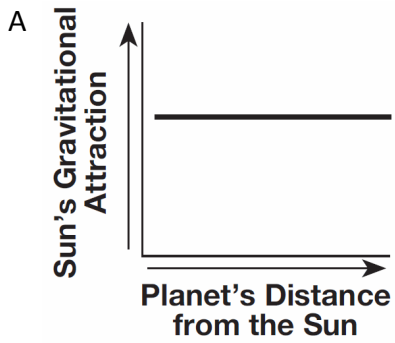
66. Compared to Jovian planets, terrestrial planets have

- A larger masses B larger equatorial diameters
C shorter periods of revolution D shorter periods of rotation

67. Which planet's orbit around the Sun is most nearly circular?

- A Mercury B Neptune C Pluto D Venus
-

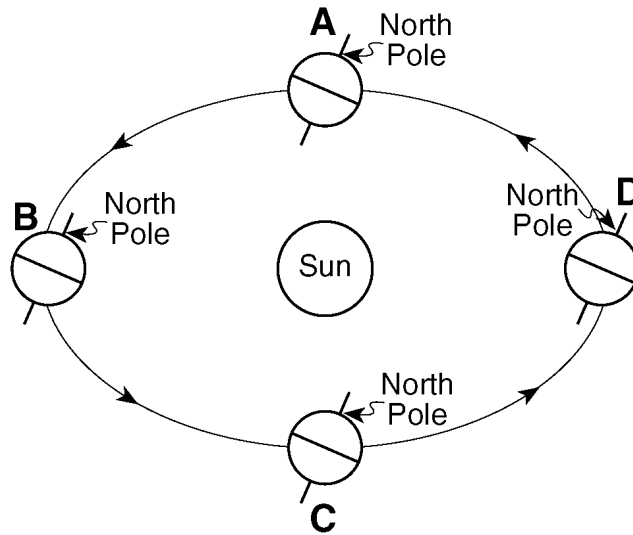
68. Which graph best shows the general relationship between a planet's distance from the Sun and the Sun's gravitational attraction to the planet?



69. If the average distance between Earth and the Sun were doubled, what changes would occur in the Sun's gravitational pull on Earth and Earth's period of revolution?

- A Gravitational pull would decrease and period of revolution would increase.
 - B Gravitational pull would decrease and period of revolution would decrease.
 - C Gravitational pull would increase and period of revolution would increase.
 - D Gravitational pull would increase and period of revolution would decrease.
-

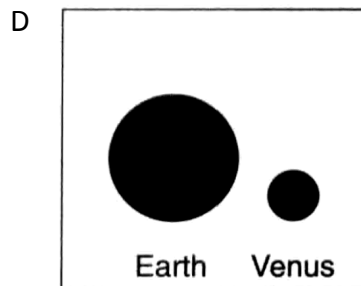
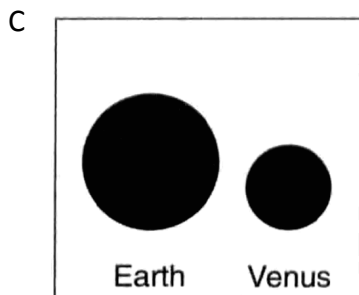
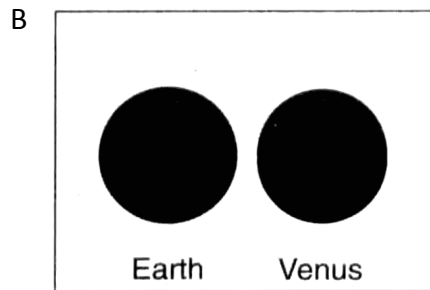
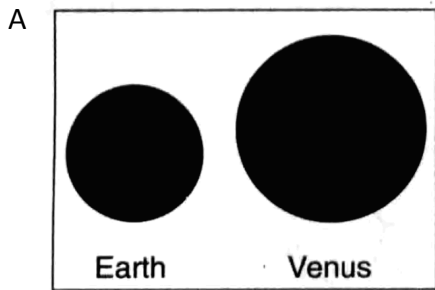
70. Base your answer to the following question on the diagram below, which represents an exaggerated view of Earth revolving around the Sun. Letters A, B, C, and D represent Earth's location in its orbit on the first day of each of the four seasons.



Which observation provides the best evidence that Earth revolves around the Sun?

- A Stars seen from Earth appear to circle *Polaris*.
- B Earth's planetary winds are deflected by the Coriolis effect.
- C The change from high ocean tide to low ocean tide is a repeating pattern.
- D Different star constellations are seen from Earth at different times of the year.

71. Which pair of shaded circles best represents the relative sizes of Earth and Venus when drawn to scale?



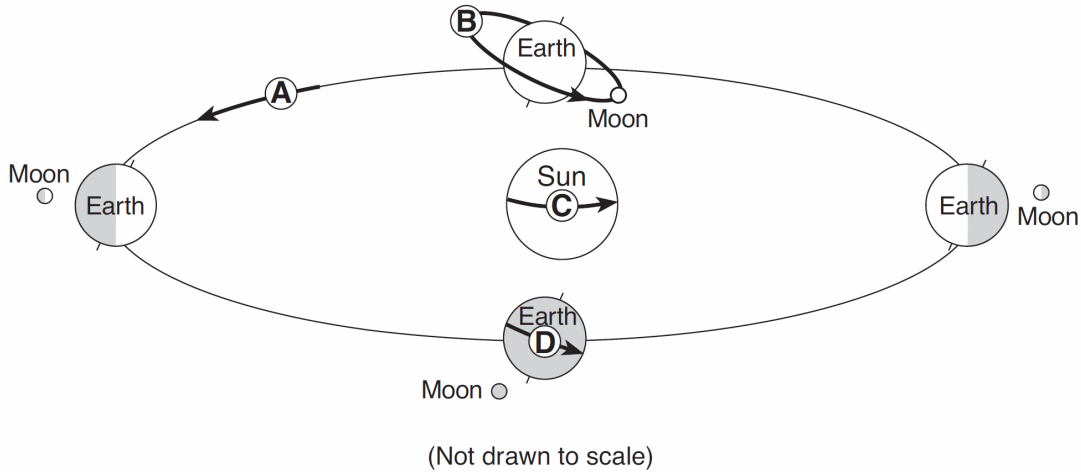
72. In which type of model are the Sun, other stars, and the Moon in orbit around the Earth?

- A heliocentric model
- B tetrahedral model
- C concentric model
- D geocentric model

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

- A the appearance of oxygen-producing organisms
- B the drifting of the continents
- C the changes in Earth's magnetic field
- D a transfer of gases from the Sun

74. 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° per day?

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

75. Which planet has the most eccentric orbit?

- A Mercury
 - B Venus
 - C Neptune
 - D Pluto
-

76. Earth's orbital velocity is slowest on July 5 because

- A the Moon is closest to Earth
- B Earth's distance from the Sun is greatest
- C Earth, the Moon, and the Sun are located along a straight line in space
- D the highest maximum temperatures occur in the Northern Hemisphere

77. Which event is cyclic and predictable?

- A a volcano erupting above a subducting tectonic plate
- B an earthquake occurring at the San Andreas Fault
- C Jupiter's apparent movement across the night sky
- D an asteroid striking Earth's surface

78. Which observation is a direct result of changes in distance between Earth and the Sun?

- A A Foucault pendulum shows predictable changes in its direction of swing.
 - B The apparent diameter of the Sun shows predictable changes in size.
 - C The length of daylight at the poles changes from 0 to 24 hours during the year.
 - D Summer occurs in the Northern Hemisphere at the same time that winter occurs in the Southern Hemisphere.
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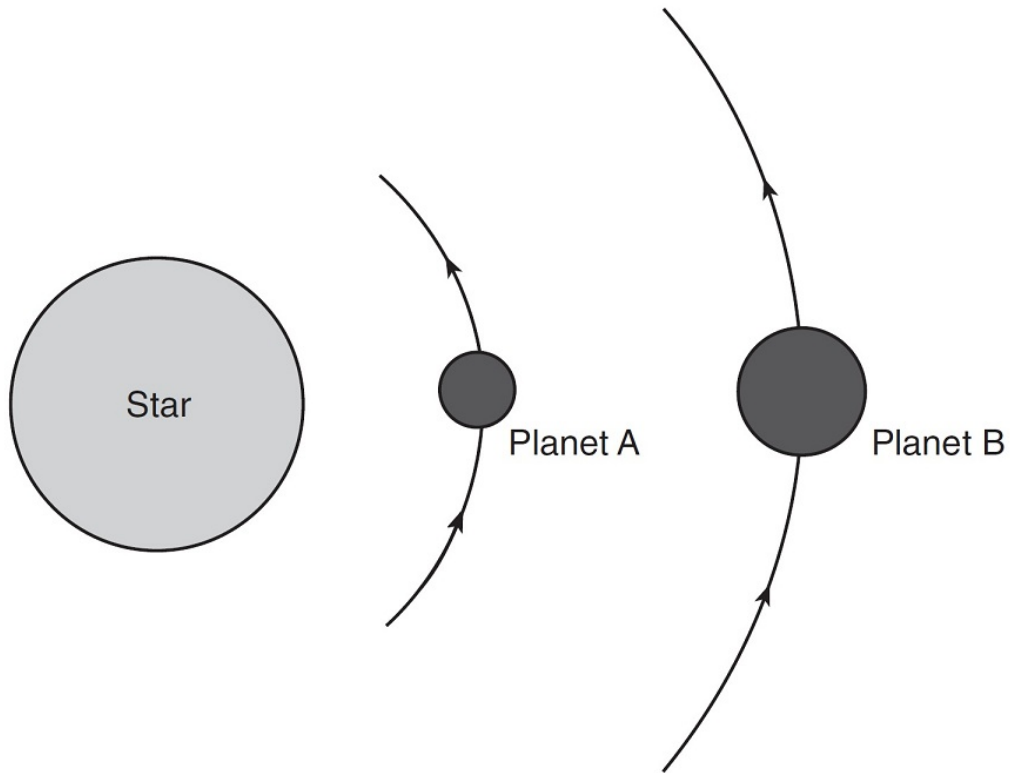
Base your answers to questions **79** and **80** on the passage below.

