Name________________________________ Period____________ Date____________

Scale Model of Sun and Planet Sizes

Background
Many of the drawings or models of the solar system cannot be drawn to scale. The distances and sizes involved vary too much and are too great to represent in a textbook or poster. Consequently, an understanding of the distances and sizes involved in astronomy is not obtained. This activity will help you gain an understanding of the planet sizes in relation to each other and the Sun.

Objective
We are turning the ceiling into the solar system! Yellow paper will cover the ceiling tiles in the back of the classroom to represent the Sun. Each group will draw one planet to scale on a ceiling tile. The end result will be a model of the size of each planet drawn to scale with the Sun.

Scale
We will represent the Sun by a circle with a 0.5-foot radius. This will be done by taking a sliver of this 0.5*ft* circle Sun and putting it in the corner of the classroom. The outline is there for you to see.

Now that there is a scale for the Sun, we need to find the size of the eight planets. Here is a table showing the radius of each object.

Object	Radius (km)
Sun	6.955×10^5
Mercury	2.4397×10^3
Venus	6.0519×10^3
Earth	6.3710×10^3
Mars	3.4025×10^3

Object	Radius (km)
Jupiter	7.1492×10^4
Saturn	6.0268×10^4
Uranus	2.5559×10^4
Neptune	2.4764×10^4

The first thing to figure out is the scale factor. This is how much smaller our model will be than the actual solar system. Using the data for the Sun, the scale ratio is

$$6.955\times10^5\,km : 0.5\,ft$$

This isn't useful yet because the units are different. Therefore, you need to convert *km* to *ft* since our drawing will be in *ft*. You can do this knowing that 2.54*cm* = 1*inch* and using the following formula:

$$1km = 1km \times \frac{\_\_\_\_\_\_\,m}{1km} \times \frac{\_\_\_\_\_\_\,cm}{1m} \times \frac{1inch}{2.54cm} \times \frac{1\,ft}{\_\_\_\_\_\_\,inch} = \_\_\_\_\_\_\_\_\_\_\ ft$$

Let's call this number A, so 1 *km* = A *ft*. Now, convert the left side of the scale ratio to feet using the formula:

$$6.955\times10^5\,km \times \frac{\text{A}\ ft}{1\,km} = 6.955\times10^5\,\text{A}\ ft \times \frac{km}{km} = 6.955\times10^5\,\text{A}\ ft = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ft$$

Let's call this number B, so B *ft* = 6.955 x 10^5*km* × A *ft*/*km*. The final step involves converting the scale ratio to the form _#_:1. This is simply done by dividing by both sides of the scale ratio by 0.5*ft*.

$$\frac{\mathrm{B}ft : 0.5\,ft}{0.5\,ft} = \left(\frac{\mathrm{B}}{0.5}\times\frac{ft}{ft}\right) : \left(\frac{0.5}{0.5}\times\frac{ft}{ft}\right) = \left(\frac{\mathrm{B}}{0.5}\times 1\right) : \left(\frac{0.5}{0.5}\times 1\right) = \frac{\mathrm{B}}{0.5} : 1 = \underline{\hspace{4cm}} : 1$$

This last number, let's call it C, is the scale factor. It represents how much smaller our model Sun is than the actual Sun. Our model Sun is C times smaller than the actual Sun.

Planet Sizes

Now that the scale factor C has been determined, we can determine the scaled down size of the planets. First, convert all the planet radii to *ft* in the following table.

Planet	Formula (Symbols)	Formula (Numbers)	Radius (*ft*)
Mercury	M Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Venus	V Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Earth	E Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Mars	M Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Jupiter	J Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Saturn	S Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Uranus	U Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________
Neptune	N Rad. (*km*) × A	___________ *km* × ________ *ft*/*km*=	________________

Divide all the planet radii in *ft* by the scale factor C to determine the scaled planet sizes in the following table.

Planet	Formula (Symbols)	Formula (Numbers)	Scaled Radius (*ft*)
Mercury	M Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Venus	V Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Earth	E Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Mars	M Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Jupiter	J Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Saturn	S Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Uranus	U Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________
Neptune	N Rad. (*ft*) / C	____________ *ft* / ____________ =	_________________

Drawing

Since the size of the planets has been figured out, it's time to put on our artistic skills to the test and draw the planets on the yellow paper. Set the width of your compass to the scaled size of your planet. Place the point of the compass on the paper away from the edge and trace out a circle representing the size of you planet. Using the posters around the room as a guide, color your planet as best you can to the actual colors of the planet. If you're doing Jupiter, include the Great Red Spot. If you're doing Saturn, include the rings around Saturn.