CHAPTER REVIEW

Concept Items

7.1 Kepler's Laws of Planetary Motion

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

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

6. Titan, with a radius of 2.58×10^6 m, is the largest moon of the planet Saturn. If the mass of Titan is 1.35×10^{23} 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. $3.49 \times 10^6\ \text{m/s}^2$
 d. $1.35 \times 10^6\ \text{m/s}^2$

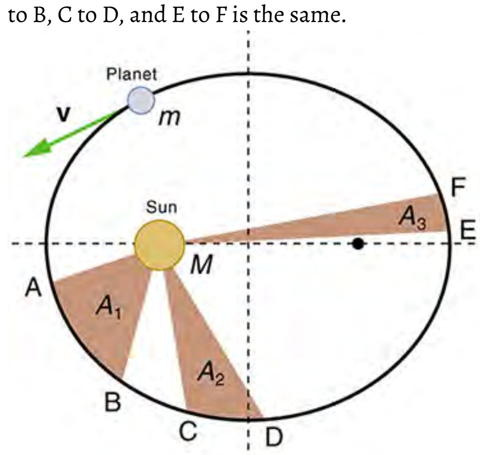
7. Saturn's moon Titan has an orbital period of 15.9 days. If Saturn has a mass of 5.68×10^{23} kg, what is the average distance from Titan to the center of Saturn?
 a. 1.22×10^6 m
 b. 4.26×10^7 m
 c. 5.25×10^4 km
 d. 4.26×10^{10} km

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.

Critical Thinking Items

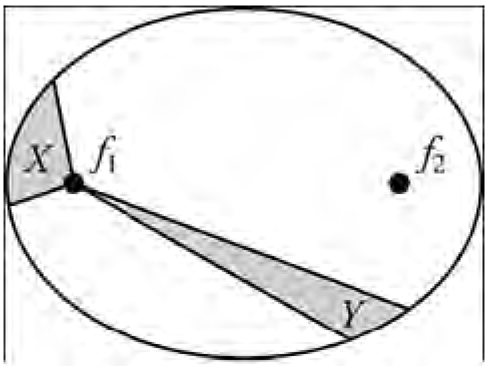
7.1 Kepler's Laws of Planetary Motion

11. In the figure, the time it takes for the planet to go from A to B, C to D, and E to F is the same.



Compare the areas A_1, A_2, and A_3 in terms of size.
 a. $A_1 \neq A_2 \neq A_3$
 b. $A_1 = A_2 = A_3$
 c. $A_1 = A_2 > A_3$
 d. $A_1 > A_2 = A_3$

13. In this figure, if f_1 represents the parent body, which set of statements holds true?



a. Area X < Area Y; the speed is greater for area X.
b. Area X > Area Y; the speed is greater for area Y.
c. Area X = Area Y; the speed is greater for area X.
d. Area X = Area Y; the speed is greater for area Y.

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

14. Rhea, with a radius of 7.63×10^5 m, is the second-largest moon of the planet Saturn. If the mass of Rhea is 2.31×10^{21} kg, what is the acceleration due to gravity on the surface of this moon?

a. 2.65×10^{-1} m/s
b. 2.02×10^5 m/s
c. 2.65×10^{-1} m/s^2
d. 2.02×10^5 m/s^2

15. Earth has a mass of 5.971×10^{24} kg and a radius of 6.371×10^6 m. Use the data to check the value of the gravitational constant.

a. $6.66 \times 10^{-11}\ \frac{\mathrm{N\cdot m}}{\mathrm{kg^2}}$, it matches the value of the gravitational constant G.
b. $1.05 \times 10^{-17}\ \frac{\mathrm{N\cdot m}}{\mathrm{kg^2}}$, it matches the value of the gravitational constant G.
c. $6.66 \times 10^{-11}\ \frac{\mathrm{N\cdot m^2}}{\mathrm{kg^2}}$, it matches the value of the gravitational constant G.
d. $1.05 \times 10^{-17}\ \frac{\mathrm{N\cdot m^2}}{\mathrm{kg^2}}$, it matches the value of the gravitational constant G.

