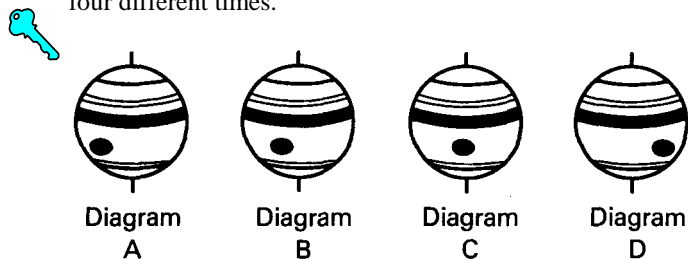


1. A planet was viewed from Earth for several hours. The diagrams below represent the appearance of the planet at four different times.



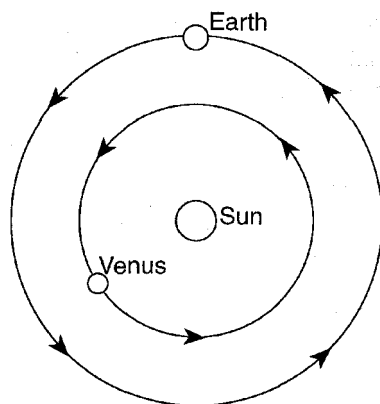
The best inference that can be made based on the diagrams is that this planet is

- 1) tilted on its axis
- 2) changing seasons
- 3) revolving
- 4) rotating

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

- 1) periods of revolution
- 2) orbital velocities
- 3) mean distances from the Sun
- 4) equatorial diameters

Base your answers to questions 3 and 4 on the diagram below. The diagram represents the orbital paths of the Earth and Venus.



( Not drawn to scale )

3. To an observer on the Earth, the planet Venus does *not* appear at one fixed position among the stars because Venus

- 1) rotates on its axis
- 2) revolves around the Sun
- 3) shows an apparent motion around the Earth
- 4) shows a complete cycle of phases

4. When measured from the Earth, the apparent diameter of Venus varies in a cyclic manner due to changes in the

- 1) rotation of Venus
- 2) altitude of Venus
- 3) distance between the Earth and Venus
- 4) gravitational attraction between the Earth and Venus

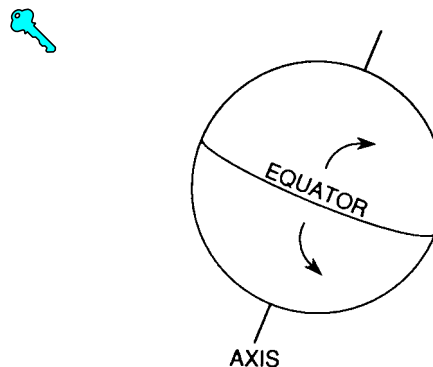
5. If the distance between the Earth and the Sun were increased, which change would occur?

- 1) The apparent diameter of the Sun would decrease.
- 2) The amount of insolation received by the Earth would increase.
- 3) The time for one Earth rotation (rotation period) would double.
- 4) The time for one Earth revolution (orbital period) would decrease.

6. In 1851, the French physicist Jean Foucault constructed a large pendulum that always changed its direction of swing at the same rate in a clockwise direction. According to Foucault, this change in direction of swing was caused by the

- 1) Moon's rotation on its axis
- 2) Moon's revolution around the Earth
- 3) Earth's rotation on its axis
- 4) Earth's revolution around the Sun

7. In the diagram below, the arrows represent the paths of moving fluids on the surface of the Earth.



Which statement best explains why the fluid is deflected?

- 1) The Earth is rotating on its axis.
- 2) The axis of the Earth is tilted.
- 3) The Earth is revolving around the Sun.
- 4) The Earth is moving away from the Sun.