A Newly Discovered Planet

Scientists studying a Sun-like star named Ogle-Tr-3 discovered a planet that is, on the average, 3.5 million kilometers away from the star's surface. The planet was discovered as a result of observing a cyclic decrease in the brightness of Ogle-Tr-3 every 28.5 hours. The changing brightness is the result of the planet blocking some of the starlight when it is between Ogle-Tr-3 and Earth. This observation allowed scientists to find not only the planet, but also to determine the planet's mass and density. The mass has been calculated to be approximately 159 times the mass of Earth. The planet is only 20% as dense as Jupiter. Scientists think that this low density is the result of being very close to Ogle-Tr-3.

- _____ 79. Compared to the period of revolution of Mercury and Venus, this newly discovered planet's period of revolution is
- A shorter than both Mercury's and Venus'
 - B longer than both Mercury's and Venus'
 - C shorter than Mercury's but longer than Venus'
 - D longer than Mercury's but shorter than Venus'
- _____ 80. The density of the discovered planet has been estimated to be approximately
- A 5.5 g/cm^3
 - B 2.0 g/cm^3
 - C 1.3 g/cm^3
 - D 0.3 g/cm^3
-

81. The diagram below represents planets *A* and *B*, of equal mass, revolving around a star.



Compared to planet *A*, planet *B* has a

- A weaker gravitational attraction to the star and a shorter period of revolution
- B weaker gravitational attraction to the star and a longer period of revolution
- C stronger gravitational attraction to the star and a shorter period of revolution
- D stronger gravitational attraction to the star and a longer period of revolution

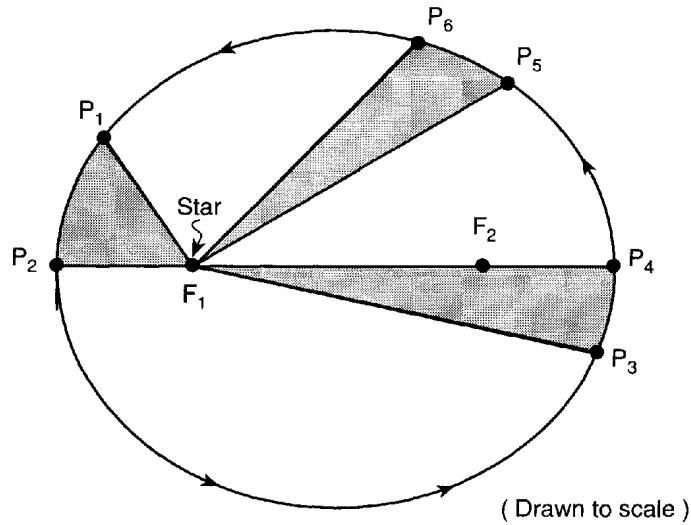
82. The force of gravity between two objects is greatest when

- A masses are small and the objects are close together
- B masses are small and the objects are far apart
- C masses are large and the objects are close together
- D masses are large and the objects are far apart

83. Terrestrial planets move more rapidly in their orbits than the Jovian planets because terrestrial planets are

- A rotating on a tilted axis
 - B more dense
 - C more massive
 - D closer to the Sun
-

Base your answers to questions **84** through **88** on the diagram below which represents a planet, P , in an elliptical orbit around a star located at F_1 . The foci of the elliptical orbit are F_1 and F_2 . Orbital locations are represented by P_1 through P_6 .



84. If the mass of planet P were tripled, the gravitational force between the star and planet P would

- | | |
|--------------------------|-------------------------|
| A remain the same | B be two times greater |
| C be three times greater | D be nine times greater |

85. If the shaded portions of the orbital plane are equal in area, the time period between P_1 and P_2 will be equal to the time period between

- | | | | |
|-------------------|-------------------|-------------------|-------------------|
| A P_2 and P_3 | B P_4 and P_5 | C P_3 and P_4 | D P_6 and P_1 |
|-------------------|-------------------|-------------------|-------------------|

86. The gravitational attraction between planet P and the star is greatest when the planet is located at position

- | | | | |
|---------|---------|---------|---------|
| A P_1 | B P_2 | C P_3 | D P_4 |
|---------|---------|---------|---------|

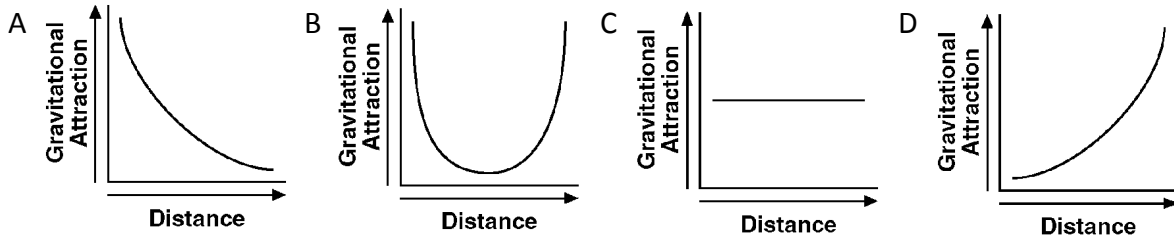
87. What is the approximate eccentricity of planet P 's orbit?

- | | | | |
|--------|--------|--------|--------|
| A 0.52 | B 0.83 | C 2.11 | D 4.47 |
|--------|--------|--------|--------|

88. When observed from the planet, the star would have its greatest apparent angular diameter when the planet is located at position

- | | | | |
|---------|---------|---------|---------|
| A P_1 | B P_2 | C P_3 | D P_4 |
|---------|---------|---------|---------|

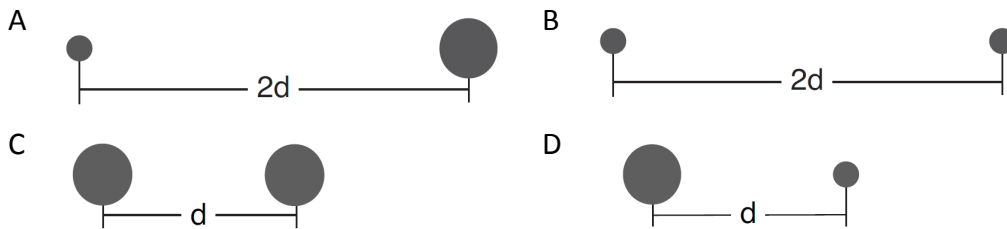
89. Which graph best represents the change in gravitational attraction between the Sun and a comet as the distance between them increases?



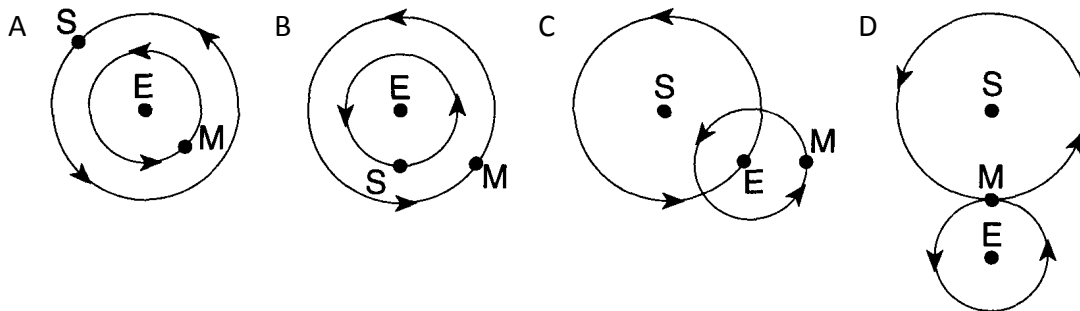
90. The symbols below represent star masses and distances.

- represents a star with a mass the same as the Sun's mass
- represents a star with a mass greater than the Sun's mass
- d represents a certain distance between star centers
- 2d represents twice the distance between star centers

Which diagram shows two stars that have the greatest gravitational force between them?



91. Which diagram best represents a portion of the heliocentric model of the solar system? [S = Sun, E = Earth, and M = Moon]



92. Which event occurred approximately 4.6 billion years ago?

- A evolution of the earliest fish
- B evolution of stromatolites
- C formation of the oldest known Earth rocks
- D formation of Earth and our solar system

93. Which planet has an orbital eccentricity most like the orbital eccentricity of the Moon?

- A Pluto
- B Saturn
- C Mars
- D Mercury

94. The shape of the orbits of most of the planets in the solar system would best be described as

- A elliptical and very elongated
- B parabolic
- C nearly circular
- D perfectly circular

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

- A periods of revolution
- B orbital velocities
- C mean distances from the Sun
- D equatorial diameters

96. Three planets that are relatively large, gaseous, and of low density are

- A Mercury, Jupiter, and Saturn
- B Venus, Jupiter, and Neptune
- C Mars, Jupiter, and Uranus
- D Jupiter, Saturn, and Uranus

97. It is inferred that during the early Archean Era the atmosphere of Earth contained water vapor, carbon dioxide, nitrogen, and other gases in small amounts. These gases probably came from

- A precipitation of groundwater
- B volcanic eruptions
- C evaporation of Paleozoic oceans
- D convection currents in the mantle

98. Compared to the average density of the terrestrial planets (Mercury, Venus, Earth, and Mars), the average density of the Jovian planets (Jupiter, Saturn, Uranus, and Neptune) is

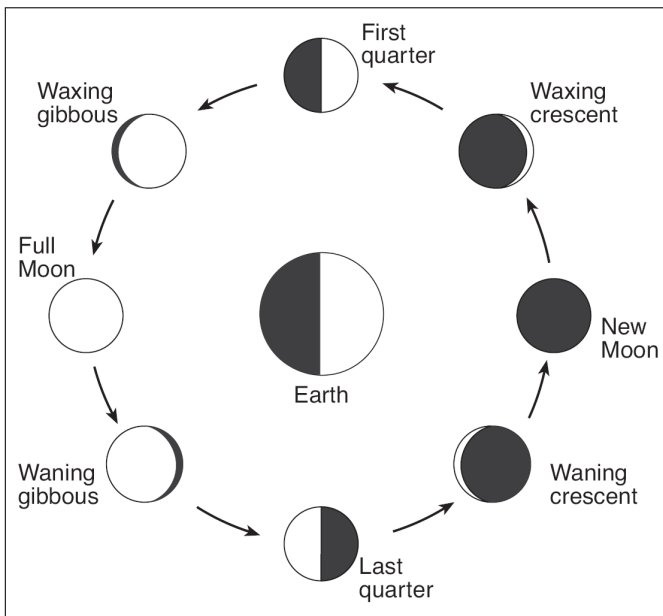
- A less
 - B greater
 - C the same
-

99. Which of the following is not a characteristic of the Jovian planets?

- A they have low average density.
- B they have orbits outside the asteroids.
- C their composition lacks hydrogen.
- D they have large diameters.

