1. The diagram below represents the position of Earth in its orbit and the position of a comet in its orbit around the Sun.

Which inference can be made about the comet's orbit, when it is compared to Earth's orbit?

A) Earth's orbit and the comet's orbit have the same distance between foci.
B) Earth's orbit has a greater distance between foci than the comet's orbit.
C) The comet's orbit has one focus, while Earth's orbit has two foci.
D) The comet's orbit has a greater distance between foci than Earth's orbit.
2. 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.]

A)

B)

C)

D)
3. the diagram below and on your knowledge of Earth science. The diagram represents the orbital paths of the four Jovian planets and Halley's comet around the Sun. Halley's comet has a revolution period of 76 years. In 1986, Halley's comet was at perihelion, its closest point to the Sun. Letters $A$, $B$, $C$, and $D$ represent locations of Halley's comet in its orbit. Location $D$ represents Halley's comet at aphelion, its farthest point from the Sun. The comet's tail is shown at perihelion and at locations $B$ and $C$.

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
4. 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
5. 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

6. 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
7. The bar graph below shows one planetary characteristic, identified as $X$, plotted for the planets of our solar system.

![Bar Graph]

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

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

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

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

A)  
B)  
C)  
D)  

10. Which planet’s orbit around the Sun is most nearly circular?

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

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

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

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

A) the Sun  
B) Betelgeuse  
C) Earth  
D) Jupiter

13. 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
14. 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

15. Base your answer to the following question on the diagram below, which shows a portion of the solar system.

![Diagram of the solar system](image)

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

16. 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.

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

   (Key: • = planet  * = star)

   ![Diagram options](image)
18. Base your answer to the following question on the diagram of the solar system below.

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

19. 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

20. 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.

21. The actual shape of the Earth's orbit around the Sun is best described as
A) a very eccentric ellipse
B) a slightly eccentric ellipse
C) an oblate spheroid
D) a perfect circle

22. 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
23. 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

24. 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 = 299,000,000 km
   5,000,000 km
B) eccentricity = 5,000,000 km
   299,000,000 km
C) eccentricity = 299,000,000 km - 5,000,000 km
D) eccentricity =
   5,000,000 km
   299,000,000 km - 5,000,000 km

25. 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
26. Which graph best shows the general relationship between a planet's distance from the Sun and the Sun's gravitational attraction to the planet?

(A) 

(B) 

(C) 

(D) 

27. 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?

(A) 

(B) 

(C) 

(D) 

28. 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.

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. 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.

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

![Diagram of satellite and planet](image)

(Not drawn to scale)

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

A)  
B)  
C)  
D)  

32. 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  

33. 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?

A)  
B)  
C)  
D)  

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

A)  
B)  
C)  
D)  

35. 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.

<table>
<thead>
<tr>
<th>Planet’s Position in the Orbit</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Gravitational Force Between Star and Planet</td>
<td>52</td>
<td>42</td>
<td>25</td>
<td>12</td>
<td>10</td>
<td>12</td>
<td>25</td>
<td>42</td>
</tr>
</tbody>
</table>

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

A)  
B)  
C)  
D)  

36. 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

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

A)  
B)  
C)  
D)  
38. 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

39. 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

40. 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

41. 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
Base your answers to questions 42 through 45 on the diagram below which represents a planet, P, in an elliptical orbit around a star located at F1. The foci of the elliptical orbit are F1 and F2. Orbital locations are represented by P1 through P6.

42. 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

43. If the shaded portions of the orbital plane are equal in area, the time period between P1 and P2 will be equal to the time period between
   A) P2 and P3  
   B) P4 and P5  
   C) P3 and P4  
   D) P6 and P1

44. When observed from the planet, the star would have its greatest apparent angular diameter when the planet is located at position
   A) P1  
   B) P2  
   C) P3  
   D) P4

45. The gravitational attraction between planet P and the star is greatest when the planet is located at position
   A) P1  
   B) P2  
   C) P3  
   D) P4

46. 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

47. 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.

48. 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

49. 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.
50. 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.

