



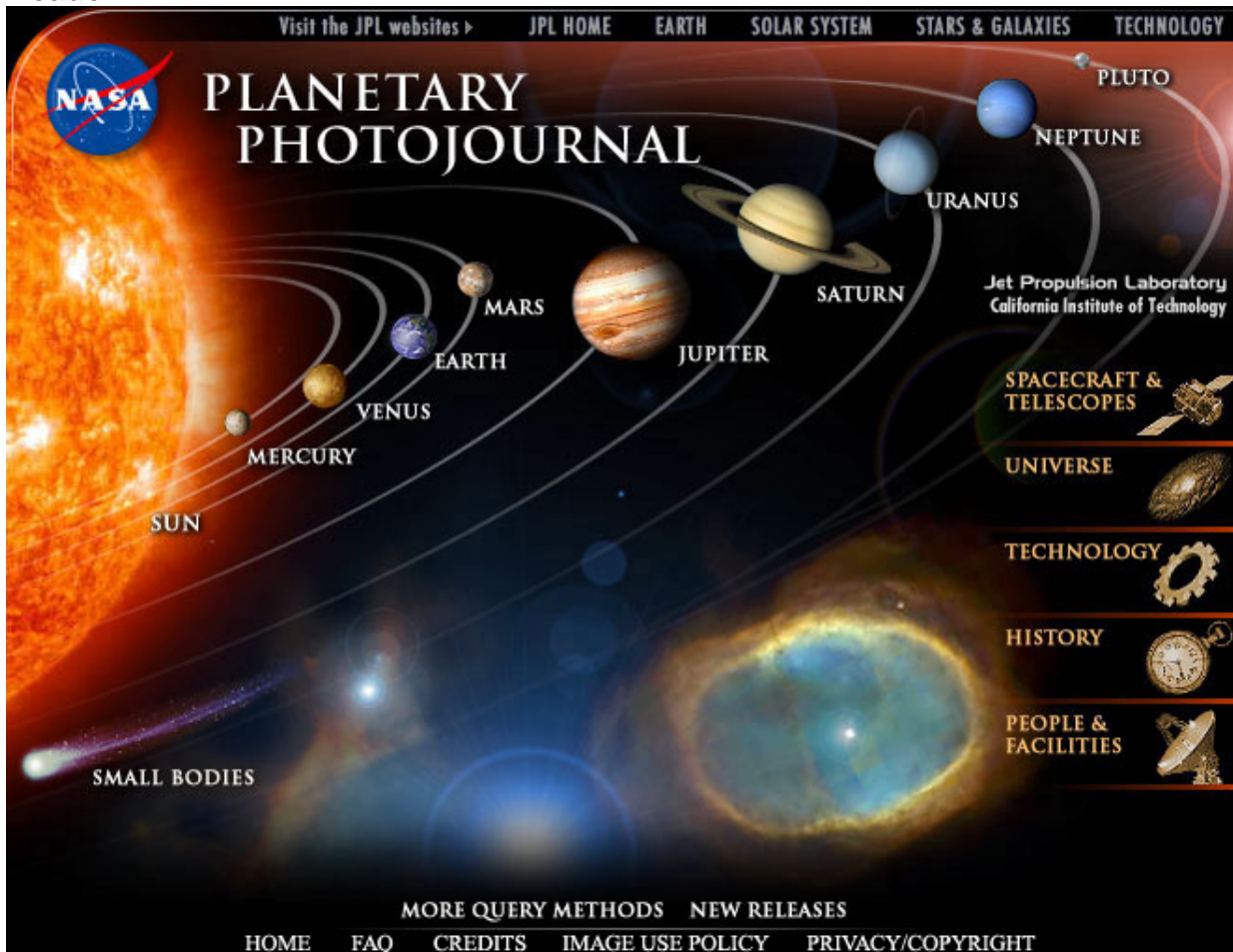
*Drexel-SDP GK-12 ACTIVITY*

**Subject Area(s):** Astronomy, Scale

**Associated Unit:** None

**Lesson Title:** Putting the Solar System in Perspective

**Header**



**Image 1**

**Description:** Picture of all the planets and their relative size in comparison to the sun

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**Grade Level** 6

**Lesson #** 1 of 1

**Time required:** 2 hours

### **Summary**

Students will make a scale version of the solar system to truly understand the size difference between planets and the sun, as well as the actual relative distance between planets.

