Solar System Scale Model

Building a scale model of the Solar System…Outside!

Just how big is the Solar System? It's hard to get a sense of it! We're going to try and get a physical sense of it using objects we know. If we use a scale of 1 mm equal to 10,000 km, the Sun (diameter of 1.392 million km) is about 14 cm in diameter. In our model, we can use a yellow foam ball if available, or a tennis ball in a pinch (though the tennis ball is only about half the diameter of the Sun, at this scale). The attached cards show the average distance from the Sun of each major body in our Solar System, and also have a small dot showing their equivalent size at this scale. Time to soak up some of the Sun's rays and build our model Solar System!

Measuring distances

You have two choices for measuring off distances in this activity: you can either use a really long tape measure, or you can do things the old-fashioned way, by counting paces!

If you're using a long (~100 meter or longer) tape measure, you can skip directly to building the model. Find a long, flat area, place your Sun, make a prediction of how big your model Solar System is going to be, and get going!

Measuring with paces

If you don't have a long tape measure, or you just find it more convenient to do this activity without the tape measure, you can measure (approximate) distances by careful *pacing* (counting off the number of "paces," or steps, between planets).

Of course, in order to do this, you have to first find out how long each pace is! You'll need a meter stick or yardstick to measure stride length. Choose a group member, and have them take a comfortable step forward. It's important that their step is comfortable (not too short, not too long) and repeatable, since the pacer will be pacing a lot for this activity!

Measure and record the length of the first pace with the meter stick or yardstick, then have the pacer take another step. Measure and record the length of this pace, as well. **Repeat this process for about ten paces, then compute an average pace length.** Now you're ready to make your scale model! Place your Sun, make your prediction, and get going!

Making the scale model

Head outside! Place your Sun at the edge of a large, flat, straight open space. Before going any further, make a prediction: how far across the open space will your Solar System stretch? Write your prediction on the question sheet.

The average distance of each planet (or dwarf planet, in the case of Pluto) from the Sun is listed on that planet's card. For example, the planet Mercury orbits at an average distance of about 58 million kilometers, which at this scale is about 5.8 meters. Venus orbits at about 108 million kilometers from the Sun, or 10.8 meters at this scale, and so forth.

Using a measuring tape or pace count, place the stake holding each planet's card at the corresponding distance from your model Sun.

How big is your resulting Solar System?

Questions

1) **Before doing the activity, make an estimate: about how far across your open space will your model Solar System stretch? Write your prediction here!**

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2) **After doing the activity, how close was your prediction? Would you revise your estimate? Briefly explain your new estimate, if you chose to revise it.**

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3) **Proxima Centauri is the closest known star to our own Solar System, at 4.2 light years distant (one light year is $9.46 \cdot 10^{12}$ km). Calculate the distance to Proxima Centauri at the scale we have been using (1 mm equals 10,000 km). About how far would that be, in your scale model? (To the next town, to the next state, across the country, etc.)**

4) **The Milky Way galaxy is about 100,000 light years across. The Earth is located not too far from one edge. Calculate about how far it is to the other edge of the galaxy, at the scale we have been using. About how far would that be, in your scale model?**