Since Earth has an elliptical orbit, the

A) distance between the Sun and Earth varies
B) distance between the Sun and the other focus varies
C) length of Earth's major axis varies
D) length of Earth's period of revolution varies

51. Which terms describe the motion of most objects in our solar system?

A) noncyclic and unpredictable
B) noncyclic and predictable
C) cyclic and unpredictable
D) cyclic and predictable

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

A) Mercury  B) Venus
C) Jupiter  D) Saturn
53. Base your answer to the following question 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.

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’

54. 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

55. 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
Base your answers to questions 56 through 58 on the data table below and on your knowledge of Earth science. The data table shows five galaxies, A through E, their distances from Earth, and their recession velocities, the velocities at which they are moving away from Earth.

<table>
<thead>
<tr>
<th>Galaxy</th>
<th>Galaxy's Distance from Earth (million light years)</th>
<th>Recession Velocity (km/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>62</td>
<td>1210</td>
</tr>
<tr>
<td>B</td>
<td>978</td>
<td>15,000</td>
</tr>
<tr>
<td>C</td>
<td>1402</td>
<td>21,600</td>
</tr>
<tr>
<td>D</td>
<td>2510</td>
<td>39,300</td>
</tr>
<tr>
<td>E</td>
<td>3912</td>
<td>61,200</td>
</tr>
</tbody>
</table>

**Note:** One light year is the distance that light travels in one year.

56. Identify the nuclear process that produces the energy released by stars within these galaxies.

57. Another galaxy has a recession velocity of 30,000 kilometers per second. What is this galaxy's approximate distance from Earth in million light years if it follows the same pattern shown on the data table?

58. State the general relationship between the galaxies' distances from Earth and their recession velocities.
Base your answers to questions 59 and 60 on the data table below and on your knowledge of Earth science. The table shows the distance from Earth to the Moon for certain days during December 2010. The percent of the Moon illuminated by the Sun as seen from Earth is also given.

<table>
<thead>
<tr>
<th>Date December 2010</th>
<th>Approximate Earth-Moon Distance (x 10^3 km)</th>
<th>Illuminated Moon Seen from Earth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>371</td>
<td>12.3</td>
</tr>
<tr>
<td>4</td>
<td>375</td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>383</td>
<td>1.2</td>
</tr>
<tr>
<td>8</td>
<td>393</td>
<td>10.2</td>
</tr>
<tr>
<td>10</td>
<td>401</td>
<td>25.5</td>
</tr>
<tr>
<td>12</td>
<td>404</td>
<td>44.0</td>
</tr>
<tr>
<td>14</td>
<td>403</td>
<td>63.3</td>
</tr>
<tr>
<td>16</td>
<td>396</td>
<td>81.0</td>
</tr>
<tr>
<td>18</td>
<td>386</td>
<td>94.3</td>
</tr>
<tr>
<td>20</td>
<td>377</td>
<td>100.0</td>
</tr>
<tr>
<td>22</td>
<td>373</td>
<td>99.0</td>
</tr>
<tr>
<td>24</td>
<td>388</td>
<td>80.4</td>
</tr>
<tr>
<td>26</td>
<td>389</td>
<td>70.1</td>
</tr>
<tr>
<td>28</td>
<td>371</td>
<td>47.0</td>
</tr>
<tr>
<td>30</td>
<td>375</td>
<td>24.8</td>
</tr>
</tbody>
</table>

59. On which data shown in the data table was the gravitational attraction between the Moon and Earth the greatest?

60. Explain how the Earth-Moon distance data support the inference that the Moon's orbit is an ellipse.
Base your answers to questions 61 and 62 on the table below and on your knowledge of Earth science. The table lists the average surface temperature, in kelvins, and the average orbital velocity, in kilometers per second, of each planet of our solar system.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Average Surface Temperature (K)</th>
<th>Average Orbital Velocity (km/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>440</td>
<td>47.87</td>
</tr>
<tr>
<td>Venus</td>
<td>737</td>
<td>35.00</td>
</tr>
<tr>
<td>Earth</td>
<td>288</td>
<td>29.78</td>
</tr>
<tr>
<td>Mars</td>
<td>208</td>
<td>24.13</td>
</tr>
<tr>
<td>Jupiter</td>
<td>163</td>
<td>13.07</td>
</tr>
<tr>
<td>Saturn</td>
<td>133</td>
<td>9.69</td>
</tr>
<tr>
<td>Uranus</td>
<td>78</td>
<td>6.81</td>
</tr>
<tr>
<td>Neptune</td>
<td>73</td>
<td>5.43</td>
</tr>
</tbody>
</table>
61. The orbital velocity of Earth is sometimes faster and sometimes slower than its average orbital velocity. Explain why the orbital velocity of Earth varies in a cyclic pattern.
62. Use the set of axes below to draw a line that represents the general relationship between the mean distances of planets from the Sun and the average orbital velocities of the planets.
Explain why the gravitational attraction between the Sun and Earth decreases as Earth travels from location $D$ to location $A$. 
64. Base your answer to the following question on the table below, which lists some information about Barnard's Star.