8. The Coriolis effect provides evidence that Earth

- 1) rotates
- 2) has a tilted axis
- 3) has seasons
- 4) revolves

9. The apparent rising and setting of the Sun as seen from the Earth are caused by the

- 1) rotation of the Sun
- 2) rotation of the Earth
- 3) revolution of the Earth
- 4) revolution of the Sun

10. What is the total number of degrees that the Earth rotates on its axis during a 12-hour period?

- 1) 1°
- 2) 15°
- 3) 180°
- 4) 360°

11. The radius of the Earth is approximately

- 1) 637 km
- 2) 6,370 km
- 3) 63,700 km
- 4) 637,000 km

12. Approximately how many degrees does the Earth rotate on its axis in 1 hour?



- 1)  $1^\circ$
- 2)  $15^\circ$
- 3)  $24^\circ$
- 4)  $360^\circ$

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



- 1) The Earth would revolve around the Sun.
- 2) The Earth would rotate on its axis.
- 3) The Moon would revolve around the Sun.
- 4) The Sun would revolve around the Earth.

14. Which planetary model allows a scientist to predict the exact positions of the planets in the night sky over many years?

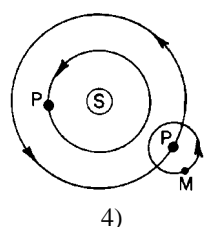
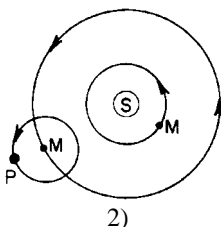
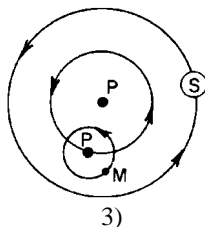
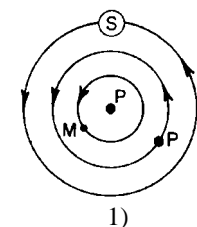


- 1) The planets' orbits are circles in a geocentric model.
- 2) The planets' orbits are ellipses in a geocentric model.
- 3) The planets' orbits are circles in a heliocentric model.
- 4) The planets' orbits are ellipses in a heliocentric model.

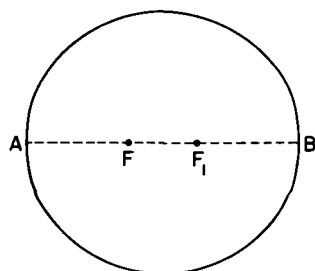
15. Which diagram best represents the motions of celestial objects in a heliocentric model?



Key:  
 P = Planet  
 M = Moon  
 S = Sun



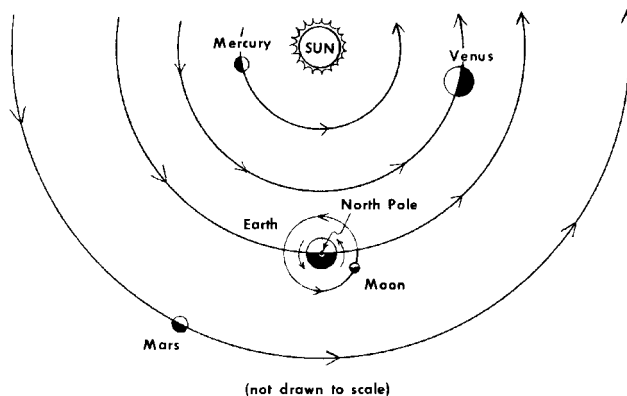
16. What is the eccentricity of the ellipse shown below?



$F, F_1$  - foci  
 AB - major axis

- 1) 1.0
- 2) 0.5
- 3) 0.25
- 4) 0.13

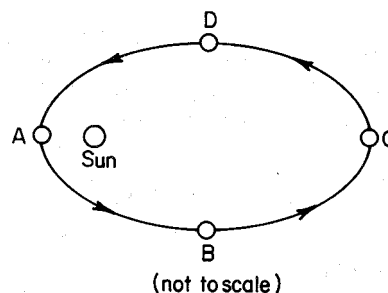
17. Base your answer to the following question on your knowledge of Earth science, the *Earth Science Reference Tables*, and the diagram below which shows part of the orbital paths of some of the planets of the solar system.



Which of the planets shown requires the longest time for one revolution around the Sun?

