NAME: Astronomy Lab Due Date:

Kepler's Orbital Lab Activity

PURPOSE:

To draw scale models of the inner planets' orbits, asteroids and comet's orbits around the sun.

MATERIALS

Plain Poster paper
4 straight pins
Cardboard (2 pieces)
String
Scissors
Pencil (colored will be helpful)
Metric ruler

PROCEDURE

1. Place a sheet of paper over the cardboard. Draw a small circle near the center of the paper.
   - A Through the center of the circle, press a pin (#1) through the cardboard (both pieces if possible) to anchor it well
   - B Label the circle SUN.
2. When making the orbits, do not move the pin (#1) labeled SUN.
   - A Move only the pin (well will call #4) the proper distance each time
   - B Move it in a straight line (to the right) so the holes it makes are in a line.
3. First make the string loop, cut a piece of string several centimeters longer than the distance around the loop. ***SEE DA TA TABLE ON THE NEXT PA GE***
   - A Place the 2nd (#2) pin somewhere in the cardboard NOT on the poster paper which you will draw on.
   - B Using the metric ruler, place the 3rd pin the distance apart (in cm) as indicated on the data table on the next page
   - C Loop the string around both pins (#2 & #3) and bring the ends of the string together at the proper distance and tie a knot.
     - i For example, for VENUS, you cut a piece of string about 30 centimeters long.
     - ii Bring the ends together and tie a knot at 8.8 centimeters
     - iii Check the knot as you tighten it. (See Fig. 1-3 (b)).
4. The following data table (on the next page) shows how far apart to set the forth (#4) pin from the sun (#l) pin is.
5. Look at Fig. 1-3 (a). You will use this method shown in the figure to draw the elliptical orbit of Mars, Earth, Venus, and Mercury, in that order, on the same sheet of paper.
   - A Keep the string tight as you move the pencil while making the orbit,
   - B You may wish to practice once or twice on a separate sheet of paper.
   - C Draw the elliptical orbit carefully.
6. Label each orbit by placing the dot (to represent the planet) and place the planet's proper symbol as soon as you draw it.
7. Then continue the activity but this time you will add an asteroids and comets to your drawing.
8. Label each orbit by placing the drawing (to represent the asteroid or comet) and place the proper symbol as soon as you draw it.
9. Answer the Data Analysis and Conclusion