<table>
<thead>
<tr>
<th>Barnard's Star</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance from Sun</strong></td>
</tr>
<tr>
<td>• 6.0 light-years*</td>
</tr>
<tr>
<td>• currently moving toward the Sun (and Earth) and will get as close as 3.8 light-years in approximately 11,000 years</td>
</tr>
<tr>
<td><strong>Characteristics of Barnard’s Star</strong></td>
</tr>
<tr>
<td>• less than 17 percent of the Sun’s mass</td>
</tr>
<tr>
<td>• approximately 20 percent of the Sun’s diameter</td>
</tr>
<tr>
<td>• age thought to be between 11 and 12 billion years old and may last another 40 billion years</td>
</tr>
<tr>
<td>• no planets observed orbiting Barnard’s Star</td>
</tr>
</tbody>
</table>

* A light-year is the distance light travels in one year.

If a planet with the same mass as Earth were discovered orbiting Barnard's Star at the same distance that Earth is orbiting the Sun, why would there be less gravitational attraction between this new planet and Barnard’s Star than there is between Earth and the Sun?

65. Base your answer to the following question on the diagram below, which shows Earth’s orbit and the orbit of a comet within our solar system.

![Diagram of Earth's orbit and a comet orbiting the Sun](Image)

(Not drawn to scale)

Explain why the time required for one revolution of the comet is more than the time required for one revolution of Earth.
Base your answers to questions 66 through 68 on the diagram below, which represents a model of Earth's orbit. Earth is closest to the Sun at one point in its orbit (perihelion) and farthest from the Sun at another point in its orbit (aphelion). The Sun and point B represent the foci of this orbit.

66. Describe how the shape of Earth's orbit would differ if the Sun and focus B were farther apart.

67. Describe the change that takes place in the gravitational attraction between Earth and the Sun as Earth moves from perihelion to aphelion and back to perihelion during one year.

68. Explain why Earth's orbit is considered to be elliptical.
Base your answers to questions 69 through 72 on the two diagrams. Diagram I shows the orbits of the four inner planets. Black dots in diagram I show the positions of the orbits where each planet is closest to the Sun. Diagram II shows the orbits of the six planets that are farthest from the Sun. The distance scale in diagram II is different that the distance scale in diagram I.

69. Describe how the orbits of each of the nine planets are similar in shape.

70. How long does it take the planet Uranus to complete one orbit around the Sun? Units must be included in your answer.

71. On diagram II circle the names of the two largest Jovian planets.

72. On diagram I, place the letter W on Mars’ orbit to represent the position of Mars where the Sun’s gravitational force on Mars would be weakest.
Base your answers to questions 73 and 74 on the diagram below, which represents an asteroid's elliptical orbit around the Sun. The dashed line is the major axis of the ellipse.

73. The Sun is located at one focal point of the orbit. Place an \textbf{X} on the diagram at the location of the second focal point.

74. Place a circle, \textbf{0}, on the orbital path where the velocity of the asteroid would be the least.
Base your answers to questions 75 and 76 on the information, data table, and diagram below.

Astronomers have discovered strong evidence for the existence of three large extrasolar (outside our solar system) planets that orbit Upsilon Andromedae, a star located 44 light years from Earth. The three planets are called planet B, planet C, and planet D. Some of the information gathered about these three new planets is shown in the table below. The period of revolution for planet C has been deliberately left blank.