- 1) Mercury
- 2) Venus
- 3) Earth
- 4) Mars

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



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

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

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



- 1) changes in the orbital velocity of the Earth
- 2) tilting of the Earth's axis
- 3) the oblate spheroid shape of the Earth
- 4) the phases of the Moon

20. As the distance between the Earth and a satellite increases, the gravitational attraction between them will



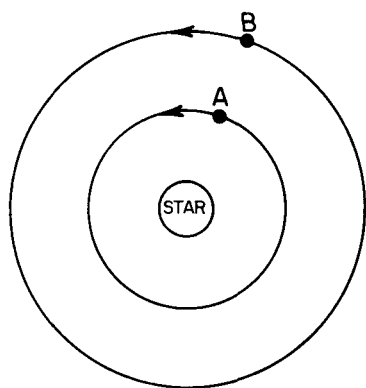
- 1) decrease
- 2) increase
- 3) remain the same

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



- 1) Venus, Neptune, and Jupiter
- 2) Jupiter, Saturn, and Venus
- 3) Jupiter, Saturn, and Uranus
- 4) Venus, Uranus, and Jupiter

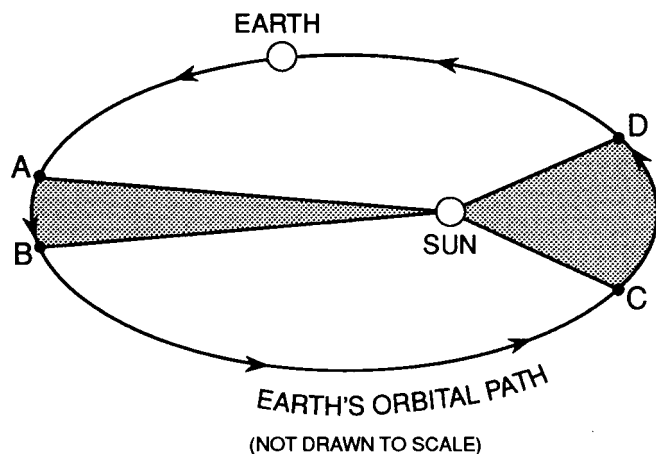
22. The diagram below shows the orbits of planets A and B in a star-planet system.



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

- 1) less than 40 days
- 2) greater than 40 days
- 3) 40 days

23. 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?

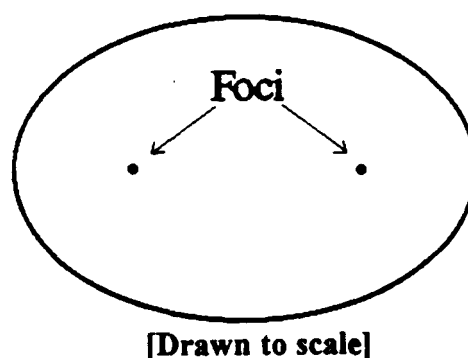
- 1) The shaded sections of the diagram are equal in area.
- 2) The distance from the Sun to the Earth is the same at point A and at point D.
- 3) The orbital velocity of the Earth at point A equals its orbital velocity at point C.
- 4) The gravitational force between the Earth and the Sun at point B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

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



- 1) Venus
- 2) Mars
- 3) Jupiter
- 4) Earth

25. The diagram below represents the orbit of a spacecraft around the sun.



The eccentricity of the spacecraft's orbit is

- 1) more eccentric than Earth's orbit but less eccentric than Mars' orbit
- 2) more eccentric than planets 300 million km from the sun but less than those 100 million km from the sun
- 3) more eccentric than the orbit of any planet in the solar system
- 4) less eccentric than planets with a density less than 5 gm/cm<sup>3</sup>

26. Which planet's day is longer than its year?



- 1) Mercury
- 2) Venus
- 3) Mars
- 4) Jupiter

27. Which planet's orbit is most nearly circular?



- 1) Earth
- 2) Venus
- 3) Neptune
- 4) Pluto

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



- 1) Mars and Jupiter
- 2) Mars and Earth
- 3) Jupiter and Saturn
- 4) Saturn and Uranus