### **Engineering Connection**

In order to better understand and design the systems that engineers are working on, it sometimes benefits them to make models of those systems. Models are more beneficial if they can be built to scale of the actual system.

### **Keywords**

Astronomy, Solar System, Scale, Model

### **Educational Standards**

- Science: 3.1.7, 3.4.7
- Math: 2.9

### **Learning Objectives**

After this lesson, students should be able to:

- Understand the relative size of planets to each other and the sun, as well as the relative distance of the planets from each other and the sun.
- Develop a to-scale model of the solar system.

### **Introduction / Motivation**

Start by giving out the first two pages of the “universe to scale” handout. Go over the questions on the handout with the students (*We can all look and see the sun in the sky, how big is the sun? Is the sun bigger than the earth? What is closer to the earth, the sun or the moon? What is the relative size of the earth to the sun? How far away is the sun in comparison to the size of the earth? How could we go about recreating the universe utilizing a model to illustrate the various planets, the moon, the sun and how could demonstrate the relative size and distances apart.*). Ultimately, go over the picture above (and on the handout) with the students and see if they can identify what is wrong. On the picture, the planets are somewhat to scale with each other, but the closeness of the planets to each other is grossly exaggerated. Explain that if the distance of the planets was ever done to scale, the solar system could never fit on a page. Review with the students the idea of scale and how they could use the scale of 1” = 10,000 miles to convert miles to inches.

## Lesson Background & Concepts for Teachers

### Vocabulary / Definitions

Word	Definition
scale	A ratio between the size of something and a representation of it

### Pre-Activity Preparation

- Review with the students how to convert miles to inches using a scale. For example, if 100 miles = 1", then 1,000 miles = 10".
- Also, go over how to convert inches to feet.

### Procedure:

1. In order to develop a model, it is important to determine a scale. The scale used is 1" = 10,000 miles. Therefore, students will complete the table in the handout located at the end of this lesson plan (completed below for the teacher but not in student's handout) by converting the actual miles to the scale miles in inches.
2. Split the students up into groups (groups of two or three). Each group will represent a different planet, the sun, or the moon.
3. Write the name of the planets, moon, and the sun on index cards (one name per card), fold the card over and place it in a grab bag. Suggest having a couple of groups designated as the sun because they will need to cut out about a 7 foot circle.
4. Go around and have each group reach into the bag and select one index card. That will be the planet they will have to make.
5. Have the students calculate the diameter and distance from the sun according to the scale of 1"=10,000 miles. The students will fill out the attached handout "universe to scale handout" for their selective planets.
6. Students will cut out circles from construction paper representing their respective planets in inches. If time permits, they can color their planet for better visual representation.
7. If possible, take the students outside so that with the sun as the starting point, measure the distance of each planet from the sun using the 100 foot tape measure. (otherwise, this will have to be done in the hallway) and starting from the sun, mark off the appropriate distance that each planet is from the sun.
  - a. Note – there will not be enough room to fit all of the planets, but that is fine, because this exercise is meant to show the vastness of the universe.

