Concept Items

7.1 Kepler's Laws of Planetary Motion 1.

A circle is a special case of an ellipse. Explain how a circle is different from other ellipses.

a. The foci of a circle are at the same point and are located at the center of the circle.
b. The foci of a circle are at the same point and are located at the circumference of the circle.
c. The foci of a circle are at the same point and are located outside of the circle.
d. The foci of a circle are at the same point and are located anywhere on the diameter, except on its midpoint.

2.

Comets have very elongated elliptical orbits with the sun at one focus. Using Kepler's Law, explain why a comet travels much faster near the sun than it does at the other end of the orbit.

a. Because the satellite sweeps out equal areas in equal times
b. Because the satellite sweeps out unequal areas in equal times
c. Because the satellite is at the other focus of the ellipse
d. Because the square of the period of the satellite is proportional to the cube of its average distance from the sun

3.

True or False—A planet-satellite system must be isolated from other massive objects to follow Kepler's laws of planetary motion.

a. True
b. False

4.

Explain why the string, pins, and pencil method works for drawing an ellipse.

a. The string, pins, and pencil method works because the length of the two sides of the triangle remains constant as you are drawing the ellipse.
b. The string, pins, and pencil method works because the area of the triangle remains constant as you are drawing the ellipse.
c. The string, pins, and pencil method works because the perimeter of the triangle remains constant as you are drawing the ellipse.
d. The string, pins, and pencil method works because the volume of the triangle remains constant as you are drawing the ellipse.

7.2 Newton's Law of Universal Gravitation and Einstein's Theory of General Relativity 5.

Describe the postulate on which Einstein based the theory of general relativity and describe an everyday experience that illustrates this postulate.

a. Gravity and velocity have the same effect and cannot be distinguished from each other. An acceptable illustration of this is any description of the feeling of constant velocity in a situation where no outside frame of reference is considered.
b. Gravity and velocity have different effects and can be distinguished from each other. An acceptable illustration of this is any description of the feeling of constant velocity in a situation where no outside frame of reference is considered.
c. Gravity and acceleration have the same effect and cannot be distinguished from each other. An acceptable illustration of this is any description of the feeling of acceleration in a situation where no outside frame of reference is considered.
d. Gravity and acceleration have different effects and can be distinguished from each other. An acceptable illustration of this is any description of the feeling of acceleration in a situation where no outside frame of reference is considered.

6.

Titan, with a radius of 2.58\times10^6\,\text{m}, is the largest moon of the planet Saturn. If the mass of Titan is 1.35\times10^{23}\text{kg}, what is the acceleration due to gravity on the surface of this moon?

a. 1.35\,\text{m/s}^2
b. 3.49\,\text{m/s}^2
c. 3.49\times10^6\,\text{m/s}^2
d. 1.35\times10^6\,\text{m/s}^2

7.

Saturn's moon Titan has an orbital period of 15.9 days. If Saturn has a mass of 5.68×10^{23} kg, what is the average distance from Titan to the center of Saturn?

a. 1.22×10^{6} m
b. 4.26×10^{7} m
c. 5.25×10^{4} km
d. 4.26×10^{10} km

8.

Explain why doubling the mass of an object doubles its weight, but doubling its distance from the center of Earth reduces its weight fourfold.

a. The weight is two times the gravitational force between the object and Earth.
b. The weight is half the gravitational force between the object and Earth.

c. The weight is equal to the gravitational force between the object and Earth, and the gravitational force is inversely proportional to the distance squared between the object and Earth.
d. The weight is directly proportional to the square of the gravitational force between the object and Earth.

9.

Explain why a star on the other side of the Sun might appear to be in a location that is not its true location.

a. It can be explained by using the concept of atmospheric refraction.
b. It can be explained by using the concept of the special theory of relativity.
c. It can be explained by using the concept of the general theory of relativity.
d. It can be explained by using the concept of light scattering in the atmosphere.

10.

The Cavendish experiment marked a milestone in the study of gravity.
Part A. What important value did the experiment determine?
Part B. Why was this so difficult in terms of the masses used in the apparatus and the strength of the gravitational force?

a. Part A. The experiment measured the acceleration due to gravity, g. Part B. Gravity is a very weak force but despite this limitation, Cavendish was able to measure the attraction between very massive objects.
b. Part A. The experiment measured the gravitational constant, G. Part B. Gravity is a very weak force but, despite this limitation, Cavendish was able to measure the attraction between very massive objects.
c. Part A. The experiment measured the acceleration due to gravity, g. Part B. Gravity is a very weak force but despite this limitation, Cavendish was able to measure the attraction between less massive objects.
d. Part A. The experiment measured the gravitational constant, G. Part B. Gravity is a very weak force but despite this limitation, Cavendish was able to measure the attraction between less massive objects.