100. 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.

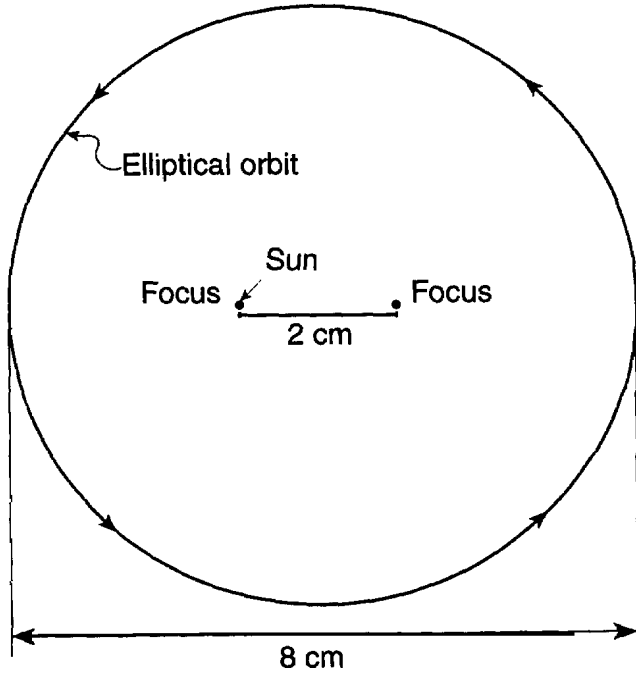


(Not drawn to scale)

What is the eccentricity of the Moon's orbit?

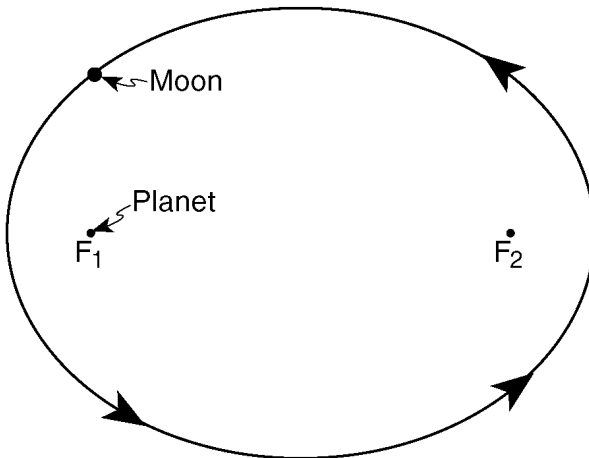
- A 0.017
- B 0.055
- C 0.386
- D 0.723

101. The constructed ellipse below is a true scale model of the orbit of a planet in our solar system. This ellipse best represents the orbit of the planet



- A Neptune B Jupiter C Pluto D Mars

102. 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 .



(Drawn to scale)

- What is the approximate eccentricity of this elliptical orbit?
- A 0.3 B 0.5 C 0.7 D 1.4

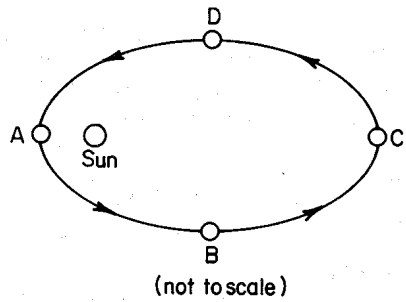
103. The speed of a planet in its orbit around the Sun depends primarily on the planet's

- A direction of revolution
- B distance from the Sun
- C polar circumference
- D axial tilt

104. Which planet is located approximately ten times farther from the Sun than Earth is from the Sun?

- A Mars
- B Jupiter
- C Saturn
- D Uranus

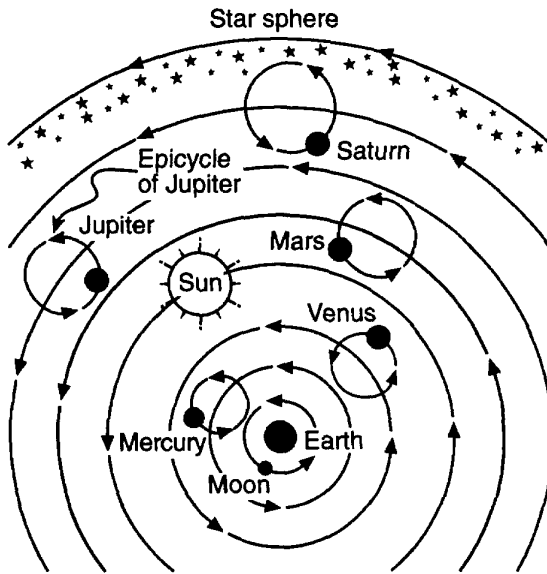
105. The diagram below shows a planet's orbit around the Sun.



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

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

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



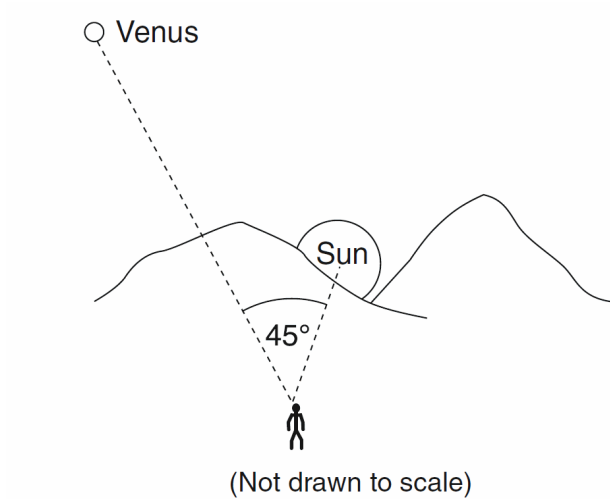
What type of model does the diagram best demonstrate?

- 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

107. An observer on Earth determines that the apparent diameter of the Moon as viewed from Earth varies in a cyclic manner. The best explanation for this observation is that the

- A Moon is rotating
 - B Moon's orbit is elliptical
 - C atmospheric transparency of the Moon changes
 - D distance between the Moon and the Sun changes
-

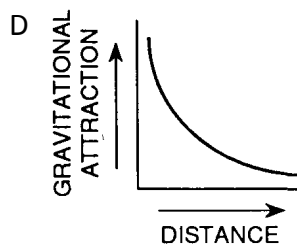
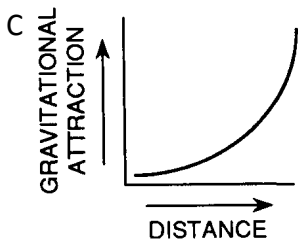
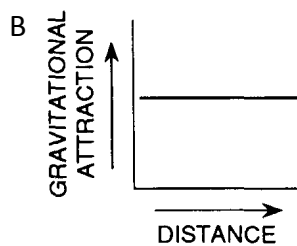
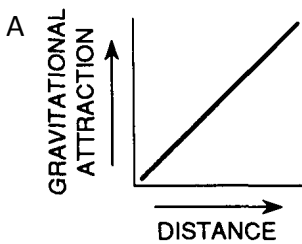
108. An observer on Earth measures the angle of sight between Venus and the setting Sun.



Which statement best describes and explains the apparent motion of Venus over the next few hours?

- A Venus will set 1 hour after the Sun because Earth rotates at 45° per hour.
- B Venus will set 2 hours after the Sun because Venus orbits Earth faster than the Sun orbits Earth.
- C Venus will set 3 hours after the Sun because Earth rotates at 15° per hour.
- D Venus will set 4 hours after the Sun because Venus orbits Earth slower than the Sun orbits Earth.

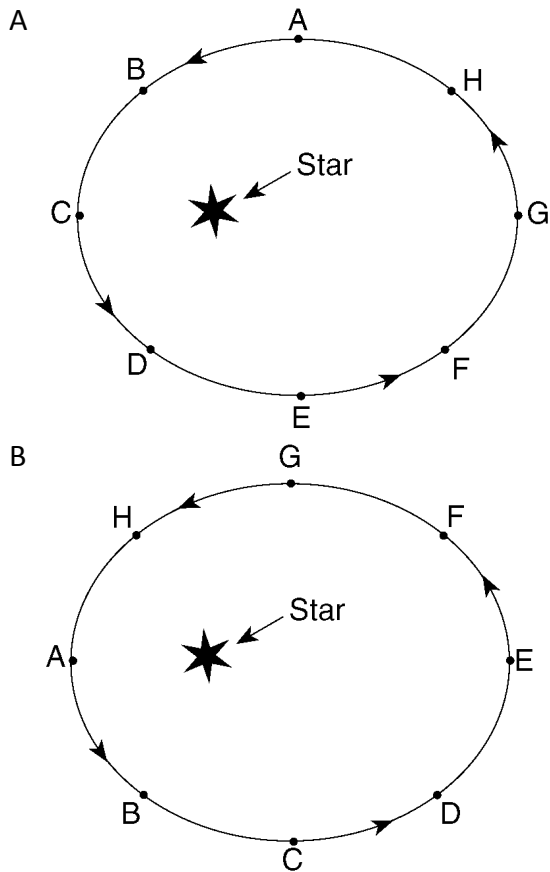
109. Which graph best represents the relationship between the gravitational attraction of two objects and their distance from each other?

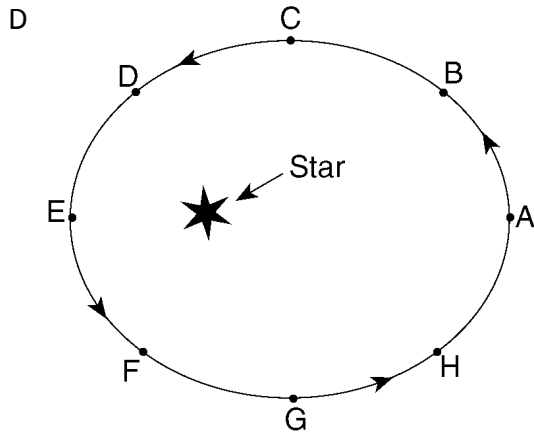
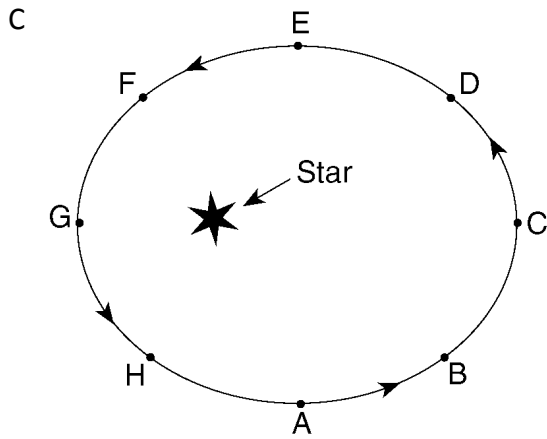


110. The table below shows gravitational data for a planet traveling in an elliptical orbit around a star. The table shows the relative gravitational force between the star and this planet at eight positions in the orbit (letters *A* through *H*). Higher numbers indicate stronger gravitational attraction.