29. Which statement best describes galaxies?



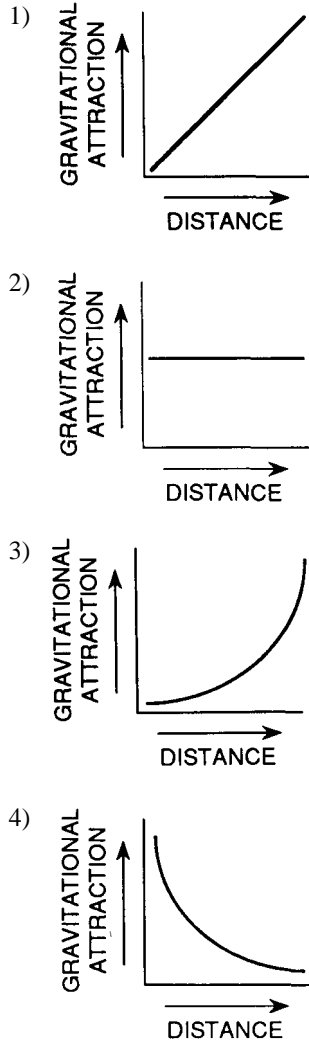
- 1) They are similar in size to the solar system.
- 2) They contain only one star but hundreds of planets.
- 3) They may contain a few hundred stars in a space slightly larger than the solar system.
- 4) They may contain billions of stars in a space much larger than our solar system.

30. According to the big bang theory, the universe began as an explosion and is still expanding. This theory is supported by observations that the stellar spectra of distant galaxies show a



- 1) concentration in the yellow portion of the spectrum
- 2) concentration in the green portion of the spectrum
- 3) shift toward the blue end of the spectrum
- 4) shift toward the red end of the spectrum

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



32. Based on the red-shift data on galaxies, most astronomers infer that the universe is currently



- 1) expanding
- 2) contracting
- 3) moving randomly
- 4) fixed and stationary

33. In which list are celestial features correctly shown in order of increasing size?



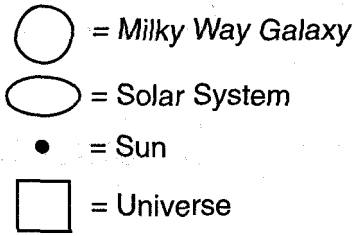
- 1) galaxy → solar system → universe → planet
- 2) solar system → galaxy → planet → universe
- 3) planet → solar system → galaxy → universe
- 4) universe → galaxy → solar system → planet

34. Most astronomers agree that at the present time universe is

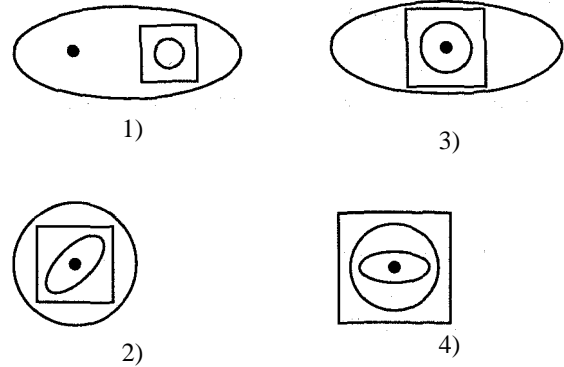


- 1) contracting
- 2) expanding
- 3) staying the same size
- 4) expanding and contracting regularly

35. The symbols below represent the Milky Way galaxy, the solar system, the Sun, and the universe.



Which arrangement of symbols is most accurate?



36. A light year is



- 1) the distance traveled by light in one year
- 2) the distance the Earth moves in one year
- 3) the time it takes light to go once around the Earth's orbit
- 4) the time it takes light to travel one year

37. The Doppler effect predicts that light from a source moving away from Earth will be



- 1) shifted to shorter wavelengths.
- 2) shifted to longer wavelengths.
- 3) appear blue.
- 4) appear red.