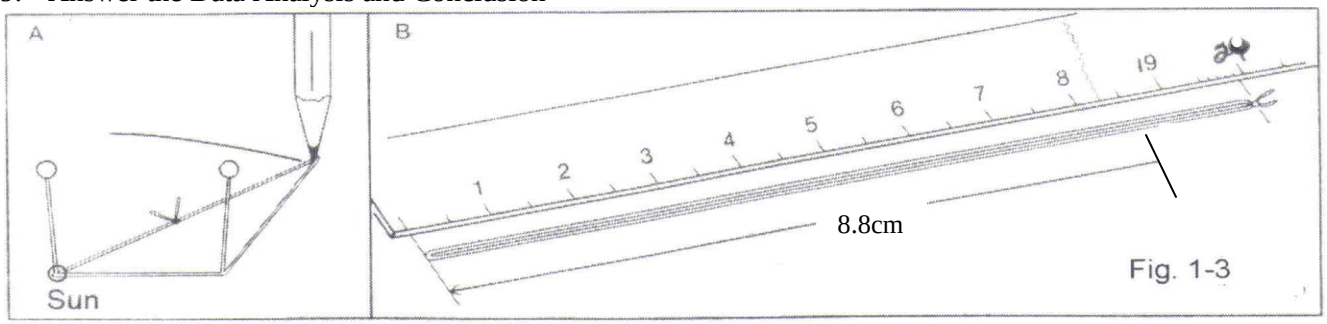

Fig. 1-3

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Object *scale:* *1.0cm = 12,400,000 km* **And** *1.0 mile = 1.6 km*	**Distance for the string to make a loop (cm)**	**Distance between Pins from the Sun in cm UNLESS told differently.**	**Location of planet (°)** USE inside numbers *If # is MORE than 180 then you need to subtract 360 Use outside numbers*	**Where the planet rises above (SOLID line) the stellar plane to 180° where below (DASH) plane in °**
Venus (brown) *67,000,000 mi*	**8.8**	**0.1**	**120**	**75 (this starts the solid line going counter clockwise)**
Earth (blue) *93,000,000 mi*	**12.1**	**0.3**	**110**	**(this is a solid line) on the plane**
Mars (red) *142,000,000 mi*	**19.9**	**2.1**	**60**	**50**
Mercury (green) *35,000,000 mi*	**6.5**	**1.2**	**10**	**45**
Asteroid Ceres (any) *257,000,000 mi*	**22.4**	**0.6**	**190 (360-190=170)**	**130**
Asteroid Apollo (any)	**17.0**	**6.0**	**270**	**126**
Asteroid Aten (any)	**24.6**	**7.4 @ 270 °**	**160**	**245**

BACK SIDE of POSTER paper OR use another POSTER paper… ASK your teacher!

Object *scale:* *0.6cm = 161,920,000 km* **And** *1.0 mile = 1.6 km*	**Distance for the string to make a loop (cm)**	**Distance between Pins from the Sun in cm UNLESS told differently.**	**Location of planet (°)** USE inside numbers *If # is MORE than 180 then you need to subtract 360 Use outside numbers from the #.*	**Where the planet rises above the stellar plane (°)**
Neptune (blue) *2,800,000,000 mi*	**18.0**	**0.0**	**150**	**132**
Jupiter (brown) *809,600,000 mi*	**3.1**	**0.2**	**50**	**100**
Saturn (purple) *888,200,000 mi*	**5.7**	**0.3**	**204 (360-204=156)**	**114**
Uranus (green) *1,790,000,000 mi*	**11.5**	**0.5**	**136**	**74**
Mars (red) *142,000,000 mi*	**0.9**	**0.7**	**60**	**50**
Main Asteroid Ceres *257,000,000 mi*	**1.7**	**0.1**	**210**	**130**
Pluto *3,670,000,000 mi*	**23.7**	**8.0 @ 225 °**	**310**	**300**
Comet Halley	**35.0**	**33.0@160 °**	**190**	**240**

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Data Analysis & Conclusion: (each problem is 1 point value)

1. Which answer BEST describe the shapes of the orbits of the inner planets.

A The orbits are circular
B The orbits are elliptical
C The orbits are spherical
D The orbits are squared

2. Which two planets seem almost identical? Meaning the orbit is similar.

A Mercury & Venus
B Earth & Mars
C Venus & Earth
D Mercury & Ceres
E Aten & Earth

3. Which is the correct order of the planets according to your illustration?

A Venus, Earth, Mars, Mercury, Ceres
B Mercury, Venus, Earth, Ceres, Mars
C Mars, Venus, Earth, Mercury, Ceres
D Mercury, Venus, Earth, Mars, Ceres

4. The Asteroid that crosses Earth's orbit is located where at right now?

A Between Earth and Venus
B Between Earth and Mars
C Between Mars and Ceres
D Earth and Aten

5. SELECT which asteroid orbit is most like the orbits of the planets drawn?

A Asteroid Aten
B Asteroid Apollo
C Asteroid Ceres

6. Most asteroids follow a typical path. SELECT which asteroid has a path that is much closer to the sun than that of the typical asteroid?

A Asteroid Ceres
B Asteroid Apollo
C Asteroid Aten

7. SELECT which asteroid has a path that takes it much farther from the sun than the typical asteroid?

A Asteroid Aten
B Asteroid Apollo
C Asteroid Ceres

8. SELECT which asteroid has the potential of colliding with Earth?

A Asteroid Aten
B Asteroid Apollo
C Asteroid Ceres

9. Which two planets seem almost identical "elliptical orbits? Meaning the orbit is oval.

A Mercury & Venus
B Apollo & Ceres
C Apollo Bob
D Venus & Earth
E Mercury & Mars

10. Compare the path of Mars & Ceres from the first side to the back side?

A The orbits are the same on both sides, just the scale size changed
B The orbits are different on both sizes. They are more circular on one size and oval shaped on the other side.
C The orbit of Mars is the same on both sides, BUT Ceres is more circular on one size and oval shaped on the other side.
D The orbit of Ceres is the same on both sides, BUT Mars is more circular on one size and oval shaped on the other side.