Planet's Position in the Orbit	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>
Relative Gravitational Force Between Star and Planet	52	42	25	12	10	12	25	42

Which diagram best represents the positions of the planet in its orbit that would produce the gravitational forces shown in the data table?





111. What is the main reason that the gravitational attraction between Earth and the Moon changes each day?

- A Earth's axis is tilted at 23.5° .
- B Earth's rotational speed varies with the seasons.
- C The Moon has an elliptical orbit.
- D The Moon has a spherical shape.

112. Which planet has vast amounts of liquid water at its surface?

- A Venus
- B Mars
- C Jupiter
- D Earth

Base your answers to questions **113** through **116** on the passage and diagram below. The diagram shows the orbits of the four inner planets and the asteroid Hermes around the Sun. Point A represents a position along Hermes' orbit.

The Curious Tale of Asteroid Hermes

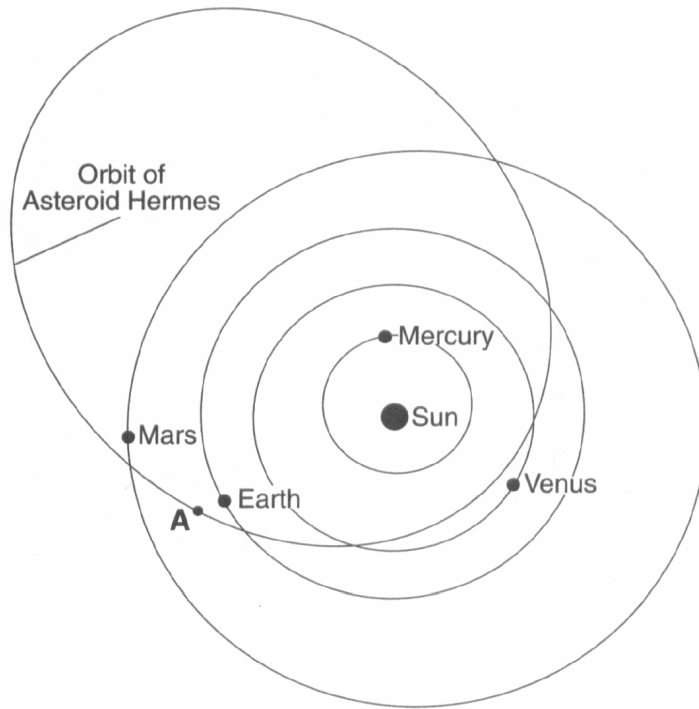
It's dogma [accepted belief] now: an asteroid hit Earth 65 million years ago and wiped out the dinosaurs. But in 1980 when scientists Walter and Luis Alvarez first suggested the idea to a gathering at the American Association for Advancement of Sciences, their listeners were skeptical. Asteroids hitting Earth? Wiping out species? It seemed incredible.

At that very moment, unknown to the audience, an asteroid named Hermes halfway between Mars and Jupiter was beginning a long plunge toward our planet. Six months later it would pass 300,000 miles from Earth's orbit, only a little more than the distance to the Moon....

Hermes approaches Earth's orbit twice every 777 days. Usually our planet is far away when the orbit crossing happens, but in 1937, 1942, 1954, 1974 and 1986, Hermes came harrowingly [dangerously] close to Earth itself. We know about most of these encounters only because Lowell Observatory astronomer Brian Skiff rediscovered Hermes on Oct. 15, 2003.

Astronomers around the world have been tracking it carefully ever since....

Excerpted from "The Curious Tale of Asteroid Hermes," Dr. Tony Phillips, *Science @ NASA*, November 3, 2003



(Not drawn to scale)

113. When Hermes is located at position A and Earth is in the position shown in the diagram, the asteroid can be viewed from Earth at each of the following times *except*

- A sunrise B sunset C 12 noon D 12 midnight

114. Why is evidence of asteroids striking Earth so difficult to find?

- A Asteroids are made mostly of frozen water and gases and are vaporized on impact.
 B Asteroids are not large enough to leave impact craters.
 C Asteroids do not travel fast enough to create impact craters.
 D Weathering, erosion, and deposition on Earth have destroyed or buried most impact craters.

115. How does the period of revolution of Hermes compare to the period of revolution of the planets shown in the diagram?

- A Hermes has a longer period of revolution than Mercury, but a shorter period of revolution than Venus, Earth, and Mars.
 B Hermes has a shorter period of revolution than Mercury, but a longer period of revolution than Venus, Earth, and Mars.
 C Hermes has a longer period of revolution than all of the planets shown.
 D Hermes has a shorter period of revolution than all of the planets shown.

116. According to the diagram, as Hermes and the planets revolve around the Sun, Hermes appears to be a threat to collide with

- A Earth, only
 - B Earth and Mars, only
 - C Venus, Earth, and Mars, only
 - D Mercury, Venus, Earth, and Mars
-

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

- A The Earth would revolve around the Sun.
- B The Earth would rotate on its axis.
- C The Moon would revolve around the Sun.
- D The Sun would revolve around the Earth.

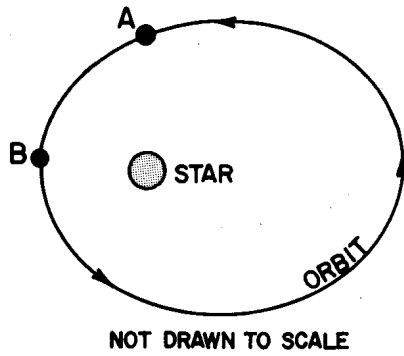
118. Compared to the terrestrial planets, the Jovian planets have

- A smaller diameters
- B greater average densities
- C slower rates of rotation
- D longer periods of revolution

119. If viewed from the Earth over a period of several years, the apparent diameter of Mars will

- A decrease constantly
 - B increase constantly
 - C remain unchanged
 - D vary in a cyclic manner
-

120. The diagram below represents a planet in orbit around a star.



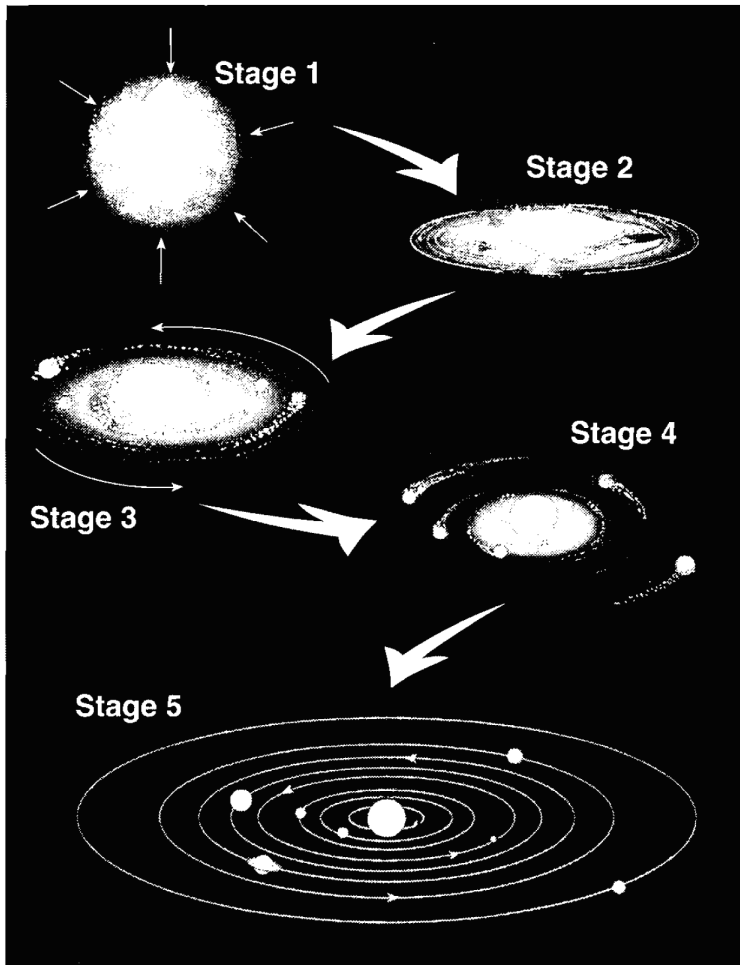
Which statement best describes how the planet's energy is changing as it moves from point *A* to point *B*?

- A Kinetic energy is increasing and potential energy is decreasing.
- B Kinetic energy is decreasing and potential energy is increasing.
- C Both kinetic and potential energy are decreasing.
- D Both kinetic and potential energy are increasing.

121. The period of time a planet takes to make one revolution around the Sun is most dependent on the planet's average

- A rotation rate
 - B mass
 - C insolation from the Sun
 - D distance from the Sun
-

122. Base your answer to the following question on the diagram below. The diagram represents the inferred stages in the formation of our solar system. Stage 1 shows a contracting gas cloud. The remaining stages show the gas cloud flattening into a spinning disk as planets formed around our Sun.



(Not drawn to scale)

Which force was mostly responsible for the contraction of the gas cloud?