The diagram below compares a part of our solar system to the Upsilon Andromedae planetary system. Planet distances from their respective star and the relative size of each planet are drawn to scale. [The scale for planet distances is not the same scale used for planet size.]

### Characteristics of Planets B, C, and D Orbiting Star Upsilon Andromedae

<table>
<thead>
<tr>
<th>Planet</th>
<th>Mass</th>
<th>Distance from Upsilon Andromedae</th>
<th>Period of Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>( \frac{3}{4} ) of the mass of Jupiter</td>
<td>0.06 AU</td>
<td>4.6 Earth days</td>
</tr>
<tr>
<td>C</td>
<td>2 times the mass of Jupiter</td>
<td>0.83 AU</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>4 times the mass of Jupiter</td>
<td>2.50 AU</td>
<td>3.5 to 4.0 Earth years</td>
</tr>
</tbody>
</table>

[1 AU = average distance of Earth from the Sun]

75. If our solar system had a planet located at the same distance from the Sun as planet C is from Upsilon Andromedae, what would be its approximate period of revolution?

76. As planet B travels in its orbit, describe the change in orbital velocity of planet B as the distance between Upsilon Andromedae and planet B decreases.
Base your answers to questions 77 and 78 on the diagram below, which shows the orbit of planet D around the star *Upsilon Andromedae*. The dashed lines show where the paths of the first four planets of our solar system would be located if they were going around *Upsilon Andromedae* instead of the Sun. All distances are drawn to scale.

77. Describe the changes in gravitational force between planet D and the star *Upsilon Andromedae* during one complete orbit around the star. Be sure to describe where the force is greatest and where the force is least.

78. Describe the eccentricity of planet D’s orbit relative to the eccentricities of the orbits of the planets shown in our solar system.
Base your answers to questions 79 and 80 on the diagram below, which represents an exaggerated model of Earth's orbital shape. Earth is closest to the Sun at one time of year (perihelion) and farthest from the Sun at another time of year (aphelion).

79. State the relationship between Earth's distance from the Sun and Earth's orbital velocity.

80. Describe the change that takes place in the apparent size of the Sun, as viewed from Earth, as Earth moves from perihelion to aphelion.
81. Base your answer to the following question on the graph below and on your knowledge of Earth science. The graph shows planet equatorial diameters and planet mean distances from the Sun. Neptune is *not* shown.

Compared to the periods of revolution and periods of rotation of the terrestrial planets, how are the periods of revolution and periods of rotation for the Jovian planets different?

