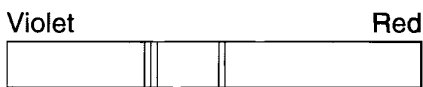


- The red shift of light from most galaxies is evidence that
 - most galaxies are moving away from Earth
 - a majority of stars in most galaxies are red giants
 - the light slows down as it nears Earth
 - red light travels faster than other colors of light
- A blue shift of the light from a star indicates that the star
 - will soon become a main sequence star
 - will soon become a giant star
 - is moving closer to Earth
 - is moving away from Earth
- The theory that the universe is expanding is supported by the
 - blue shift of light from distant galaxies
 - red shift of light from distant galaxies
 - nuclear fusion occurring in the Sun
 - radioactive decay occurring in the Sun
- The diagram below represents the bright-line spectrum for an element.

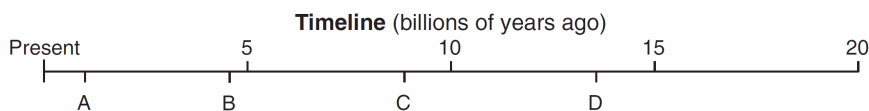


The spectrum of the same element observed in the light from a distant star is shown below.



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

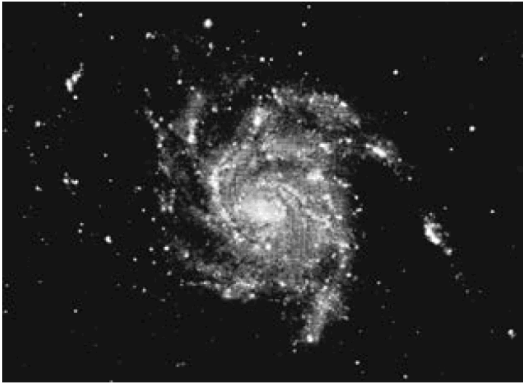
- toward Earth
 - away from Earth
 - in an elliptical orbit around the Sun
 - in a circular orbit around the Sun
- The timeline below represents time from the present to 20 billion years ago. Letters *A*, *B*, *C*, and *D* represent specific times.



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

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

-
6. Earth, the Sun, and billions of stars are contained within
- A) a single constellation
 - B) the Milky Way galaxy
 - C) the solar system
 - D) a giant cloud of gas
7. Fourteen billion years represents the approximate age of
- A) Earth
 - B) Earth's Moon
 - C) our solar system
 - D) the universe
8. The photograph below shows a feature of the universe as seen through a telescope.

