A Scale Model of the Solar System

This exercise is an excellent way for your students to gain a better understanding of the actual scale of our Solar System, in terms of relative sizes, distances, and speeds. The materials needed are simple, inexpensive, and easily obtained. The activity is three-fold. First it deals with relative sizes. Secondly, it covers relative distances. And lastly, it demonstrates relative speeds.

- ***Materials Needed:***
  - 1 Beach ball (preferably yellow or orange)
  - 1 Set of Play Doh® or some other modeling clay
  - 1 String (13 meters or 40 feet long)

- ***Preparation:*** Tie a loop about 5 centimeters (2”) in diameter in one end of the string. This is where you will place the beach ball Sun later on. Now tie an overhand knot  at the appropriate distances along the string for where each succeeding planet will be from the beach ball Sun. Use the following planet scale chart to tell you how far away from the Sun each knot should be tied.

- ***Planet Scale Information Chart:***

Planet	Scaled Distance	Actual Distance	Scaled Diameter
Mercury	13 cm 5”	58 million km 26 million miles	1.5 mm 1/16”
Venus	23 cm 9”	108 million km 67 million miles	6 mm 1/4”
Earth	31 cm 12”	150 million km 93 million miles	6 mm 1/4”

Mars	46 cm 18”	227 million km 141 million miles	3 mm 1/8”
Jupiter	155 cm 61”	779 million km 483 million miles	25 mm 1”
Saturn	274 cm 108”	1,428 million km 886 million miles	20 mm 3/4"
Uranus	572 cm 225”	2,974 million km 1,782 million miles	14 mm 1/2"
Neptune	889 cm 350”	4,506 million km 2,794 million miles	13 mm 1/2"
Pluto	1174 cm 462”	5,913 million km 3,666 million miles	1.3 mm 1/16”

- **Part One: Size Scale**

  HINT: You might want to make two or more model Solar Systems so that every student can partake.

  Assign every student a planet and give them a lump of clay more than big enough to make their planet. If you are using Play Doh®, you might want to use appropriate colors (ie. red for Mars, Blue for Earth, etc.). Explain that you want them to guess how big their planet would be if the beach ball were the size of the Sun. It is best not to have them attempt to make rings for Saturn. Have each student make her planet out of clay according to how big she thinks it should be.

  Almost always, everyone’s planet will be too big. Once they are done, go through the group and change their planets to the correct size. Correcting the students in this fashion will make the actual size much more impressive. Every student must then be responsible for not losing her planet. This isn't necessarily easy, as some planets, like Mercury and Pluto, are only about the size of a grain of sand!

- *Part Two: Distance Scale*

  This part of the model should be done either in the gymnasium, cafeteria, or outside. In order to make the distance scale workable within a school environment, we found it best to represent distance on a smaller scale than that used to illustrate size (See the footnote on the previous page).

  Separate your students into their various Solar Systems (if you have more than one). Have each student take her clay planet and place it where she thinks the appropriate distance for that planet should be from the beach ball Sun. Once each student has placed her planet down where she thinks it belongs, take out the string with the proper distance scale measured out in knots. Then, one at a time, beginning with Mercury, have each student move her planet to its proper position. Again, this makes the students aware that their perspectives are different from reality. The Solar System is probably much larger than any of them had guessed.

- *Part Three: Relative Motion*

  Now that your model Solar System is laid out properly, have your students pick up their respective planets. Tell them to try to keep the same distance from the Sun and have them walk at approximately the same speed around the Sun (in their respective orbits!). Which planet goes around the Sun first? Once Mercury makes one revolution, have them all stop and examine how much of their own orbits they have covered compared to Mercury's complete orbit. *(In actuality the distance is not the only factor in different period orbits. Inner planets do move faster than outer planets. However, for demonstration purposes, having the students all walk at about the same speed works well.)*

**The size scale is 1 cm=140,000 km (1"=225,000 miles) while the distance scale is about 32 times smaller with 1 cm=4,500,000km (1"=7,000,000 miles). We found it best to represent distance on a smaller scale than used for size. If we maintained the same scale for distance as for size, the string would have been 420 meters long rather than 13 meters!*