**Vocabulary: Orbital Motion – Kepler’s Laws**



**Vocabulary**

* Astronomical unit – a distance unit equal to the average Earth-Sun distance.
	+ The symbol for astronomical unit is “AU.”
	+ One astronomical unit is approximately equal to 150 million kilometers. (The actual distance is 149,597,870.691 km.)
* Eccentricity – the degree by which the shape of an *orbit* differs from a circle.
	+ The eccentricity of an *ellipse* can vary between 0 and 1. An ellipse with an eccentricity of 0 is a circle. An ellipse with an eccentricity of 1 is a line segment.
	+ To measure the eccentricity of an ellipse, divide the distance between the *foci* by the width of the ellipse. (On the diagram below, the foci are labeled “F1” and “F2.”)
* Ellipse – a flattened circle.
	+ An ellipse contains two foci, labeled “F1” and “F2” on the diagram at right.
	+ The sum of the distances from any point on the ellipse to the two foci is constant. On the diagram, *a*1 + *a*2 = *b*1 + *b*2.
	+ The orbits of planets and other objects in the solar system are elliptical, with the Sun at one focus.
* Force – something that can cause a change in motion; a push or a pull.
	+ When you push or pull an object, you exert a force on the object. Other examples of forces include *gravity*, the electrostatic force, and the strong and weak nuclear forces.
* Gravity – the force of attraction between all objects in the universe.
	+ The magnitude of the gravitational force between two objects depends on the masses of the two objects and the distance between them.
		- The force of gravity is proportional to the product of the masses.
		- The force of gravity is inversely proportional to the square of the distance.
* Kepler’s first law – law that states that planets orbit in ellipses, with the Sun at one focus.
* Kepler’s second law – law that states that planets speed up as they get nearer the Sun and slow down as they move farther from the Sun.
* Kepler’s third law – law that states that the square of a planet’s *period* is proportional to the cube of the planet’s *orbital radius*.
* Orbit – the path of one body around another body in space, such as the path of Earth around the Sun.
* Orbital radius – the average distance from an orbiting object to the object it is orbiting around.
	+ The orbital radius of a planet is the mean distance from the planet to the Sun.
* Period – the amount of time it takes for an object to complete one full orbit.
* Vector – a representation that specifies the direction and magnitude of a quantity.
	+ In physics, vectors are used to represent displacement, *velocity*, acceleration, force, and other quantities that have a specific direction.
	+ A vector can be resolved into perpendicular components.
		- For example, “6.0**i** + 3.0**j**” describes a vector that points 6 units east and 3 units north.
* Velocity – the speed and direction of a moving object.
	+ The velocity of an object can be described by a vector.