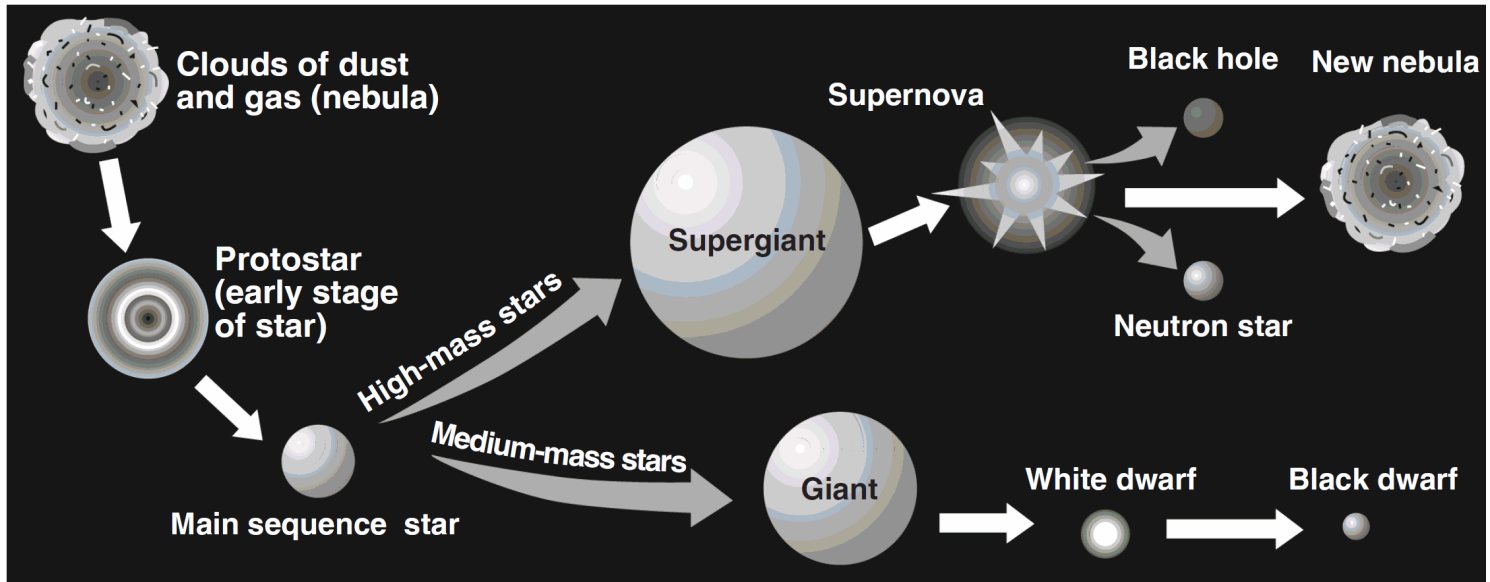


This feature is best identified as

- A) a galaxy
 - B) a comet
 - C) an asteroid
 - D) a star
9. Which evidence best supports the theory that the universe was created by an explosion called the Big Bang?
- A) impact craters found on Earth
 - B) cosmic background radiation
 - C) the different compositions of terrestrial and Jovian planets
 - D) the blue shift of light from distant galaxies
-

Base your answers to questions 10 through 13 on the diagram below and on your knowledge of Earth science. The diagram represents two possible sequences in the evolution of stars.

Stages of Star Evolution



(Not drawn to scale)

10. Which process generates the energy that is released by stars?

- A) nuclear fusion
- B) thermal conduction
- C) convection currents
- D) radioactive decay

11. Which table includes data that are characteristic of the surface temperature and luminosity of some white dwarf stars?

- A)

Surface Temperature	5000 K
Luminosity	100
- B)

Surface Temperature	5000 K
Luminosity	0.001
- C)

Surface Temperature	10,000 K
Luminosity	100
- D)

Surface Temperature	10,000 K
Luminosity	0.001

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

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

13. What causes clouds of dust and gas to form a protostar?

- A) magnetism
B) gravitational attraction
C) expansion of matter
D) cosmic background radiation
-

