02-08 Elliptical Orbits Lab *Name:* _____

Adapted from Take-Home Physics by Michael Horton

Objectives

- Understand how elliptical the earth's orbit is.

Materials

- Corkboard (15 cm × 15 cm)
- 2 Push pins
- String loop (20 cm string tied in loop)
- Paper

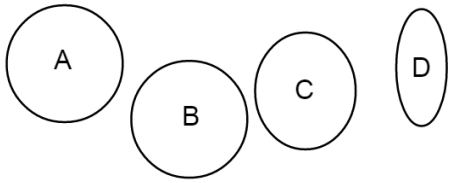
Procedure

All planets and moons, or satellites, orbit in ellipses. The measure for the ovalness of an ellipse is called eccentricity. This is a number between 0 and 1 for ellipses. 0 means perfect circle whereas near 1 means a very stretched out ellipse. The formula for eccentricity is

$$e = \sqrt{1 - \frac{b^2}{a^2}}$$

where a is the semimajor axis (distance from center to farthest point) and b is the semiminor axis (distance from the center to closest point).

1. Place a piece of paper over the corkboard. Push the push pins into the paper about 3 cm apart. Make sure the midpoint between the pins is approximately the center of the corkboard.
2. Place the loop of string over the pins and draw an ellipse by using your pencil to hold the string taunt as you draw.
3. Take off the loop and push pins. Using the holes from the pins, draw a line across the center of the ellipse. This is the major axis.
4. Find the center of the major axis and draw a perpendicular line. This is the minor axis.
5. Measure from the center to the end of the major axis. a = _____
6. Measure from the center to the end of the minor axis. b = _____
7. Find the eccentricity. e = _____
8. Move the pins farther apart and repeat steps 2-7. a = _____, b = _____, e = _____
9. Move the pins closer together and repeat steps 2-7. a = _____, b = _____, e = _____
10. What effect did moving the pins have on the eccentricity? _____
11. The earth's orbit eccentricity is about 0.0167. One of these ellipses has an eccentricity of 0.0167. Which is it? _____



12. Does the ovalness of the earth's orbit cause the seasons as based on the shape of the earth's orbit from this lab? _____ If not, what does cause the seasons? (Look it up after class) _____
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