- A friction B gravity C magnetism D inertia

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

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

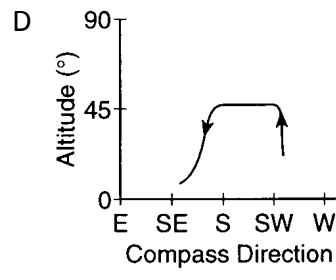
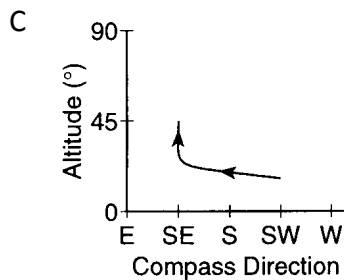
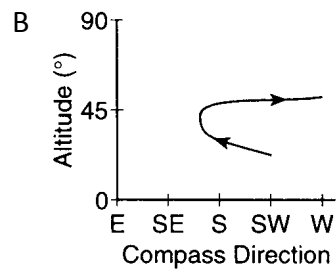
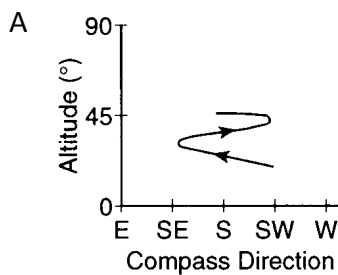
124. The giant planets are composed primarily of

- A hydrogen and helium
- B carbon dioxide
- C iron
- D rocky materials

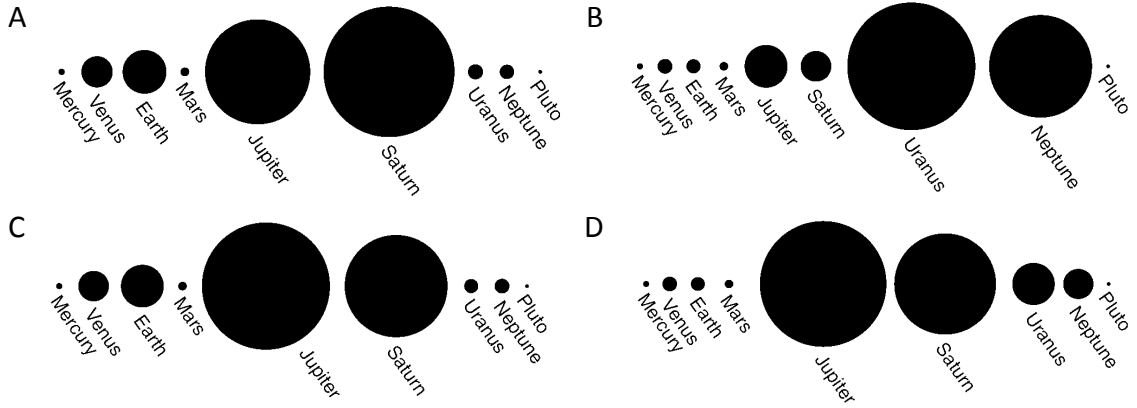
125. The table below shows the altitude and compass direction of one planet, as viewed by an observer in New York State at 10 p.m. on the first day of each month from April through November.

Month	Altitude	Compass Direction
April	20°	SW
May	23°	SSW
June	25°	S
July	29°	SSE
August	33°	SE
September	38°	S
October	42°	SW
November	45°	S

Which graph best represents a plot of this planet's apparent path, as viewed by the observer over the 7-month period?



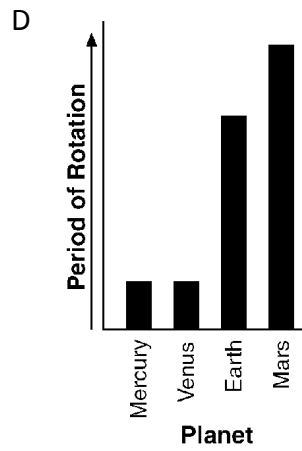
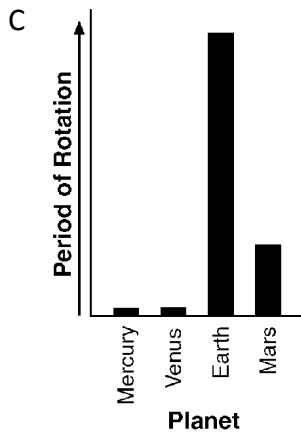
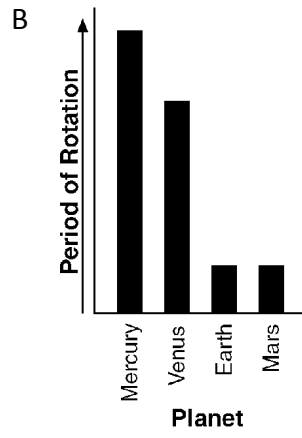
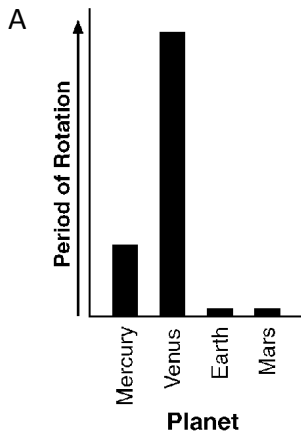
126. Which sequence correctly shows the relative size of the nine planets of our solar system?



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

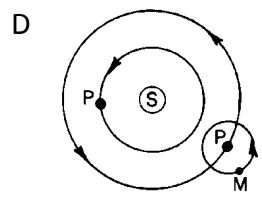
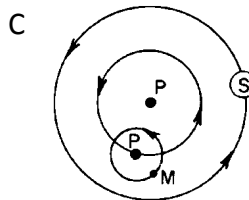
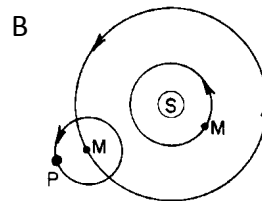
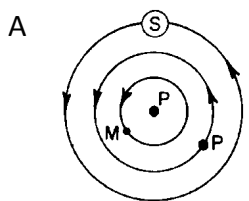
- A much less
- B much greater
- C about the same

128. Which graph best represents the relative periods of rotation of Mercury, Venus, Earth, and Mars?

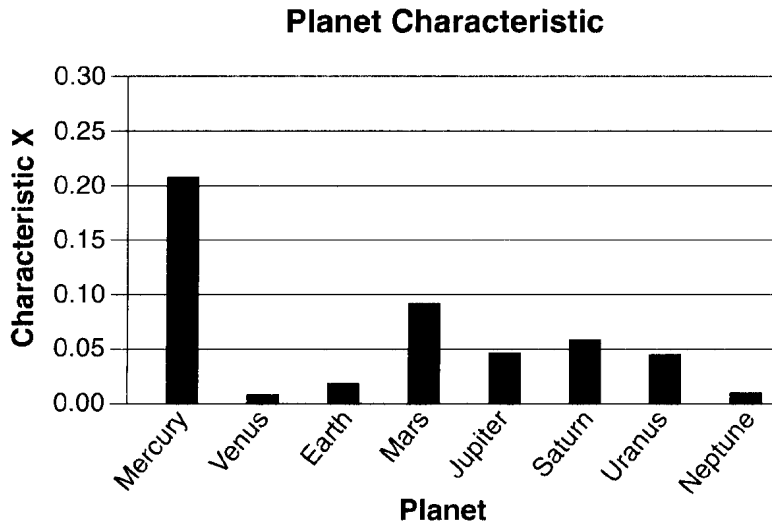


129. Which diagram best represents the motions of celestial objects in a heliocentric model?

Key:
 P● = Planet
 M● = Moon
 ⊙ = Sun



130. The bar graph below shows one planetary characteristic, identified as X, plotted for the planets of our solar system.



Which characteristic of the planets in our solar system is represented by X?

- A mass
- B density
- C eccentricity of orbit
- D period of rotation

131. Differences in Earth's orbital velocity around the Sun are caused primarily by changes in the

- A inclination of Earth's axis
- B rate of rotation of Earth
- C distance between Earth and the Sun
- D oblate spheroid shapes of Earth and the Sun

132. In our solar system, the orbits of the planets are best described as

- A circular, with the planet at the center
- B circular, with the Sun at the center
- C elliptical, with the planet at one of the foci
- D elliptical, with the Sun at one of the foci

133. The force of gravity between two objects will be greatest if their masses are

- A small and they are far apart
- B small and they are close together
- C large and they are far apart
- D large and they are close together

-
134. According to current data, the Earth is apparently the only planet in our solar system that has
- A an orbiting moon
 - B an axis of rotation
 - C atmospheric gases
 - D liquid water on its surface
135. Which object orbits Earth in both the Earth-centered (geocentric) and Sun-centered (heliocentric) models of our solar system?
- A the Moon
 - B the Sun
 - C Venus
 - D *Polaris*
136. Why do the planets in our solar system have a layered internal structure?
- A All planets cooled rapidly after they formed.
 - B The Sun exerts a gravitational force on the planets.
 - C Each planet is composed of materials of different densities.
 - D Cosmic dust settled in layers on the planets' surfaces.
137. As a rotating cloud collapses its rate of rotation
- A decreases
 - B increases
 - C remains the same
138. Which statement best describes the geocentric model of our solar system?
- A The Earth is located at the center of the model.
 - B All planets revolve around the Sun.
 - C The Sun is located at the center of the model.
 - D All planets *except* the Earth revolve around the Sun.
139. For what reason did the heliocentric model of the universe replace the geocentric model of the universe?
- A The geocentric model no longer predicted the positions of the constellations.
 - B The geocentric model did not predict the phases of the Moon.
 - C The heliocentric model provided a simpler explanation of the motions of the planets.
 - D The heliocentric model proved that the Earth rotates.
-