14. 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

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

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

16. Which star has a surface temperature most similar to the surface temperature of *Alpha Centauri*?

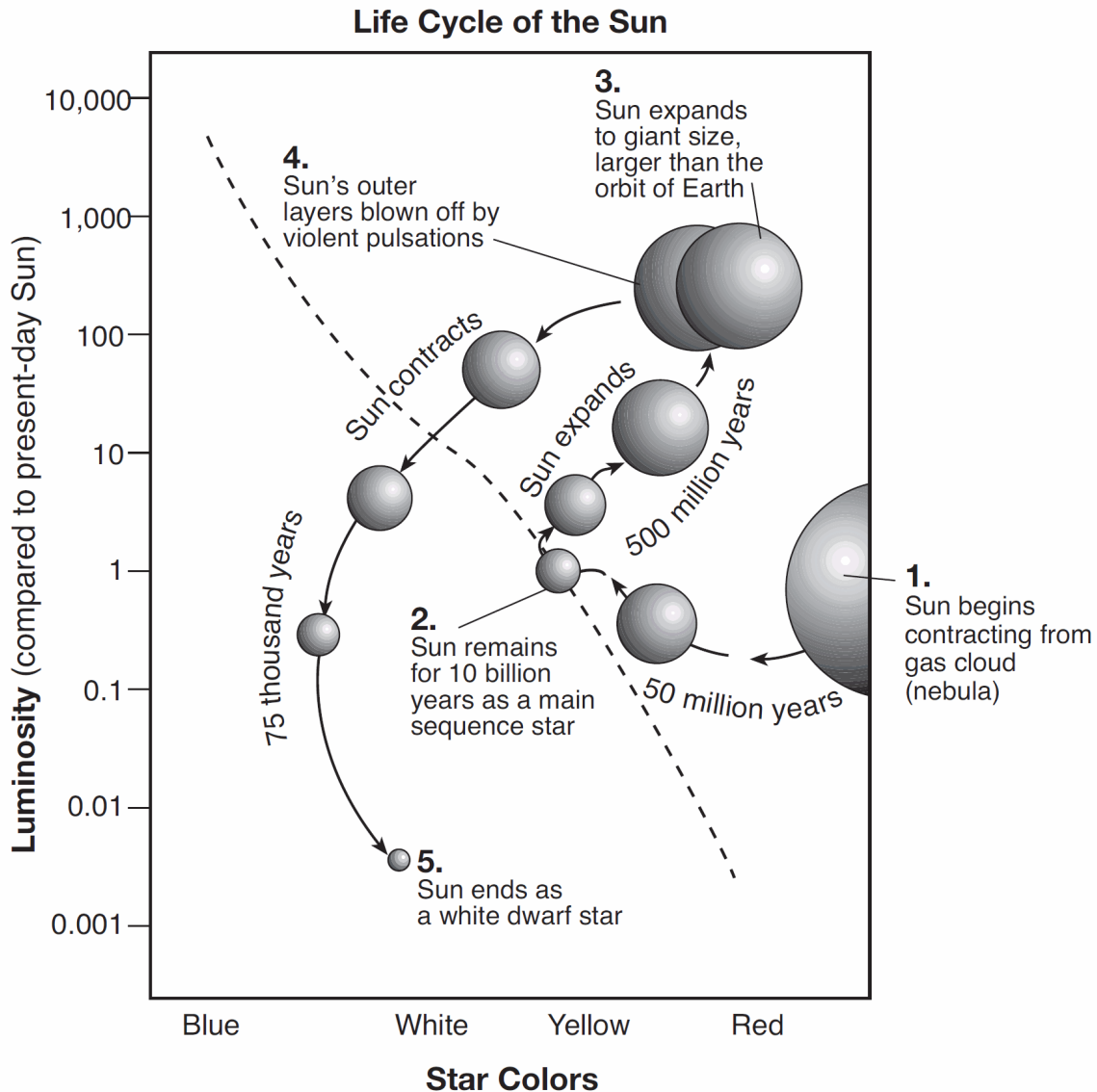
- A) *Polaris*
B) *Betelgeuse*
C) *Procyon B*
D) *Sirius*

17. Which statement describes the general relationship between the temperature and the luminosity of main sequence stars?

- A) As temperature decreases, luminosity increases.
B) As temperature decreases, luminosity remains the same.
C) As temperature increases, luminosity increases.
D) As temperature increases, luminosity remains the same.
-