38. The explosion of a massive star near the end of its life is known as a



- 1) nova
- 2) pulsar
- 3) supernova
- 4) nebula

39. Compared to the sun, Polaris is



- 1) hotter and less luminous
- 2) cooler and more luminous
- 3) the same temperature and larger
- 4) hotter and larger

40. Which star is cooler and many times brighter than Earth's Sun?



- 1) Barnard's Star
- 2) Betelgeuse
- 3) Rigel
- 4) Sirius

41. The diagram below represents a standard dark-line spectrum for an element.



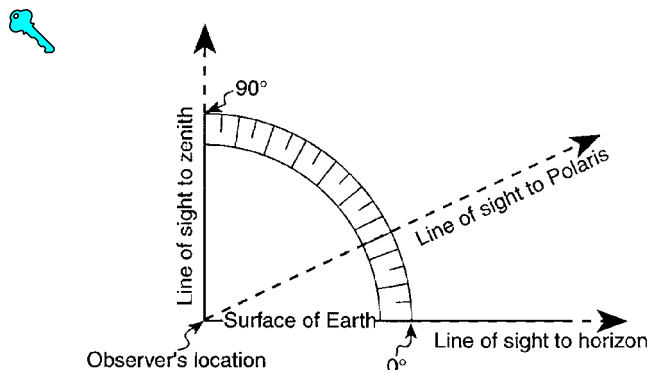
The spectral lines of this element are observed in light from a distant galaxy. Which diagram represents these spectral lines?

- 1) **Violet** **Red**
- 2) **Violet** **Red**
- 3) **Violet** **Red**
- 4) **Violet** **Red**

42. To an observer on a ship at sea, at which latitude does the North Star appear closest to the horizon?

- 1)  $5^\circ$  N                      3)  $50^\circ$  N  
 2)  $20^\circ$  N                    4)  $85^\circ$  N

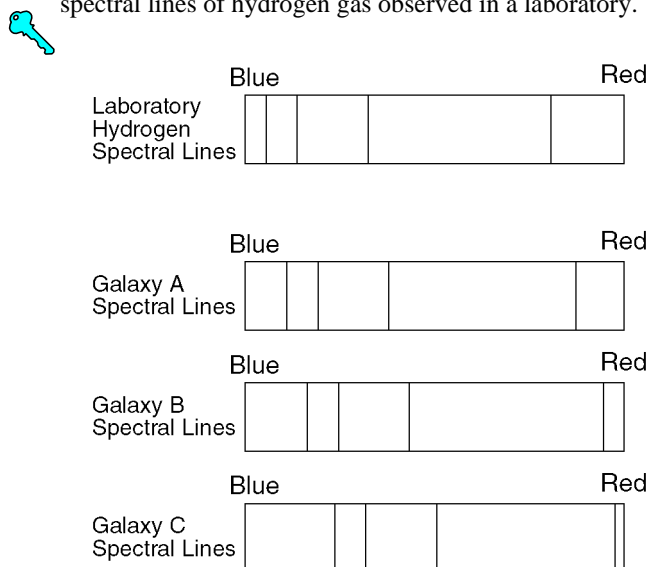
43. The diagram below shows the angular altitude of *Polaris* above the horizon at a certain location.



What is the latitude of the observer?

- 1)  $15^\circ$  N                      3)  $30^\circ$  N  
 2)  $25^\circ$  N                    4)  $65^\circ$  N

44. In the diagram below, the spectral lines of hydrogen gas from three galaxies, *A*, *B*, and *C*, are compared to the spectral lines of hydrogen gas observed in a laboratory.



What is the best inference that can be made concerning the movement of galaxies *A*, *B*, and *C*?

- 1) Galaxy *A* is moving away from Earth, but galaxies *B* and *C* are moving toward Earth.  
 2) Galaxy *B* is moving away from Earth, but galaxies *A* and *C* are moving toward Earth.  
 3) Galaxies *A*, *B*, and *C* are all moving toward Earth.  
 4) Galaxies *A*, *B*, and *C* are all moving away from Earth.

45. Which graph best represents the altitude of *Polaris* observed at northern latitude positions on the Earth's surface?