16. The orbit of the planet Mercury has a period of 88.0 days and an average radius of 5.791×10^{10} m. What is the mass of the sun?

a. 3.43×10^{19} kg
b. 1.99×10^{30} kg
c. 2.56×10^{29} kg
d. 1.48×10^{40} kg

Problems

7.1 Kepler's Laws of Planetary Motion

18. Earth is 1.496×10^8 km from the sun, and Neptune is 4.490×10^9 km from the sun. What best represents the number of Earth years it takes for Neptune to complete one orbit around the sun?

a. 10 years
b. 30 years
c. 160 years
d. 900 years

TEST PREP

Multiple Choice

7.1 Kepler's Laws of Planetary Motion

22. An artificial satellite orbits the Earth at a distance of 1.45×10^4 km from Earth's center. The moon orbits the Earth at a distance of 3.84×10^5 km once every 27.3 days. How long does it take the satellite to orbit the Earth?

a. 0.200 days
b. 3.07 days
c. 243 days
d. 3721 days

23. Earth is 1.496×10^8 km from the sun, and Venus is 1.08×10^8 km from the sun. One day on Venus is 243 Earth days long. What best represents the number of Venusian days in a Venusian year?

a. 0.78 days
b. 0.92 days
c. 1.08 days
d. 1.21 days

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

24. What did the Cavendish experiment measure?

a. The mass of Earth
b. The gravitational constant
c. Acceleration due to gravity
d. The eccentricity of Earth's orbit

25. You have a mass of 55 kg and you have just landed on one of the moons of Jupiter where you have a weight of 67.9 N. What is the acceleration due to gravity, g, on the moon you are visiting?

a. $.810 \text{m/s}^2$
b. 1.23m/s^2
c. 539m/s^2
d. 3735 m/s^2

Short Answer

7.1 Kepler's Laws of Planetary Motion

27. Explain how the masses of a satellite and its parent body must compare in order to apply Kepler's laws of planetary motion.

a. The mass of the parent body must be much lessthan that of the satellite.
b. The mass of the parent body must be much greater than that of the satellite.
c. The mass of the parent body must be equal to the mass of the satellite.
d. There is no specific relationship between themasses for applying Kepler's laws of planetary motion.

30. Mars has two moons, Deimos and Phobos. The orbit of Deimos has a period of 1.26 days and an average radius of $2.35 \times 10^3 \text{ km}$. The average radius of the orbit of Phobos is $9.374 \times 10^3 \text{ km}$. According to Kepler's third law of planetary motion, what is the period of Phobos?

a. 0.16 d
b. 0.50 d
c. 3.17 d
d. 10.0 d

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

31. Newton's third law of motion says that, for every action force, there is a reaction force equal in magnitude but that acts in the opposite direction. Apply this law to gravitational forces acting between the Washington Monument and Earth.

a. The monument is attracted to Earth with a force equal to its weight, and Earth is attracted to the monument with a force equal to Earth's weight. The situation can be represented with two force vectors of unequal magnitude and pointing in the same direction.

b. The monument is attracted to Earth with a force equal to its weight, and Earth is attracted to the monument with a force equal to Earth's weight. The situation can be represented with two force vectors of unequal magnitude but pointing in opposite directions.

c. The monument is attracted to Earth with a force equal to its weight, and Earth is attracted to the monument with an equal force. The situation can be represented with two force vectors of equal magnitude and pointing in the same direction.

d. The monument is attracted to Earth with a force equal to its weight, and Earth is attracted to the monument with an equal force. The situation can be represented with two force vectors of equal magnitude but pointing in opposite directions.

Extended Response

7.1 Kepler's Laws of Planetary Motion

33. The average radius of Earth is 6.37×10^6 m. What is Earth's mass?

a. 9.35×10^{17} kg
b. 5.96×10^{24} kg
c. 3.79×10^{31} kg
d. 2.42×10^{38} kg

34. What is the gravitational force between two 60.0 kg people sitting 100 m apart?

a. 2.4×10^{-11} N
b. 2.4×10^{-9} N
c. 3.6×10^{-1} N
d. 3.6×10^{1} N

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

38. The masses of Earth and the moon are 5.97×10^{24} kg and 7.35×10^{22} kg, respectively. The distance from Earth to the moon is 3.80×10^5 km. At what point between the Earth and the moon are the opposing gravitational forces equal? (Use subscripts e and m to represent Earth and moon.)

a. 3.42×10^5 km from the center of Earth
b. 3.80×10^5 km from the center of Earth
c. 3.42×10^6 km from the center of Earth
d. 3.10×10^7 km from the center of Earth