140. What was the most abundant gas present in the original planetary atmosphere?

A methane

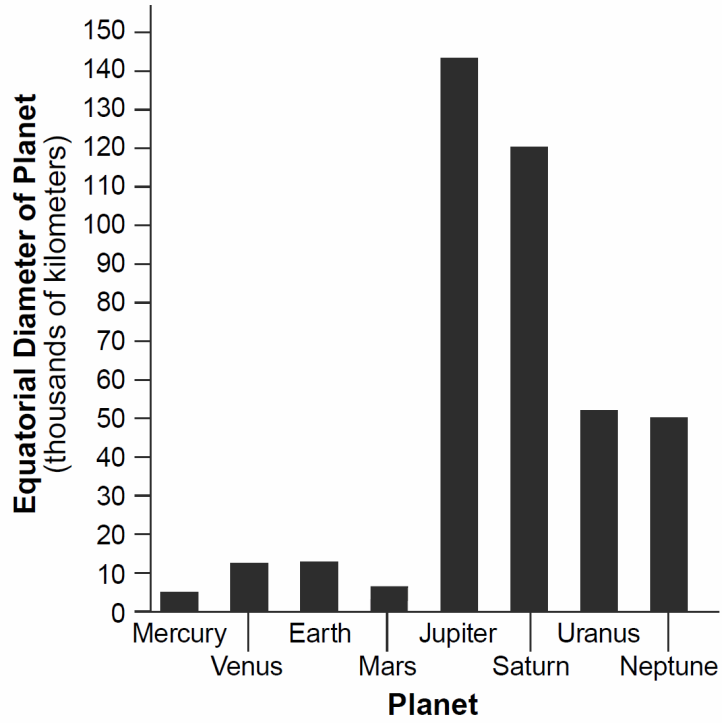
B hydrogen

C water vapor

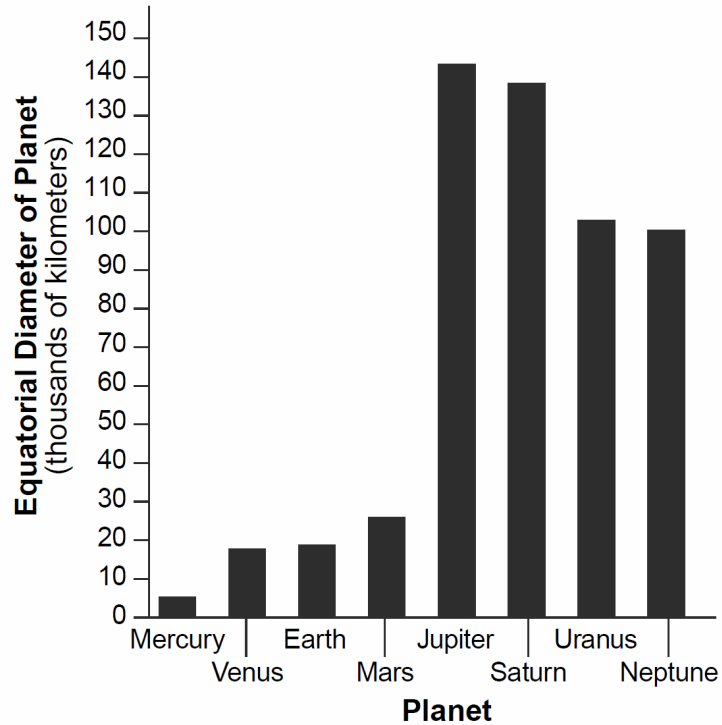
D carbon dioxide

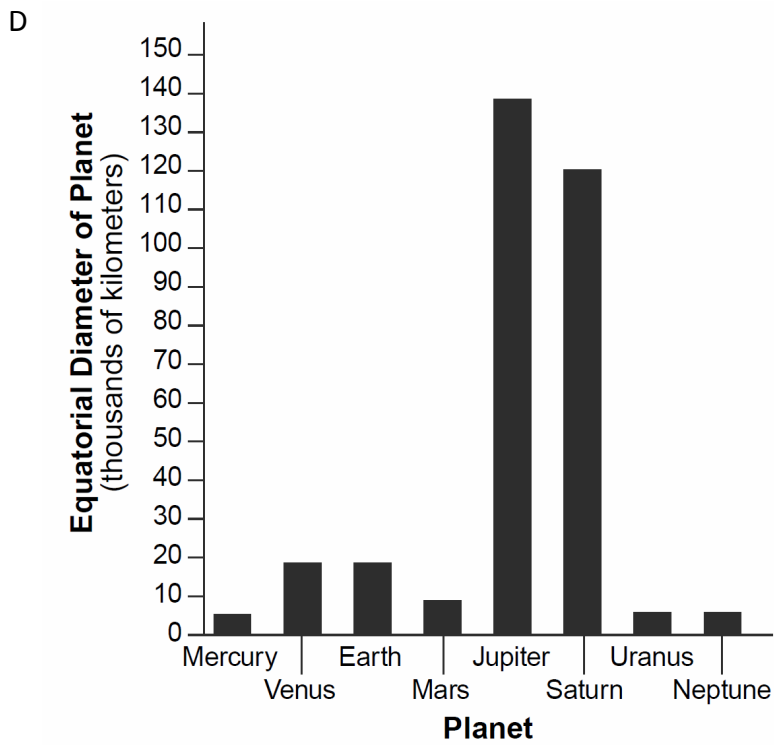
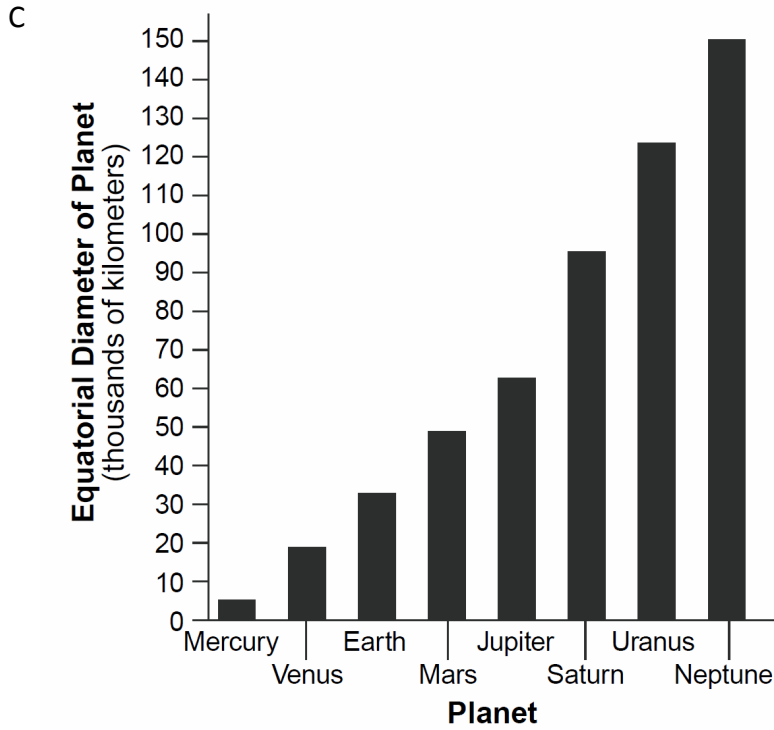
141. Which bar graph best represents the equatorial diameters of the eight planets of our solar system?

A



B





142. Which planet has the *least* distance between the two foci of its elliptical orbit?

- A Venus B Earth C Mars D Jupiter

143. Which object has the most elongated orbit?

- A Mercury B Earth's moon C Neptune D Pluto

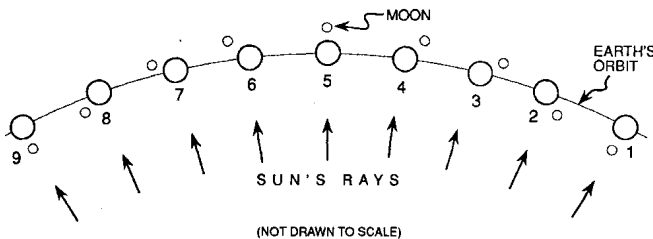
144. Which apparent motion can be explained by a geocentric model?

- A deflection of the wind B curved path of projectiles
C motion of a Foucault pendulum D the sun's path through the sky

145. Which motion causes some constellations to be visible in New York State only during winter nights and other constellations to be visible only during summer nights?

- A Stars in constellations revolve around Earth.
B Stars in constellations revolve around the Sun.
C Earth revolves around the Sun.
D Earth rotates on its axis.

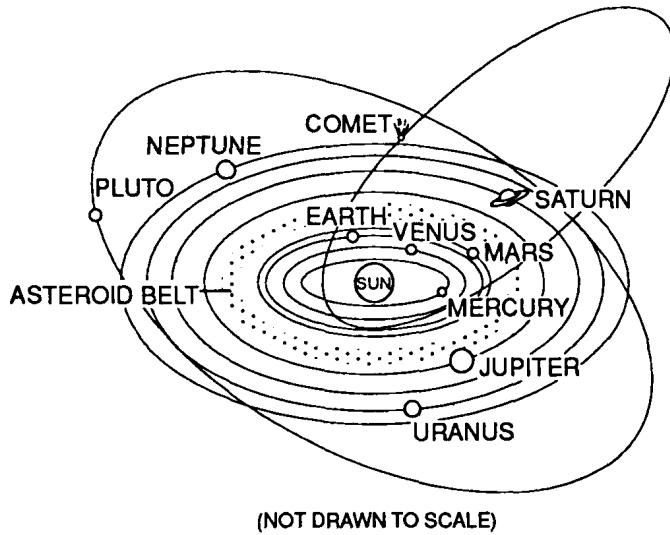
146. Base your answer to the following question on the diagram below which represents nine positions of the Earth in orbit around the Sun during one complete orbit of the Moon around the Earth.



The elliptical shape of the Moon's orbit around the Earth causes

- A changes in the gravitational attraction between the Moon and the Earth
B the Earth to have an equatorial bulge
C the Moon's period of rotation to equal its period of revolution
D the $23\frac{1}{2}^\circ$ tilt of the Earth's axis of rotation
-

147. The diagram below represents our solar system.



This system is best classified as

- A geocentric, with elliptical orbits
- B geocentric, with circular orbits
- C heliocentric, with elliptical orbits
- D heliocentric, with circular orbits

148. An astronomical unit (A.U.) is

- A a term for defining the luminosity of a star
- B the average distance from the Earth to the sun
- C the average distance of any given planet to the sun
- D equal to a light year

149. Compared to the other planets in our solar system, Jupiter, Saturn, and Neptune have

- A shorter periods of rotation
- B shorter periods of revolution
- C greater eccentricities
- D greater densities

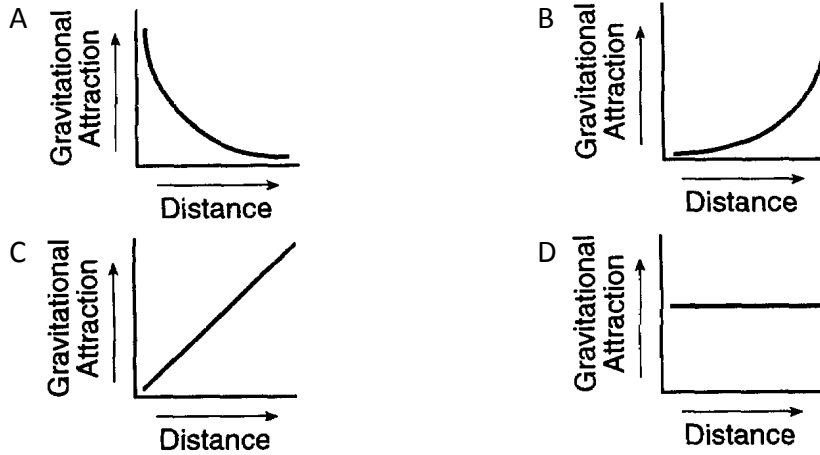
150. Which change always occurs as the distance between the Earth and the Sun decreases?