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

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



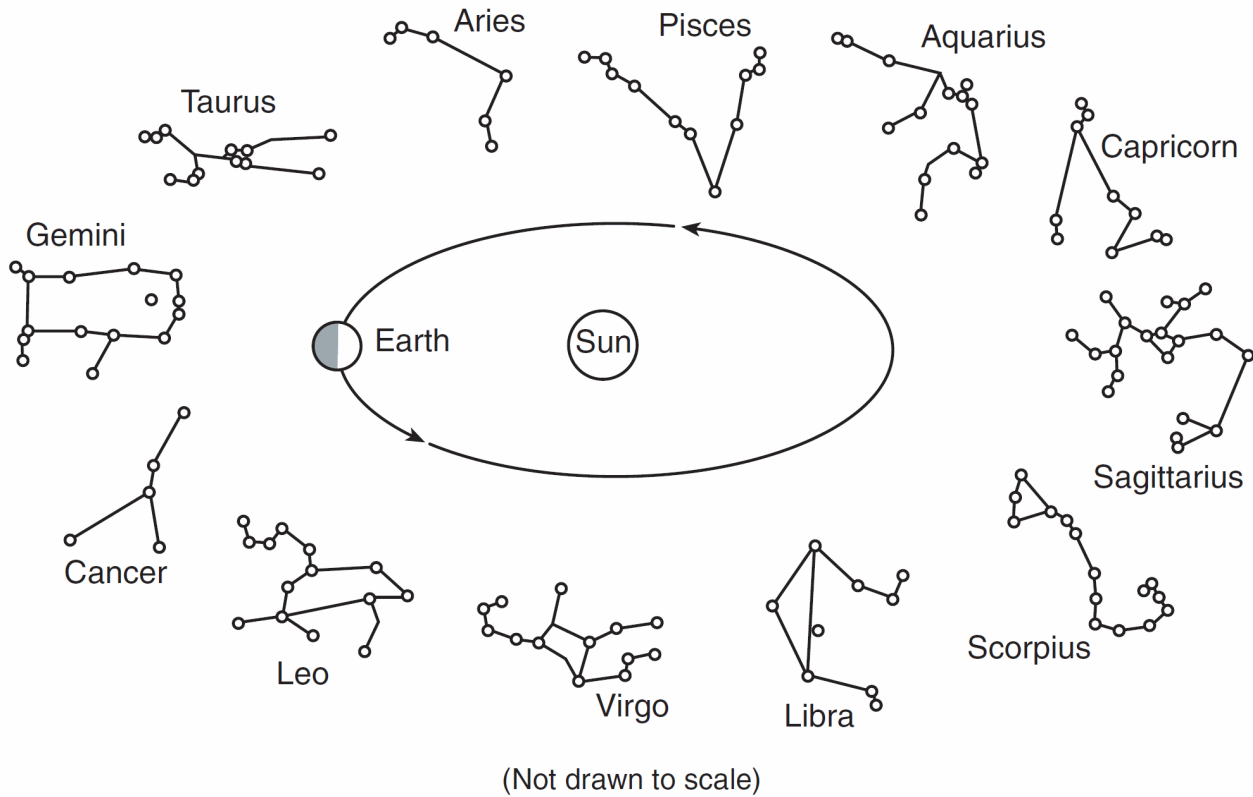
The Sun is inferred to be the most luminous when it is classified as a

- A) white dwarf star B) gas cloud (nebula)
C) main sequence star D) giant star

19. What celestial phenomenon most affects radio communication and other electrical atmospheric changes for us on earth?

- A) solar eclipses
B) solar flares
C) meteorites entering the atmosphere
D) lunar eclipses

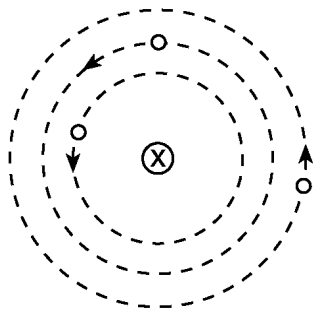
20. The diagram below represents some constellations and one position of Earth in its orbit around the Sun. These constellations are visible to an observer on Earth at different times of the year.



