

Name _____

Date _____

Kepler's Laws of Planetary Motion Activity

Kepler's first law of Planetary Motion states that the motion of every planet is an ellipse with the Sun located at one focal point. But exactly is an ellipse and a focal point?

During this activity, you will use focal points to draw an ellipse.

Materials

- Cork Board/Cardboard
- Construction Paper
- Pencil/Marker
- Two Push Pins
- String
- Ruler

Procedure for Drawing a Perfect Circle

1. Place a piece of construction paper on top of the corkboard that has been attached to the cardboard.
2. Place one push pin through the center of the construction paper.
3. Place the string around the push pin and hold the ends of the string together, pulling the string tight.
4. Keeping the string on the push pin, make a circular motion around the pushpin with the string, making sure the ends of the string remain on the paper.
5. Tie the string together so that the circle made, from the string, remains on the paper, when you circle around the push pin.
6. Place your pencil or marker in the string and use the string as a guide to draw a perfect circle.
7. Remove the push pin and use your marker to mark the hole where the push pin used to be.
8. Label this hole as the "Focus".
9. Use a ruler to measure the distance from the focus to one point on the circle and record your results in centimeters: _____ cm.
10. Use the ruler to measure the distance from the focus to a different point on the circle and record your results: _____ cm.
11. If you succeeded in drawing a perfect circle, the above two measurements should be the same.

Procedure for Drawing an Ellipse

1. Turn the construction paper over and place it on top of the corkboard.
2. Place two pins in the center of the corkboard, about 3 inches apart from each other.
3. Place a piece of string around both push pins and hold the ends of the string together.
4. Keeping the string on both push pins, make a circular motion around the push pins with the string, making sure the ends of the string remain on the paper.
5. Tie the string together so that circle made, from the string, remains on the paper, when your circle around both push pins.
6. Place your pencil or marker in the string and use the string as a guide to draw an ellipse.
7. Remove both push pins and use your marker to mark both holes where the push pins used to be.
8. Label each hole as "Focus". (The plural term for focus is foci.)
9. Use the marker to make one mark somewhere along the edge of the ellipse.
10. Use a ruler to measure the distance from each focus to the mark you made on the ellipse.

Focus One _____ cm Focus Two _____ cm

11. Add the two distances together: _____ cm

12. Use the marker to make another mark somewhere along the edge of the ellipse.
13. Use a ruler to measure the distance from each focus to the second mark you made on the ellipse.

Focus One _____ cm Focus Two _____ cm

14. Add the two distances together: _____ cm
15. If you succeeded in drawing an ellipse, the sum of the distances from each foci to any two points on the ellipse will be the same.

Kepler's Laws of Planetary Motion

First Law - the motion of every planet is an ellipse with the Sun located at one focal point.

- On a separate sheet of paper, write Kepler's first law.
- Draw an ellipse and label each focus.
- Label one focus as the "Sun".
- Draw a line from the ellipse, closer to the Sun, towards the Sun and label the line "Perihelion".
- Draw a second line from the ellipse, farther from the Sun, and label this line "Aphelion".

Second Law – Planets travel faster nearer the Sun than when they are farther away from the Sun.

- On the separate sheet of paper, write Kepler's second law.
- Draw an ellipse and label the "Sun" at one focus.
- Draw a planet on the ellipse, near the Sun. Use arrows to indicate direction of motion.
- Write "Faster", near the planet.
- Draw a planet on the ellipse, farther away from the Sun. Use arrows to indicate direction of motion.
- Write "Slower", near the planet.

Third Law – Planets farther away from the Sun take a longer time to orbit the Sun than planets that are closer to the Sun.

- On the Separate sheet of paper, write Kepler's third law.
- Draw the elliptical orbits for all 8 planets.
- Label the Sun at one focus.
- Label the names of each planet on the elliptical orbit.
- Write the time it takes for each planet to orbit the Sun, along the orbit for each planet.
 - Mercury – 88 days
 - Venus – 225 days
 - Earth – 365.25 days
 - Mars – 687 days
 - Jupiter – 12 years
 - Saturn – 30 years
 - Uranus – 84 years
 - Neptune – 165 years