Scale: 1 inch = 10,000 miles

	Diameter (miles)	Diameter (inches)	Distance from the sun (miles)	Distance (inches)	Distance (feet)	Distance (yards)
Sun	862,400	86.2	-	-	-	-
Mercury	3,032	0.3	35,983,610	3,598	300	100.0
Venus	7,521	0.8	67,232,360	6,723	560	186.8
Earth	7,926	0.8	92,957,100	9,296	775	258.2
Mars	4,222	0.4	141,635,300	14,164	1,180	393.4
Ceres	590	0.1	257,869,045	25,787	2,149	716.3
Jupiter	88,846	8.9	483,632,000	48,363	4,030	1343.4
Saturn	74,898	7.5	888,188,000	88,819	7,402	2467.2
Uranus	31,763	3.2	1,783,950,000	178,395	14,866	4955.4
Neptune	30,778	3.1	2,798,842,000	279,884	23,324	7774.6
Pluto	1,413	0.1	3,674,491,000	367,449	30,621	10206.9
Eris	1,492	0.1	3 times pluto's distance	1102347	91862.3	30620.8

	Diameter (miles)	Distance (inches)	Distance from earth (miles)	Distance from earth (inches)
Moon	2,159	0.22	238,857	24

### Materials

- Paper (both regular and construction paper)
- Scissors
- Tape
- Calculators
- Markers
- 100 ft tape measure
- Ruler
- Yardstick

### Post-Activity Assessment

Go over with the students how much space they would need to fit the entire solar system in their scaled model. Also, go over how far away the earth would be from the sun.

## **Lesson Closure**

### Investigating Questions

- What did we learn about the true size of the universe
- How could we have changed the scale so that we could fit the entire solar system? Would we still be able to cut out the planets?

## **References**

**Owner:** Drexel University GK-12 Program

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# Student Handout

## Understanding the solar system

### *Putting the universe in perspective*

We can all look and see the sun in the sky, how big is the sun? Is the sun bigger than the earth? What is closer to the earth, the sun or the moon? What is the relative size of the earth to the sun? How far away is the sun in comparison to the size of the earth? How could we go about recreating the universe utilizing a model to illustrate the various planets, the moon, the sun and how could demonstrate the relative size and distances apart. Here's a list of the planets, dwarf planets, their diameters and their distances from the sun.