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

- A) Libra and Virgo
- B) Gemini and Taurus
- C) Aquarius and Capricorn
- D) Cancer and Sagittarius

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



- A) Earth
- B) Sun
- C) Moon
- D) Polaris

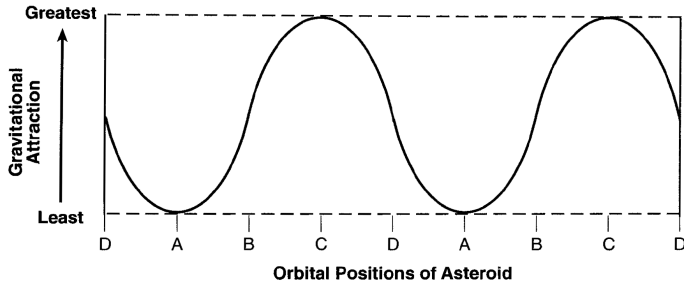
22. In which type of model are the Sun, other stars, and the Moon in orbit around the Earth?

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

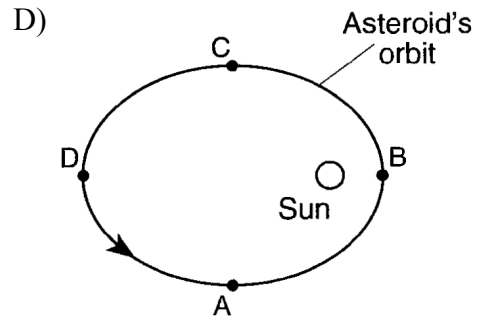
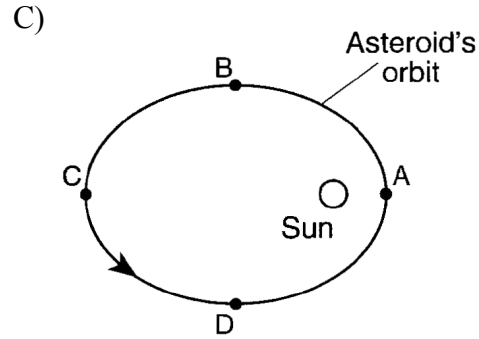
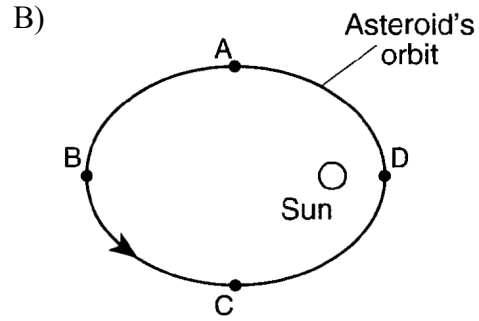
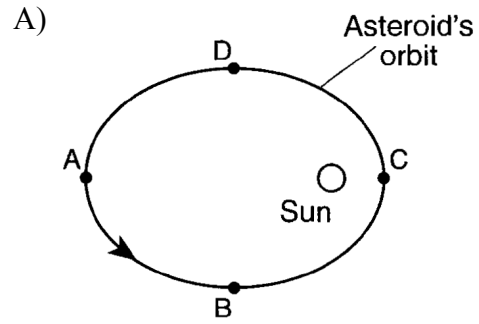
23. This diagram of our solar system represents a

- A) geocentric model with the Sun near the center
- B) geocentric model with Earth near the center
- C) heliocentric model with the Sun near the center
- D) heliocentric model with Earth near the center

