

## Kepler's Laws

### Pre-lab Questions: Kepler's Laws of Planetary Motion (Use your Notes)

1. Describe Kepler's First law in your own words.
2. Describe Kepler's Second law in your own words. What does this mean about a planet's speed around its orbit?
3. Describe Kepler's third law in your own words.

### Kepler's First Law Activity

#### Materials:

Cardboard, 2 Pushpins, 30 cm of String, Pencil, Binder Paper, Metric Ruler

#### Procedure: (work in groups of two)

1. Use the loop of string provided by your teacher.
2. Lay a piece of binder paper on the cardboard so you have something to draw on.
3. Push the pushpins 6 centimeters apart into the paper/ cardboard.
4. Place the loop around the two pins.
5. Put the pencil into the loop and pull the string into a triangle.
6. Keeping the triangle tight draw an ellipse around the pencils.
7. Each point is called the focus of the ellipse. Label the one on the right the "sun".
8. Pick a point along the ellipse and label it a "planet".
9. Along the orbit find the place where the planet would be closest to the sun, this is called the perihelion, label this on your drawing.
10. Find the place where the planet would be farthest from the sun, this is called its aphelion, label it.
11. Move to a different location on your binder paper. Create at least two more ellipses. Play with the distance between the pushpins. How does it change the shape of your ellipse? (You only have to label the first of the diagrams.)

#### Data:

Turn in your diagram as your data.

#### Questions:

1. Which of the materials from lab represented the focal points?

2. Is the sun at the center of a planets orbit? If not where is it located?
3. How does the distance between the pushpins change the shape of your ellipse?

### **Kepler's Third Law**

**Materials:** String, Washers, Drinking Straw

**Caution:** Be aware of where you are during this part so you do not hit anyone with the washers.

#### **Procedure:**

1. The washer/straw setup should already be made for you. Please be careful to not bend the straw.
2. Pull the string through the top of the straw so that the most possible string is exposed.
3. Hold the straw and slowly begin spinning the washers in a circle over your head. Only spin them fast enough to get them to orbit the straw.
4. Once they are spinning slowly pull down on the bottom washers, reducing the length of the spinning sting.
5. Observe what happens.

#### **Questions:**

1. What do the washers in the experiment represent?
2. Describe what happened to the size of the orbit as you shortened the string?
3. Describe what happened to the speed of the orbit as you shortened the length of the string?
4. How does this relate to Kepler's Third law?