- A The gravitational force between the Earth and the Sun decreases.
 - B The Sun's apparent diameter decreases.
 - C The Sun's rate of rotation increases.
 - D The Earth's orbital speed increases.
-

151. Which object in our solar system has the greatest density?

- A Jupiter B Earth C the Moon D the Sun

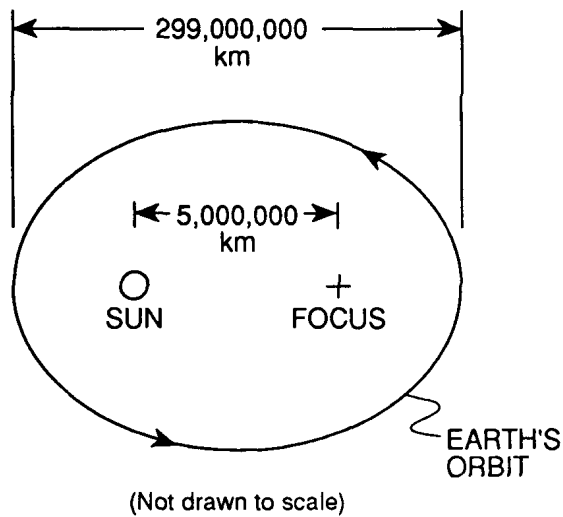
152. Which graph best represents the relationship between the gravitational attraction of two objects and their distance from each other?



153. The density of the sun is closest to the density of

- A Earth B Jupiter C Earth's moon D an asteroid
-

154. The diagram below represents the elliptical orbit of the Earth around the Sun.



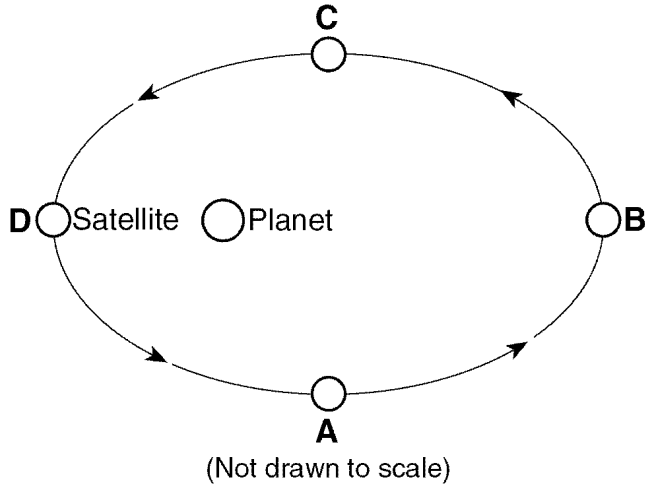
Which equation should be used to find the eccentricity of the Earth's orbit?

- A eccentricity = $\frac{299,000,000 \text{ km}}{5,000,000 \text{ km}}$
- B eccentricity = $\frac{5,000,000 \text{ km}}{299,000,000 \text{ km}}$
- C eccentricity = $299,000,000 \text{ km} - 5,000,000 \text{ km}$
- D eccentricity = $\frac{5,000,000 \text{ km}}{299,000,000 \text{ km} - 5,000,000 \text{ km}}$

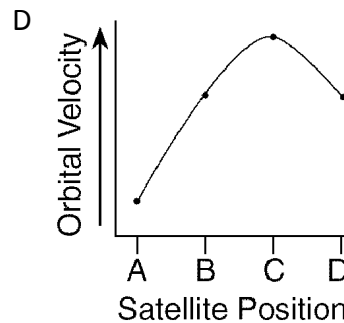
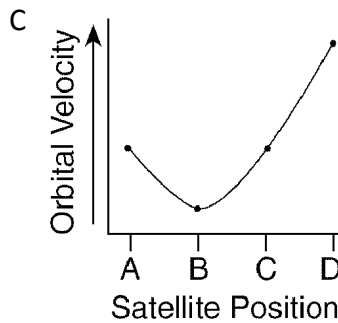
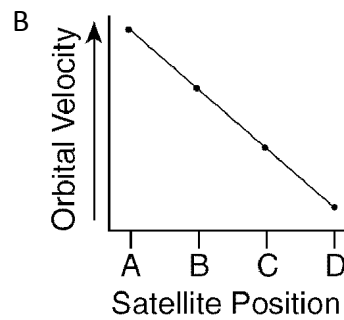
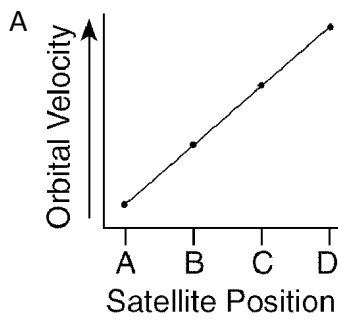
155. Why are impact structures (craters) more common on the surface of Mars than on the surfaces of Venus, Earth, and Jupiter?

- A Mars has the greatest surface area and receives more impacts.
 - B The tiny moons of Mars are breaking into pieces and showering its surface with rock fragments.
 - C Mars has a strong magnetic field that attracts iron-containing rock fragments from space.
 - D The thin atmosphere of Mars offers little protection against falling rock fragments from space.
-

156. The diagram below shows a satellite in four different positions as it revolves around a planet.



Which graph best represents the changes in this satellite's orbital velocity as it revolves around the planet?

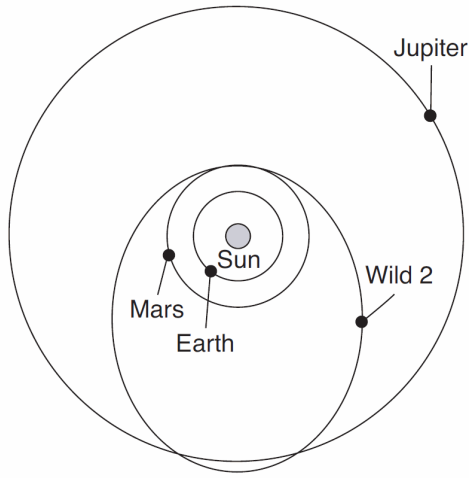


157. The actual shape of the Earth's orbit around the Sun is best described as

- A a very eccentric ellipse
- C an oblate spheroid

- B a slightly eccentric ellipse
- D a perfect circle

158. The diagram below shows the orbital paths of Earth, Mars, Jupiter, and a comet named Wild 2.



(Not drawn to scale)

What is the approximate distance between the Sun and Wild 2 when this comet is closest to the Sun?

- A 150 million kilometers
- B 228 million kilometers
- C 778 million kilometers
- D 820 million kilometers

159. Which planet would float if it could be placed in water?

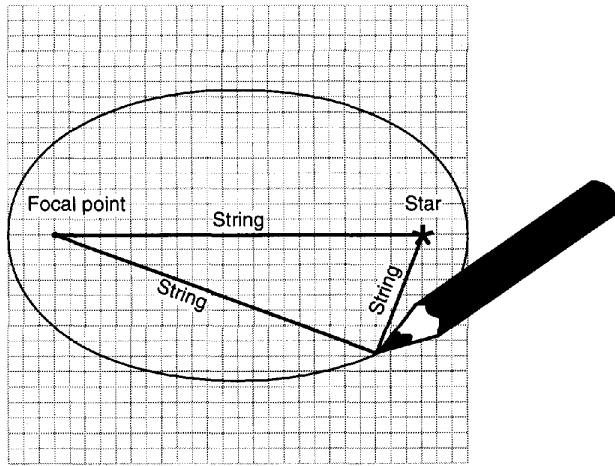
- A Mercury
- B Earth
- C Saturn
- D Pluto

160. Which of the following has the lowest density?

- A the planet Saturn
 - B the planet Jupiter
 - C the planet Earth
 - D salt water
-

161. The diagram below represents the construction of a model of an elliptical orbit of a planet traveling around a star.

The focal point and the center of the star represent the foci of the orbit.



(Drawn to scale)

The eccentricity of this orbit is approximately

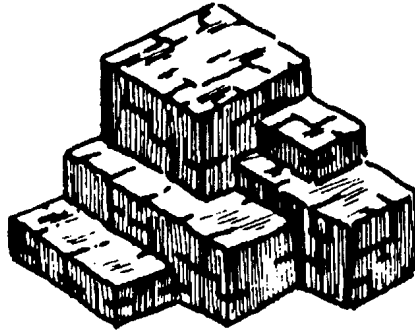
- A 1.3 B 0.8 C 0.5 D 0.3

162. Compared to the terrestrial planets, the Jovian planets are

- A smaller and have lower densities B smaller and have greater densities
C larger and have lower densities D larger and have greater densities
-

163. Base your answer to the following question on the diagram and table below.

Mineral Sample A



Mass = 210 grams

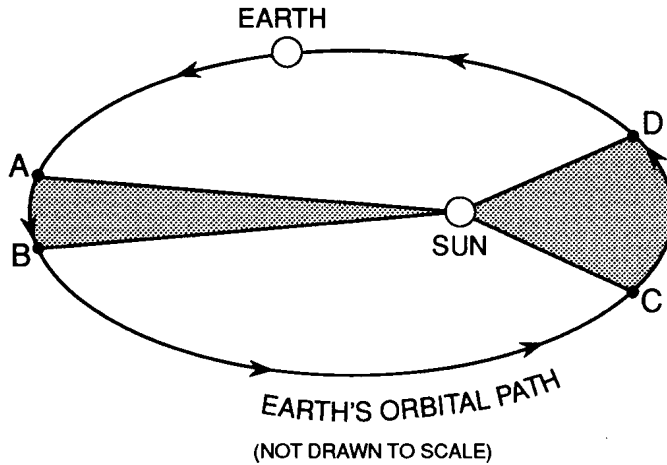
Mineral Density Table

Mineral	Density (g/cm ³)	Mineral	Density (g/cm ³)
Gypsum	2.3	Hornblende	3.2
Orthoclase	2.6	Chalcopyrite	4.2
Quartz	2.7	Pyrite	5.0
Calcite	2.7	Magnetite	5.2
Dolomite	2.9	Galena	7.5
Fluorite	3.2	Copper	8.9

If the volume of mineral sample A is 28 cubic centimeters, sample A is most likely