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



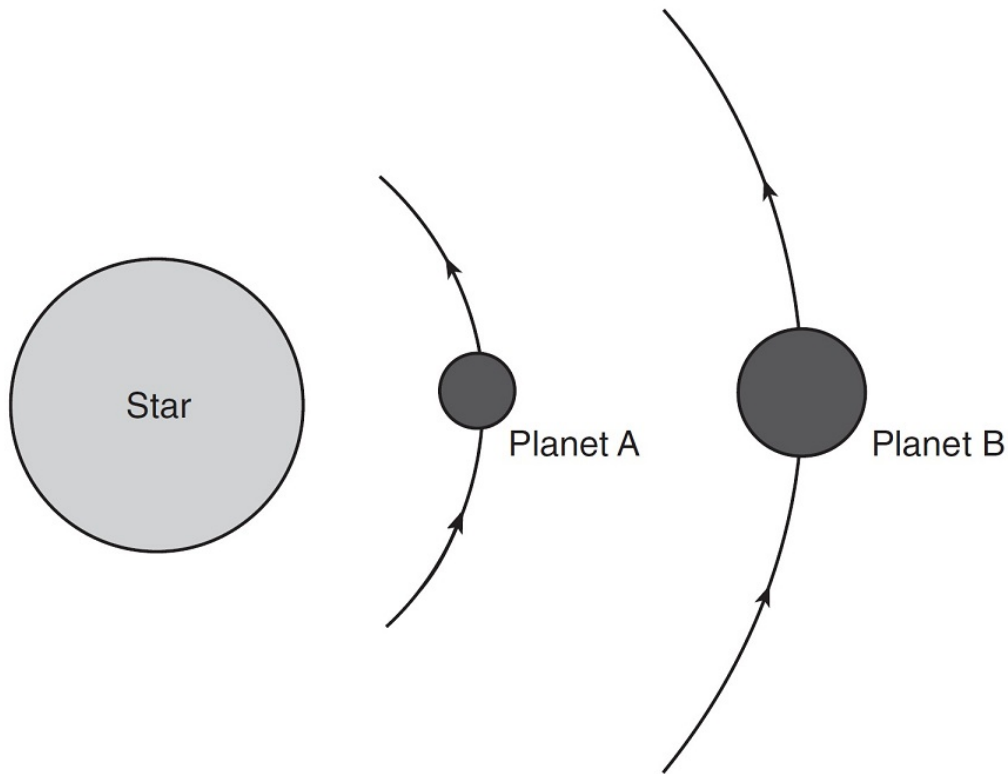
Which diagram best represents the positions of the asteroid in its orbit around the Sun? [Note: The diagrams are not drawn to scale.]



25. Compared to the orbit of the Jovian planets, the orbit of Halley's comet is

- A) less elliptical, with a shorter distance between its foci
- B) less elliptical, with a greater distance between its foci
- C) more elliptical, with a shorter distance between its foci
- D) more elliptical, with a greater distance between its foci

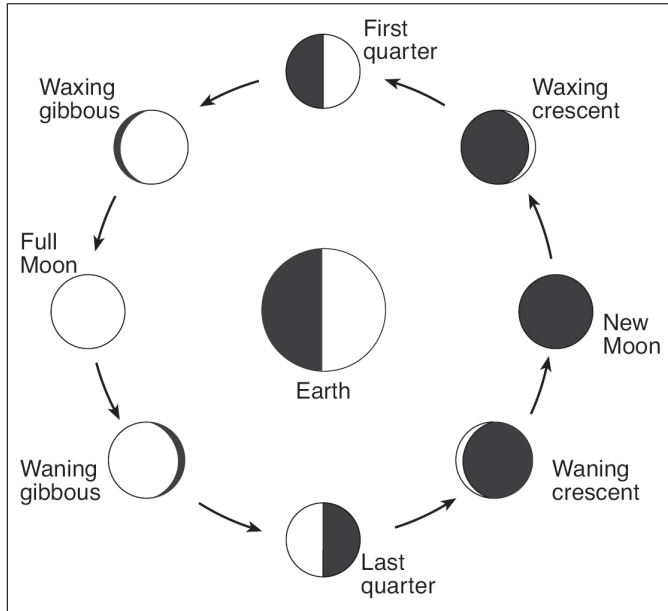
26. The diagram below represents planets *A* and *B*, of equal mass, revolving around a star.



