Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chapter 7 worksheet on Gravitation

True/False

Indicate whether the statement is true or false.

____ 1. Copernicus was the first Western scientist to publish work showing that the Earth and other planets revolve around the Sun.

____ 2. Tycho Brahe was a Danish astronomer who confirmed Copernicus's theories by making many observations with his telescope.

____ 3. After studying 30 years worth of previous work, Kepler became convinced that geometry and mathematics could explain the number, distance, and motion of the planets.

____ 4. Ellipses have only one focus.

____ 5. The point of distinction between a long-period comet and a short-period comet is 100 years.

____ 6. Cavendish used the attraction between large and small lead balls to measure an experimental value for the gravitational constant, G.

____ 7. The value found for the universal gravitational constant, G, will vary depending on the materials used for the balls of a Cavendish balance.

____ 8. Gravity is a contact force.

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 9. Johannes Kepler started his astronomy career as an assistant to _____.

a. Nicolaus Copernicus
b. Tycho Brahe
c. Galileo Galilei
d. Ptolemy

____ 10. Kepler's first law states that

a. the orbits of the planets are elliptical.
b. the speed of a planet's orbit varies depending on which part of the ellipse it is occupying.
c. the square of the ratio of the periods of any two planets revolving around the Sun is equal to the cube of the ratio of their average distance from the Sun.
d. objects attract other objects with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them.

____ 11. Kepler's second law states that

a. the orbits of the planets are elliptical.
b. the speed of a planet's orbit varies depending on which part of the ellipse it is occupying.
c. the square of the ratio of the periods of any two planets revolving around the Sun is equal to the cube of the ratio of their average distance from the Sun.
d. objects attract other objects with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them.

____ 12. Kepler's third law states that
a. the orbits of the planets are elliptical.
b. the speed of a planet's orbit varies depending on which part of the ellipse it is occupying.
c. the square of the ratio of the periods of any two planets revolving around the Sun is equal to the cube of the ratio of their average distance from the Sun.
d. objects attract other objects with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them.

____ 13. Newton's law of universal gravitation states that
a. the orbits of the planets are elliptical.
b. the speed of a planet's orbit varies depending on which part of the ellipse it is occupying.
c. the square of the ratio of the periods of any two planets revolving around the Sun is equal to the cube of the ratio of their average distance from the Sun.
d. objects attract other objects with a force that is directly proportional to the product of their masses, and inversely proportional to the square of the distance between them.

____ 14. Cavendish's experiment to find the value of G was performed in _____.
a. the 1540s
b. the 1600s
c. the 1660s
d. the 1790s

____ 15. A planet moving in an elliptical orbit moves
a. slower when it is closer to the Sun.
b. faster when it is farther away from the Sun.
c. slower when it is farther away from the Sun.
d. faster when it is closer to the Sun.
e. both c and d.

____ 16. Which of the following is in correct chronological order?
a. Galileo, Copernicus, Kepler, Brahe
b. Kepler, Brahe, Copernicus, Galileo
c. Newton, Kepler, Copernicus, Brahe
d. Copernicus, Brahe, Kepler, Newton

____ 17. When considering the Law of Universal Gravitation, the graph of force v. distance is _____.
a. linear
b. parabolic
c. circular
d. none of the above

____ 18. The correct expression for finding the period of a planet revolving around the Sun is:
a. $T = r^2(2\pi / Gm_S)$
b. $T = r^3(4\pi^2 / Gm_S)$
c. $T^2 = r^3(4\pi^2 / Gm_S)$
d. $T^2 = r^3(2\pi / Gm_S)$

____ 19. Gravity is what type of force?
a. field force
b. contact force
c. normal force
d. frictional force

Problem

20. The distance between Pluto and the Sun is 39.1 times more than the distance between the Sun and Earth. Calculate the time taken by Pluto to orbit the Sun in Earth days.

21. The Moon has an orbital period of 27.3 days around Earth and a mean distance of 3.85×10^5 km from Earth's center. Use Kepler's laws to find the orbital period of an artificial satellite orbiting Earth at a distance of 3.03×10^4 km from the center of Earth.

22. Venus orbits the Sun with an orbital radius of 1.08×10^{11} m. Given that the mass of the Sun is 2.0×10^{30} kg, calculate the period of Venus's orbit.

23. Jupiter orbits the Sun with an orbital radius of 7.78×10^{11} m. Given that the mass of the Sun is 2.00×10^{30} kg, calculate the orbital velocity of Jupiter.

24. Calculate the force of gravitational attraction between two spheres of mass 10.1 kg and 45.4 kg that are 38.5 m apart.

25. Venus has radius 6.05×10^6 m and mass 4.87×10^{24} kg. Calculate the value of acceleration due to gravity on Venus's surface.

26. If Earth shrinks in size such that its shape and mass remain the same, but the radius decreases to 0.21 times its original value, find the acceleration due to gravity on its surface.

27. A satellite orbits Neptune 4000 km above its surface. Given that the mass of Neptune is 1.02×10^{26} kg and the radius of Neptune is 2.48×10^7 m, calculate the orbital speed of the satellite.

28. A satellite orbits Jupiter 6.40×10^3 km above its surface. Given that the mass of Jupiter is 1.90×10^{27} kg and the radius of Jupiter is 7.15×10^7 m, calculate the period of orbit of the satellite.

29. At what height above Earth's surface does the gravitational intensity becomes 0.67 times its value on the surface of Earth? Given the radius of the Earth is 6.40×10^6 m.