Kepler’s Second Law of Planetary Motion: describes the speed of a planet traveling in an elliptical orbit around the sun. It states that a line between the sun and the planet sweeps equal areas in equal times. Thus, the speed of the planet increases as it nears the sun and decreases as it recedes from the sun.

The planets in our Solar System orbit the Sun. The orbits of some planets are almost perfect circles, but others are not. Some orbits are shaped more like ovals, or "stretched out" circles. Scientists call these oval shapes "ellipses". If a planet's orbit is a circle, the Sun is at the center of that circle. If, instead, the orbit is an ellipse, the Sun is at a point called the "focus" of the ellipse, which is not quite the same as the center. When both focus 1 and focus 2 of an ellipse are discussed, the plural form of “focus,” which is “foci,” is used instead.

Since the Sun is not at the center of an elliptical orbit, the planet moves closer towards and then further away from the Sun as it orbits. The place where the planet is closest to the Sun is called perihelion. When the planet is furthest away from the Sun, it is at aphelion. The words "aphelion" and "perihelion" come from the Greek language. In Greek, "helios" mean Sun, "peri" means near, and "apo" means away from.

When Earth is at perihelion, it is about 147 million km (91 million miles) from the Sun. When it is at aphelion, it is 152 million km (almost 95 million miles) from the Sun. Earth is about 5 million km (more than 3 million miles) further from the Sun at aphelion than at perihelion!

Some people think that this is why we have seasons, but they are wrong. Earth reaches perihelion, its closest approach to the Sun and when you might think it should be warmest, in January - the middle of winter in the Northern Hemisphere! The difference in distance is not the cause of our seasons. Instead, seasons are caused by the tilt of Earth's axis.

Some planets have very "stretched out" orbits. Astronomers say that a "stretched out" orbit has a high eccentricity, which means it is long and skinny, not round like a circle. Asteroids, many comets, and some spacecraft also travel around the Sun in elliptical orbits. They all have perihelion and aphelion points along their orbits. Anything following an elliptical orbit moves fastest at perihelion and slowest at aphelion.

If an object orbits something other than the Sun, we don't use the terms perihelion and aphelion. Satellites orbiting other bodies have a close point called perigee and a far point called apogee.

Name: _____

1. What is eccentricity? How does it relate to planetary orbits?

2. What does perihelion mean? How does it relate to Kepler's Second Law?

3. What does aphelion mean? How does it relate to Kepler's Second Law?

4. What causes Earth's seasons?

5. Label the following diagram with the following: *perihelion, aphelion, planet, sun, orbit, area x, area y, distance x, distance y, and focus*