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

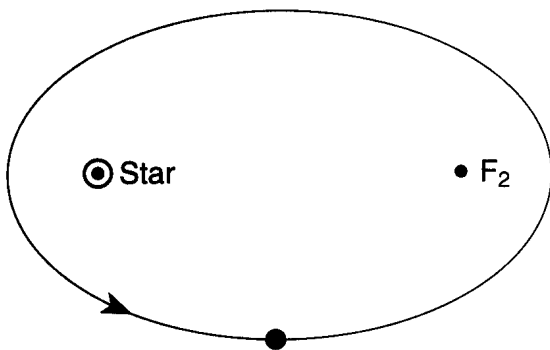
27. Base your answer to the following question on the diagram below, which shows positions of the Moon in its orbit and phases of the Moon as viewed from New York State.



(Not drawn to scale)

What is the eccentricity of the Moon's orbit?

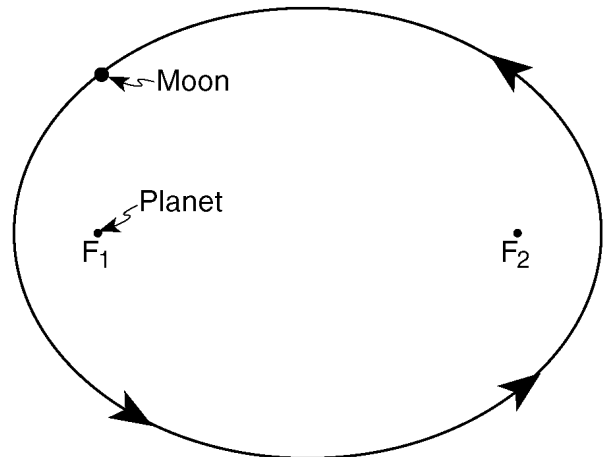
- A) 0.017 B) 0.055 C) 0.386 D) 0.723
28. Which planet has the *least* distance between the two foci of its elliptical orbit?
- A) Venus B) Earth
C) Mars D) Jupiter
29. The diagram below shows the elliptical orbit of a planet revolving around a star. The star and F_2 are the foci of this ellipse.



What is the approximate eccentricity of this ellipse?

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

30. 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 .

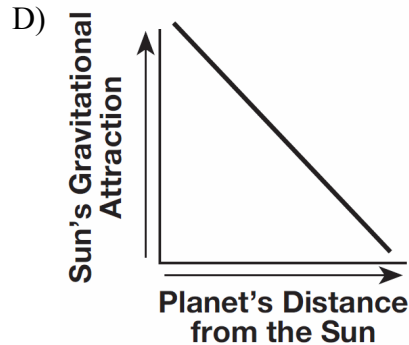
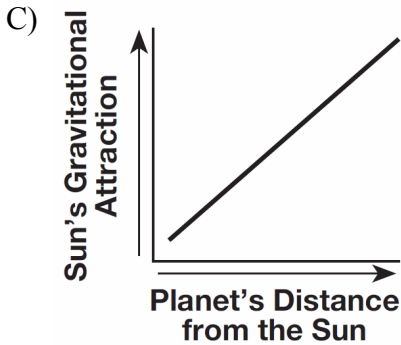
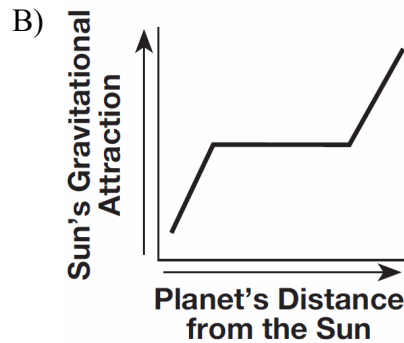
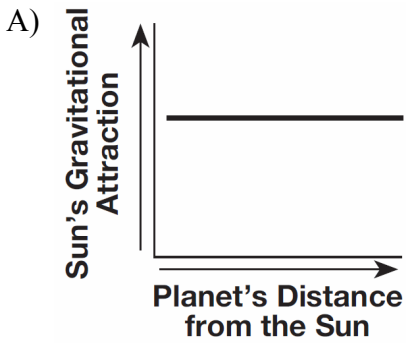


(Drawn to scale)

What is the approximate eccentricity of this elliptical orbit?

