Earth Science

Name:

Drawing Ellipses Lab

The ellipse is the geometric shape of most orbits. In this lab, you'll construct 2 ellipses, and examine and measure them to determine some of the fundamental properties of ellipses.

Follow the directions below, making sure you draw and measure carefully along the way. When you have completed the construction and measurement of your ellipses, carefully and thoughtfully answer the questions posted at the end of this lab.

1. Gather up the materials you need to complete this lab (See Fig. 1):

    - ☐ A piece of cardboard
    - ☐ 2 sheets of clean white paper
    - ☐ 2 push pins
    - ☐ A 30 cm (or so) length of string
    - ☐ A metric ruler/straight edge
    - ☐ A pen or sharp pencil

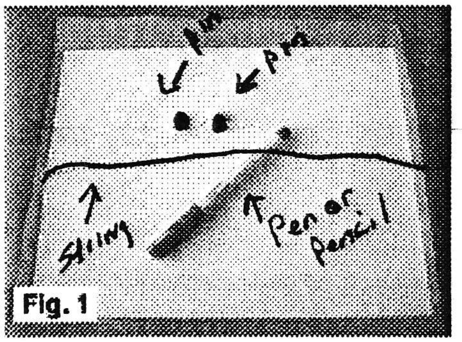

Fig. 1

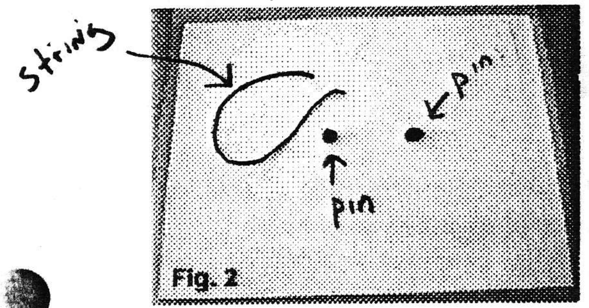

Fig. 2

2. Tie your string into a loop. The loop, when stretched tight, should be 12 cm or so long (anything between 10 and 13 cm will work fine) (See Fig. 2)

2A. <u>Write your name on the corner of each sheet of paper</u>. Place one sheet of paper on the cardboard, and place the 2 push pins horizontally about **6 cm apart** near the center of your paper as shown in Fig. 2.

3. Place your loop of string around the 2 push pins, and, keeping the string tight, use the string as a guide to carefully draw an ellipse around the push pins. (See Fig 3.) Be patient - you may have to try it a few times before you get the hang of it!

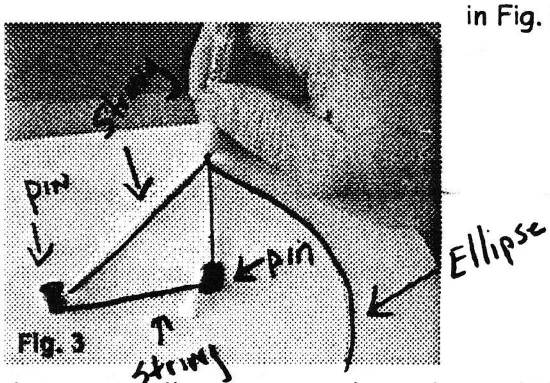

Fig. 3

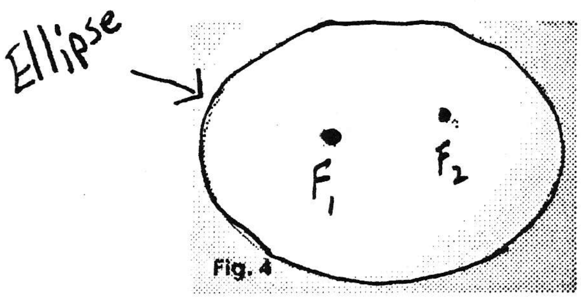

Fig. 4

4. After you've drawn your ellipse, remove the push pins (it's probably a good idea to stick them in the margin of cardboard so they don't roll away). The 2 pinholes are called the ***foci*** of the ellipse (each one is called a ***focus***). Label the 2 foci F_1 and F_2 as indicated in Fig.4.

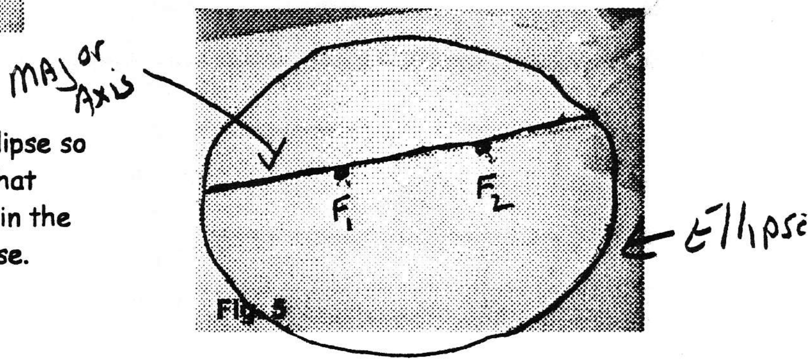

Fig. 5

5. Carefully draw a straight line across the ellipse so that it passes **exactly** through the foci. That line, which is the longest one you can draw in the ellipse, is called the *major axis* of the ellipse. Label it on your diagram. (See Fig. 5)

6. The eccentricity of an ellipse tells us how round or flat it is. Use this formula:

$$\textbf{Eccentricity} = \frac{\textbf{distance between the foci}}{\textbf{length of the major axis}}$$

and calculate the eccentricity of your ellipse. Round your answer to the nearest tenth and record it below and on your sheet.

Distance between the foci = ____6 cm____ / length of the major axis = ___________

Eccentricity of 1st ellipse = ___________

7. On a second sheet of paper, repeat the first six steps of this lab, ***but place the push pins 9 cm apart!***

8. Calculate the eccentricity of your 2nd ellipse (just like you did above):

Distance between the foci = ____9 cm____ / length of the major axis = ___________

Eccentricity of 2nd ellipse = ___________

9. Place the 2 ellipses on your desk next to each other. Which one looks more circular?___________

10. Which one has the greater eccentricity? ___________. Is this one more circular or more flattened? _______________

11. Finish this statement: "The greater the eccentricity of an ellipse, the ______________________

____"

12. Look at the table below showing the eccentricities of the planets and their orbits:

a. Which planet has the most circular (least Eccentric orbit)?

b. Which planet has the most eccentric orbit?

c. Compare the eccentricities of your 2 ellipses with that of Earth's orbit. Which of the 3 is more circular? How do you know?

Mercury	0.2056
Venus	0.0068
Earth	0.0167
Mars	0.0934
Jupiter	0.0483
Saturn	0.0560
Uranus	0.0461
Neptune	0.0097
Pluto	0.2488