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Data Analysis & Conclusion: (outer planets… Halley comet's side)

11. Which shape BEST describe the shapes of the orbits of most outer planets.

A Circular **B Elliptical** **C Spherical**

12. Which shape BEST describe the shapes of the Neptune orbit?

A Circular **B Elliptical** **C Spherical**

13. Which planets appear to "cross" orbits even though they REALLY do not?

A Jupiter & Ceres
B Venus & Earth
C Halley's Comet & Neptune
D Neptune & Pluto

14. SELECT which Object listed below has an extreme elliptical orbit?

A Halley's Comet **B Pluto** **C Typical Asteroid**

15. According to your orbital lab with object is farthest from the Sun?

A Neptune
B Halley's Comet
C Pluto
D Asteroid Ceres

16. Which MAJOR planet is located below is orbital plane?

A Mars **C Saturn** **E Neptune**
B Jupiter **D Uranus**

17. Halley's Comet in its orbit right now is located where?

A Between Neptune and Uranus
B Between Pluto and Neptune
C Between Saturn and Jupiter
D Between Jupiter and Ceres

18. Describe the orbital path of the Comet?

A The orbits are circular
B The orbits are ellipse (ovals)
C The orbits are spherical
D The orbits are squared

19. Compare the path of Halley's Comet to the path of a typical asteroid.

A Halley's Comet has a more extreme ellipse than the Typical Asteroid which is closer to being circular.
B Halley's Comet has a more circular than the Typical Asteroid which is MORE elliptical
C Both Halley's Comet & the Typical Asteroid are circular
D Both Halley's Comet & the Typical Asteroid are spherical

20. What is the distance (in centimeters) from the Sun to the Earth using the scale given on the data table? HINT: Earth is 93 000 000 miles from the Sun.

A 5.95 cm **C 12.0 cm** **E My answer is not shown above**
B 7.50 Km **D 1.453000000000000 cm**

Show your math work (+5) on the SCAN TRON.

NAME: _____ DATE: _____ PD: _____

Kepler's Orbital Lab Rubric

TOTAL:

CURATE EVALUATION SHEET:

2 **1) LOCATED on POSTER PAPER:**

0 1 a. Title of project on at least ONE side of poster

0 1 b. Name on at least ONE side of poster

18 2) **KEY**: has the student identified on <u>BOTH</u> sides of poster

0 1 2 3 4 5 6 7 8 9 10 11 a. Planet major (each): & (2 dwarf planet)

0 1 2 3 4 b. Asteroid (each): 3 on one side; one on back side

0 1 c. Comet: on back side

0 1 2 d. SUN: on BOTH sides

67 **3) ORBIT OF PLANETS & OTHERS**

MUST have the following: (+1 symbol; +1 location; +1 orbit +1color)

0 1 2 3 4	a. Mercury: (any GREEN)	----	----	----	----
0 1 2 3 4	b. Venus (colored in BROWN)	----	----	----	----
0 1 2 3 4	c. Earth (colored in BLUE)	----	----	----	----
0 1 2 3 4	d. Mars (colored in RED)	----	----	----	----
0 1 2 3 4	e. Typical Asteroid CERES (colored in YELLOW)	----	----	----	----
0 1 2 3 4	f. Apollo (asteroid) (any color & symbol)	----	----	----	----
0 1 2 3 4	g. Aten (asteroid) (any color & symbol)	----	----	----	----

BACK SIDE *MUST have the following: (+1 symbol; +1 location; +1 orbit +1color)*

0 1 2 3 4	h. Mars (colored in RED) (other side)	----	----	----	----
0 1 2 3 4	i. Ceres Typical Asteroid colored in YELLOW)	----	----	----	----
0 1 2 3 4	j. Jupiter (colored in BROWN)	----	----	----	----
0 1 2 3 4	k. Saturn (colored in PURPLE)	----	----	----	----
0 1 2 3 4	l. Uranus (colored in GREEN)	----	----	----	----
0 1 2 3 4	m. Neptune (colored in BLUE)	----	----	----	----
0 1 2 3 4	n. Pluto (dwarf planet) (any color)	----	----	----	----
0 1 2 3 4	o. Halley's comet (colored in BLACK)	----	----	----	----

0 1 2 3 4 5 6 7 4) **Professional look over all**

Eraser marks/ white out -2/error Random lines -3 LATE -4

_____/ 87 point total this side