Names_____ Period_____

ELLIPSES LAB

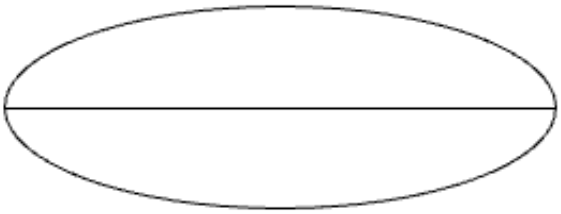
INTRODUCTION: Earth revolves around the sun in an orbit which is a special geometric figure called an *ellipse*. An ellipse has two "center points". Each one is called a *focus*. The sun is not in the exact middle of Earth's orbit. Rather, it is found at one of the foci.

OBJECTIVE: You will be able to compare the shape of Earth's orbit and orbits of other planets with the shape of a circle.

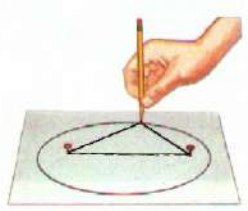
VOCABULARY: Define the following terms using the textbook or internet. *These can be SHORT definitions.*

- Ellipse:_____
  _____
- Eccentricity:_____
  _____
- Focus (plural is foci):_____
  _____
- Major Axis:_____
  _____
- Minor Axis:_____
  _____
- Circle:_____
  _____

Label the parts on the ellipse below: major axis, minor axis, foci



PROCEDURE :



1. Cut a piece of string about 24 cm in length and tie the ends together to form a loop.
2. On plain white paper draw a straight line lengthwise down the middle of the paper.
3. Near the center of this line, draw two dots 3 cm apart.
4. Placing the paper on a piece of cardboard, put a thumbtack in each dot (focus).
5. Loop the string around the thumbtacks and draw the ellipse by placing your pencil inside the loop as shown →
6. Label this ellipse #1.
7. Measure the distance between the thumbtacks (foci). This is "d". Record this on your Report Sheet.
8. Measure the length of the major axis (L) and record this on the Report Sheet.
9. Move **each** tack out 1 cm and draw a new ellipse. Label it #2 and measure and record d and L.
10. Move **each** tack out another 1 cm and draw an ellipse. Label it #3 and measure and record d and L.
11. Move **each** tack out another 1 cm and draw an ellipse. Label it #4 and measure and record d and L.

12. For #5, place a dot in the exact **middle** of the first two foci. Using a compass with a red pencil, place the point of the compass in the center dot. Extend the compass along the major axis so the pencil touches ellipse #1. Draw your circle. *Note: there is only one center dot, so the distance between the dots is 0 cm.*
13. Using the given equation, calculate the eccentricity (e) of each of the five figures. Show all work on your Report Sheet.

$$e = \frac{d \text{ (distance between thumbtacks)}}{L \text{ (length of the major axis)}}$$

REPORT SHEET *round answers to the nearest tenth (one decimal point) – there are no units for eccentricity*

Ellipse #1	Calculations
d = _____	
L = _____	
e = _____	

Ellipse #2	Calculations
d = _____	
L = _____	
e = _____	

Ellipse #3	Calculations
d = _____	
L = _____	
e = _____	

Ellipse #4	Calculations
d = _____	
L = _____	
e = _____	

#5 (circle)	Calculations
d = _____	
L = _____	
e = _____	

DISCUSSION QUESTIONS: (*Answer in Complete Sentences.)*

1. What change takes place in the eccentricity of the ellipses when you increase the distance between the foci?

2. Which of the four ellipses you drew (not counting the circle) was the most eccentric?

3. Which of the four ellipses you drew (not counting the circle) was the least eccentric?

4. What is the minimum eccentricity an ellipse can have? What is the name of the geometric figure which has the minimum eccentricity?

5. How does the numerical value of "e" change as the shape of the ellipse approaches a straight line?

Use the table below to answer questions 6-8

6. Which is rounder (less eccentric), the orbit of Earth or your Ellipse #1?

7. List the planets in order of the **increasing eccentricity** of their orbits.

ECCENTRICITIES OF THE PLANETS

Planet	Eccentricity
Mercury	0.206
Venus	0.007
Earth	0.017
Mars	0.093
Jupiter	0.048
Saturn	0.056
Uranus	0.047
Neptune	0.009

8. In the table, *Eccentricities of the Planets*, the planets are listed in order by their distance from the sun. Is there a direct relationship between the eccentricity of its orbit and the distance a planet is from the sun?

CONCLUSION:

Write your conclusion in at least two complete sentence and reference data from the lab
Describe the true shape of Earth's orbit.