Jovian periods of revolution: _____________________________________

Jovian periods of rotation: _____________________________________
Answer Key

eccentricity practice

1. D 37. A 60. —The Earth-Moon distance varies in a regular pattern.
4. B 40. A 63. —Earth's distance to the Sun is increasing. —Earth is getting farther from the Sun. —Earth is approaching aphelion.
5. A 41. C 64. —Barnard's Star is a smaller star than the Sun. —The Sun has more mass.
6. A 42. C 65. —The comet moves farther from the Sun than Earth's greatest distance from the Sun. —During most of its orbit the comet is moving slower than Earth. —The comet's average distance from the Sun is greater. —The comet has a larger orbit.
7. C 43. B 66. Examples: —The orbit would become more eccentric. —The eccentricity would increase. —The eccentricity value would be closer to 1.0. —The path would be more elliptical.
8. A 44. B 67. Examples: —The force of gravity decreases, then increases. —Gravity becomes less, then becomes greater.
9. A 45. B 68. Examples: —The distance from the Sun varies. —There are two foci instead of one center. —The orbit is an oval shape. —Earth's eccentricity of orbit is 0.017.
10. D 46. B 69. The orbits are elliptical or oval shaped. The orbits are nearly circular.
11. B 47. D 70. 84 years
16. B 52. B 75. —Earth's distance to the Sun changes in a cyclic pattern.
17. A 53. A 76. —Earth's distance to the Sun changes in a cyclic pattern.
18. D 54. A 77. —Earth's distance to the Sun changes in a cyclic pattern.
19. A 55. D 78. —Earth's distance to the Sun changes in a cyclic pattern.
22. D 58. —As the Earth-to-galaxy distance increases, the recession velocity increases. —Galaxies closer to Earth are moving more slowly. —direct relationship/positive relationship
24. B 60. —The Earth-Moon distance varies in a regular pattern.
25. A 61. —Earth's distance to the Sun changes in a cyclic pattern.
26. D 62. Examples: —The force of gravity decreases, then increases. —Gravity becomes less, then becomes greater.
27. C 63. —Earth's distance to the Sun is increasing. —Earth is getting farther from the Sun. —Earth is approaching aphelion.
28. A 64. —Barnard's Star is a smaller star than the Sun. —The Sun has more mass.
29. B 65. —The comet moves farther from the Sun than Earth's greatest distance from the Sun. —During most of its orbit the comet is moving slower than Earth. —The comet's average distance from the Sun is greater. —The comet has a larger orbit.
30. C 66. Examples: —The orbit would become more eccentric. —The eccentricity would increase. —The eccentricity value would be closer to 1.0. —The path would be more elliptical.
31. C 67. Examples: —The force of gravity decreases, then increases. —Gravity becomes less, then becomes greater.
32. A 68. Examples: —The distance from the Sun varies. —There are two foci instead of one center. —The orbit is an oval shape. —Earth's eccentricity of orbit is 0.017.
33. B 69. The orbits are elliptical or oval shaped. The orbits are nearly circular.
34. C 70. 84 years
35. B 71. —Earth's distance to the Sun changes in a cyclic pattern.
36. B 72. —Earth's distance to the Sun changes in a cyclic pattern.
37. A 73. —Earth's distance to the Sun changes in a cyclic pattern.
38. B 74. —Earth's distance to the Sun changes in a cyclic pattern.
39. C 75. —Earth's distance to the Sun changes in a cyclic pattern.
40. A 76. —Earth's distance to the Sun changes in a cyclic pattern.
41. C 77. —Earth's distance to the Sun changes in a cyclic pattern.
42. C 78. —Earth's distance to the Sun changes in a cyclic pattern.
43. B 79. —Earth's distance to the Sun changes in a cyclic pattern.
44. B 80. —Earth's distance to the Sun changes in a cyclic pattern.
45. A 81. —Earth's distance to the Sun changes in a cyclic pattern.
46. A 82. —Earth's distance to the Sun changes in a cyclic pattern.
47. D 83. —Earth's distance to the Sun changes in a cyclic pattern.
48. D 84. —Earth's distance to the Sun changes in a cyclic pattern.
49. A 85. —Earth's distance to the Sun changes in a cyclic pattern.
50. A 86. —Earth's distance to the Sun changes in a cyclic pattern.
51. D 87. —Earth's distance to the Sun changes in a cyclic pattern.
52. B 88. —Earth's distance to the Sun changes in a cyclic pattern.
53. A 89. —Earth's distance to the Sun changes in a cyclic pattern.
54. A 90. —Earth's distance to the Sun changes in a cyclic pattern.
55. D 91. —Earth's distance to the Sun changes in a cyclic pattern.
56. —fusion/nuclear fusion —Light elements combine to form heavier elements.
57. Any value from 1800 to 2200 million light years.
58. —As the Earth-to-galaxy distance increases, the recession velocity increases. —Galaxies closer to Earth are moving more slowly. —direct relationship/positive relationship
59. December 24, 2010
71. 224.7 days to less than 365.26 days.

72. As the distance between them decreases, the orbital velocity increases. It speeds up.

73. The gravitational pull is greatest when planet \( D \) is closest to the star and the pull is least when planet \( D \) is farthest from the star.

74. – Planet \( D \) has a much more eccentric orbit than any of the first four planets of our solar system.
– The first four planets of our solar system have less eccentric orbits than planet \( D \).

75. 76. 

77. examples: – As Earth moves from perihelion to aphelion, the orbital velocity decreases. – As distance of Earth from the Sun increases, orbital velocity decreases. – an inverse relationship

78. examples: – As Earth moves from perihelion to aphelion, the apparent size decreases. – The Sun appears smaller.

79. Jovian periods of revolution: — longer — greater — more time

80. Jovian periods of rotation: — shorter — less time