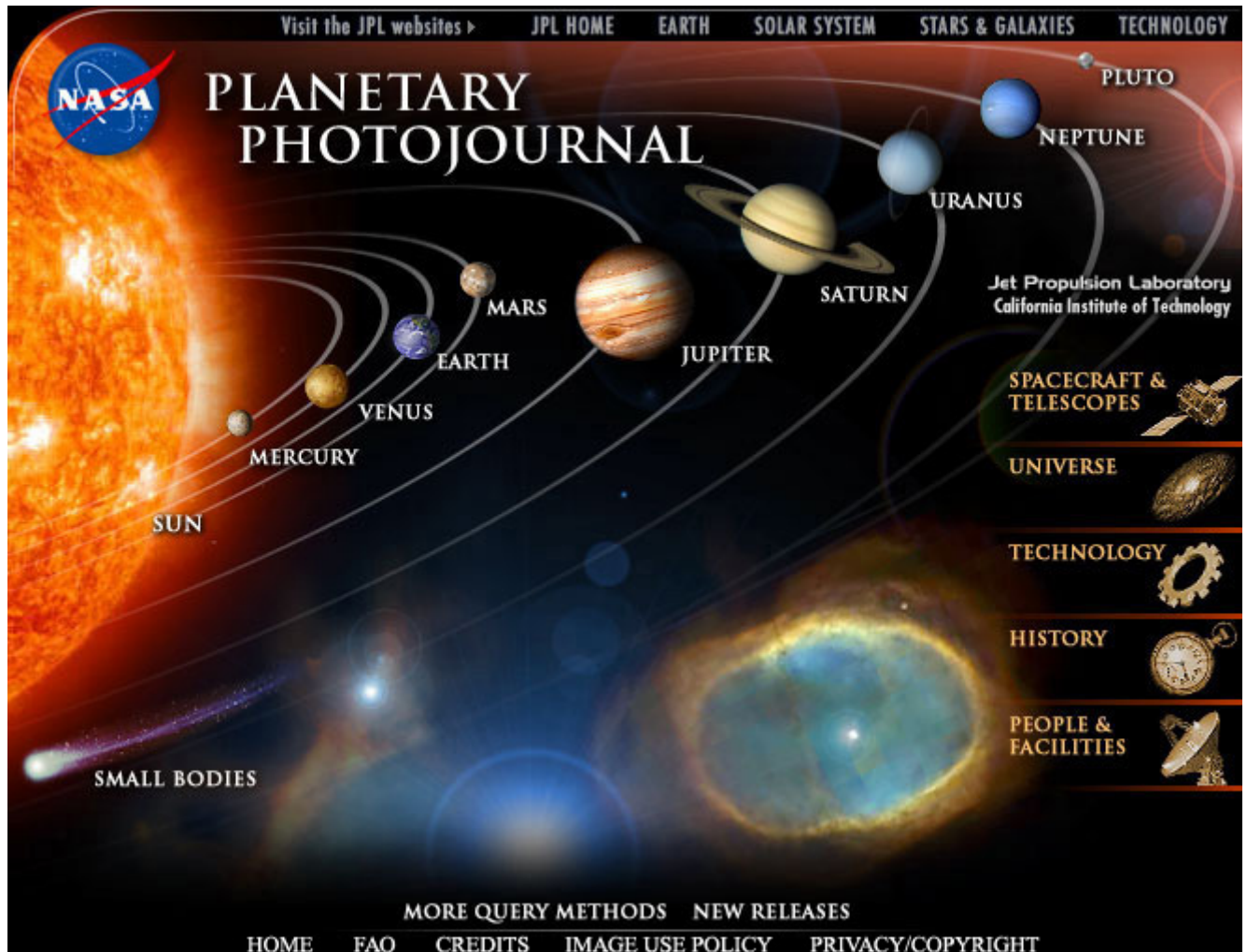
	Diameter (miles)	Distance from the sun (miles)
Sun	862,400	-
Mercury	3,032	35,983,610
Venus	7,521	67,232,360
Earth	7,926	92,957,100
Mars	4,222	141,635,300
Ceres	590	257,869,045
Jupiter	88,846	483,632,000
Saturn	74,898	888,188,000
Uranus	31,763	1,783,950,000
Neptune	30,778	2,798,842,000
Pluto	1,413	3,674,491,000
Eris	1,492	3 times pluto's distance

Let's not forget about the moon. It is important to know the diameter of the moon as well as the distance from earth.

	Diameter (miles)	Distance from earth (miles)
Moon	2,159	238,857

The tables above simply are there to show that the planets are pretty big and pretty far from the sun. Unfortunately, simply looking at the diameter and distance numbers does not do much to put things into perspective. Therefore, you will create a model solar system to scale in order to visualize the solar system and its relative size.

What is wrong with this picture?



While, it looks like the size of the planets are drawn to scale, the distance from the sun is grossly under visualized. This is necessary in order to fit all of the planets in one picture.

Materials:

- Calculator
- Construction Paper
- Compass
- Scissors
- Masking tape
- Ruler
- Tape measure

In order to develop a model, it is important to determine a scale. The scale used is 1" = 10,000 miles. Complete your planet's section by converting the actual miles to the scale miles in inches.

Scale: 1 inch = 10,000 miles

Other Conversions: 1 foot = 12 inches

1 yard = 3 feet

	Diameter (miles)	Diameter (inches)	Distance from the sun (miles)	Distance (inches)	Distance (feet)	Distance (yards)
Sun	862,400		-	-	-	-
Mercury	3,032		35,983,610			
Venus	7,521		67,232,360			
Earth	7,926		92,957,100			
Mars	4,222		141,635,300			
Ceres	590		257,869,045			
Jupiter	88,846		483,632,000			
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Pluto	1,413		3,674,491,000			
Eris	1,492		3 times pluto's distance			

	Diameter (miles)	Distance (inches)	Distance from earth (miles)	Distance from earth (inches)
Moon	2,159		238,857	