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

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



32. 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.

33. 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

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

- A) larger and less dense
- B) smaller and more dense
- C) closer to the Sun and less rocky
- D) farther from the Sun and more rocky

35. Which sequence lists the Jovian planets in order of increasing mass?

- A) Jupiter, Saturn, Neptune, Uranus
- B) Uranus, Neptune, Saturn, Jupiter
- C) Jupiter, Saturn, Uranus, Neptune
- D) Neptune, Uranus, Saturn, Jupiter

36. Base your answer to the following question 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.

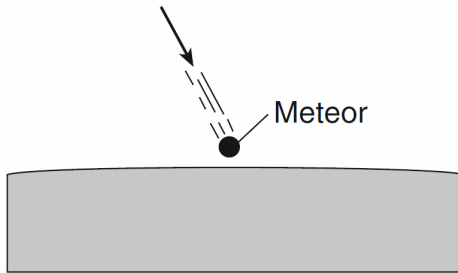


Diagram A: Before Impact

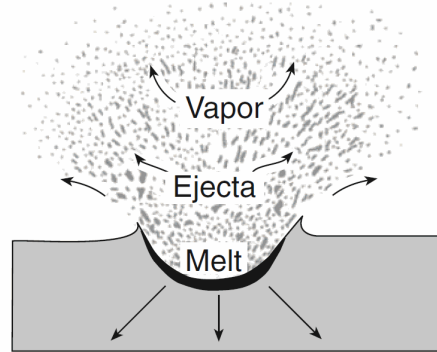


Diagram B: During Impact

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
37. Base your answer to the following question on on the data table below, which shows information about the four largest asteroids found in our solar system.

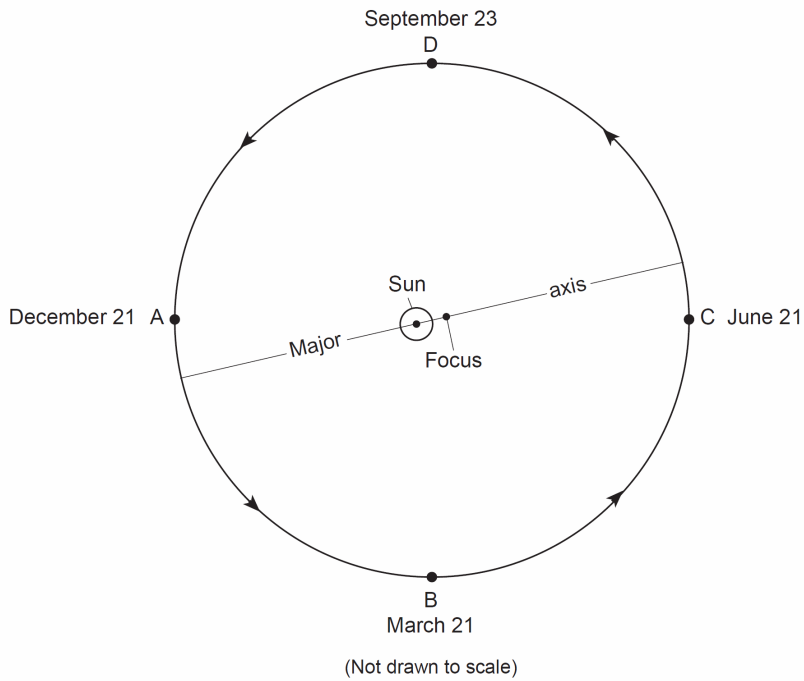
Data Table

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

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
38. 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
39. 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

40. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents Earth's revolution around the Sun. Points *A*, *B*, *C*, and *D* represent Earth's positions in its orbit on the first day of each of the four seasons. The major axis and the foci (the center of the Sun and the other focus) of Earth's orbit are shown.



Approximately how many days (d) does it take Earth to travel from position *A* to position *C*?

- A) 91 d B) 182 d C) 274 d D) 365 d