- A copper B galena C chalcopyrite D dolomite

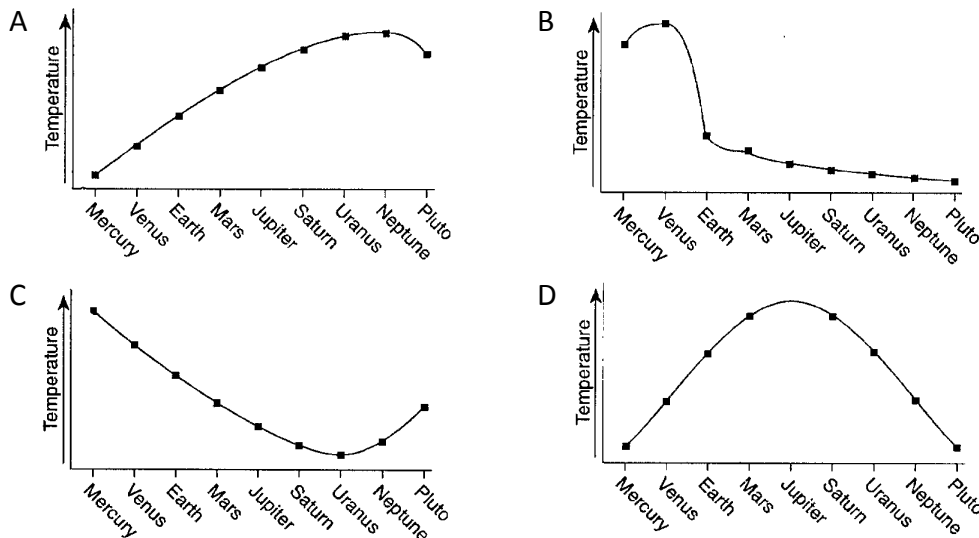
164. The diagram below represents the Earth's orbital path around the Sun. The Earth takes the same amount of time to move from *A* to *B* as from *C* to *D*.



Which values are equal within the system?

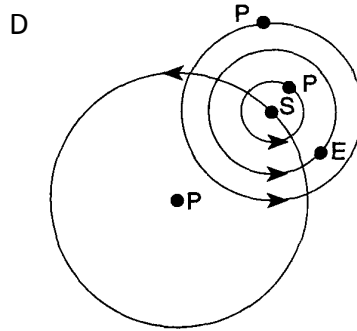
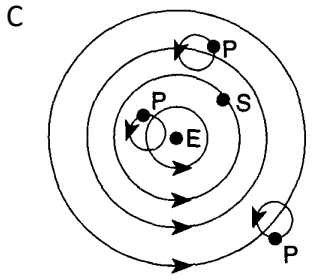
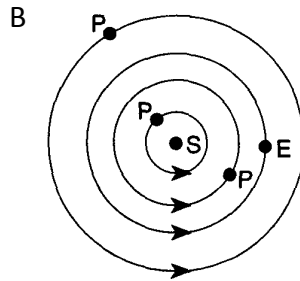
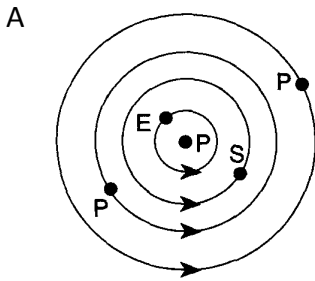
- A The shaded sections of the diagram are equal in area.
- B The distance from the Sun to the Earth is the same at point *A* and at point *D*.
- C The orbital velocity of the Earth at point *A* equals its orbital velocity at point *C*.
- D The gravitational force between the Earth and the Sun at point *B* is the same as the gravitational force at point *D*.

165. Which graph best illustrates the average temperatures of the planets in the solar system?



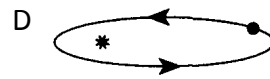
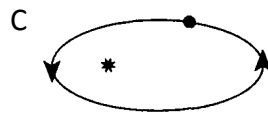
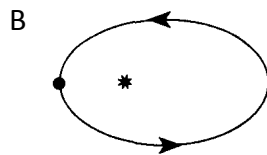
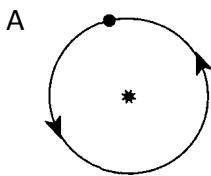
166. Which diagram represents a geocentric model?

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



167. Which diagram shows a planet with the *least* eccentric orbit?

(Key: • = planet * = star)



168. Which object is located at one foci of the elliptical orbit of Mars?

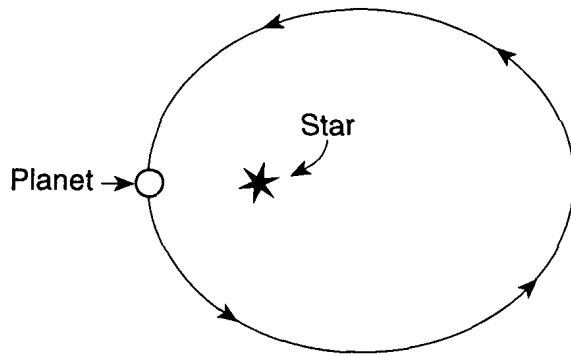
A the Sun

B *Betelgeuse*

C Earth

D Jupiter

169. The diagram below represents a planet revolving in an elliptical orbit around a star.



As the planet makes one complete revolution around the star, starting at the position shown, the gravitational attraction between the star and the planet will

- A decrease, then increase
- B increase, then decrease
- C continually decrease
- D remain the same

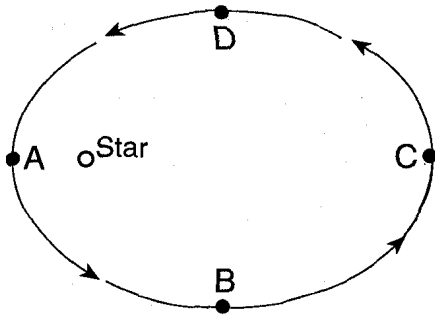
170. Because Venus has greater atmospheric carbon dioxide (CO_2) content than Earth has, the surface temperature of Venus is

- A warmer, due to absorption of long-wave (infrared) radiation by a greenhouse gas
- B warmer, due to absorption of short-wave (ultraviolet) radiation by a greenhouse gas
- C cooler, due to absorption of long-wave (infrared) radiation by a greenhouse gas
- D cooler, due to absorption of short-wave (ultraviolet) radiation by a greenhouse gas

171. Compared to the Jovian planets in our solar system, Earth is

- A less dense and closer to the Sun
 - B less dense and farther from the Sun
 - C more dense and closer to the Sun
 - D more dense and farther from the Sun
-

172. Base your answer to the question below on the diagram below. The diagram represents the path of a planet orbiting a star. Points *A*, *B*, *C*, and *D* indicate four orbital positions of the planet.



When viewed by an observer on the planet, the star has the largest apparent diameter at position

- A A B B C C D D

173. How do Jupiter's density and period of rotation compare to Earth's?

- A Jupiter is less dense and has a longer period of rotation.
- B Jupiter is less dense and has a shorter period of rotation.
- C Jupiter is more dense and has a longer period of rotation.
- D Jupiter is more dense and has a shorter period of rotation.

174. The average temperature of the planets

- A increases with greater distance from the Sun
- B decreases with greater distance from the Sun
- C has no relationship to the distance from the Sun
- D depends only on the chemical composition of the atmosphere of each planet

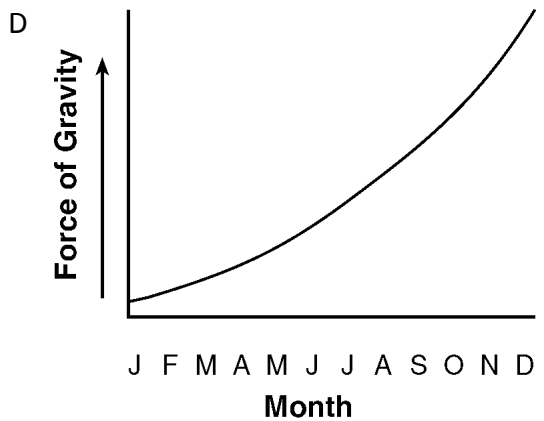
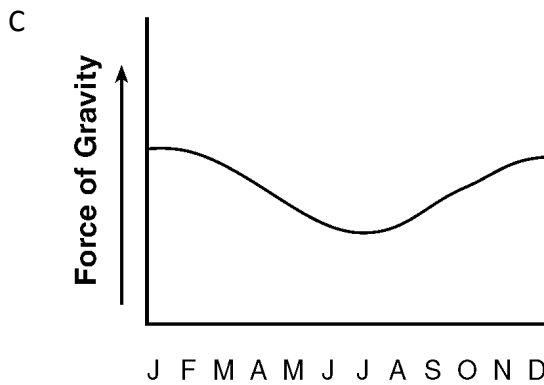
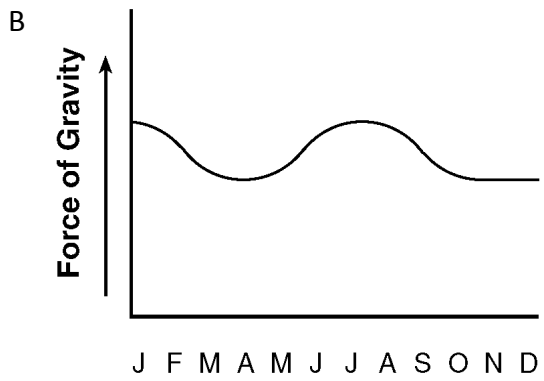
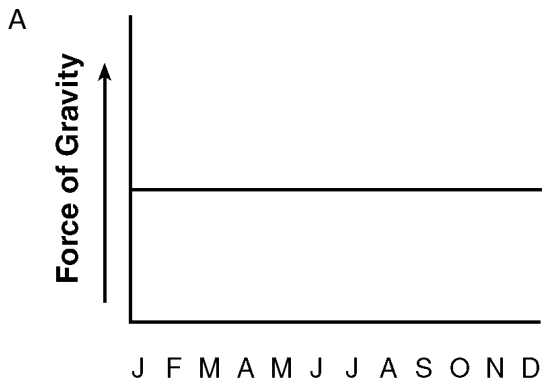
175. Which planet's diameter is approximately four times Earth's diameter?

- A Venus B Jupiter C Saturn D Uranus

176. Earth is farthest from the Sun during the Northern Hemisphere's summer, and Earth is closest to the Sun during the Northern Hemisphere's winter. During which season in the Northern Hemisphere is Earth's orbital velocity greatest?

- A winter B spring C summer D fall
-

177. Which graph best represents the force of gravity between Earth and the Sun during one revolution of Earth around the Sun?



178. Which planet below has the highest average density?

A Earth

B Uranus

C Jupiter

D Saturn