An Impossible Alignment: Building a Scale Model of the Solar System

Earth Science/Geology Mr. Traeger

Name: _____________________ Period: ____ Date: __________________

Purpose

The purpose of this assignment is to become familiar with the scale of the solar system. It shows visually the average distance of each planet from the sun if an impossible alignment of the planets were to occur. It also shows the relative diameters of the planets and their angle of tilt.

Materials

- 4+ meters of 7.5 cm (3ö) Adding Machine Tape
- Meter Stick
- Colored Pencils
- Drawing Compass
- Textbook
- Protractor

Part 1: Drawing the distances from the sun in the solar system to scale

1. Convert each of the following planetary distances into astronomical units (AU).
2. Once you have converted into AUÕs, then determine a ***scaling factor*** that will allow your farthest distance away from the sun to fit on to your 4 meter tape.
3. Convert your distances into centimeters using the scaling factor.
4. Unroll your adding machine tape and measure the distance that each planet would be away from the sun. Pick one end of the adding machine tape to be the location of the surface of the sun. Mark these distances on your adding machine tape.

Planet	**Average Distance from Sun in Km**	**Scaling Factor to convert to AU's**	**Average Distance from Sun in AU's**	**Scaling Factor to convert to cm**	**Scale Average Distance from Sun in cm**
Mercury	58,000,000				
Venus	108,000,000				
Earth	150,000,000				
EarthÕs Moon at Full Phase	150,384,400				
Mars	228,000,000				
Jupiter	778,000,000				
Saturn	1,430,000,000				
Uranus	2,870, 000,000				
Neptune	4,500,000,000				
Pluto	5,900,000,000				
Alpha Centauri, our nearest star	4.114995×10^{13}				

Part 2: Drawing the diameters of each planet to scale

1. We will need to make a separate scale to calculate the scale diameter of each of the planets. This is because the planets would appear extremely small if we were going to draw them according to the previous scale that we calculated.
2. We will convert the actual diameters into Earth diameters, or how each planet would compare to the Earth.
3. We want to determine another scaling factor that will allow our largest planet to fit within the confines of a 7.5 cm wide adding machine tape.
4. Once we scale down the diameter of our planets to fit on the adding machine tape, we will draw each planet (using a compass) on our tape. We will draw each planet at the exact location that was determined in Part 1.

An Impossible Alignment: Building a Scale Model of the Solar System

Earth Science/Geology Mr. Traeger

Planet	**Diameter (Km)**	**Scaling Factor to Convert to Earth Diameters**	**Earth Diameters**	**Scaling Factor to convert to cm**	**Scale Diameter in cm**
Sun	1,392,000				
Mercury	4,880				
Venus	12,104				
Earth	12,756				
Earthôs Moon	3,476				
Mars	6,787				
Jupiter	142,800				
Saturn	120,000				
Uranus	51,800				
Neptune	49,500				
Pluto	2,300				

Part 3: Drawing the Axes of Each Planet

1. Using a protractor, draw the axis of each planet. Note that any planet that has an angle greater than 90° is spinning in the opposite direction of Earth.

Planet	**Angle From Vertical**	**Planet**	**Angle from Vertical**
Mercury	2°	Jupiter	3°
Venus	177.3°	Saturn	27°
Earth	23.5°	Uranus	97.9°
Earthôs Moon	7°	Neptune	30°
Mars	25°	Pluto	122°

Part 4: Making it Look Good

1. Now, using pictures from your book make your Solar System Scale a work of art! **Don’t forget to draw the asteroid belt!**

Part 5: Questions

1. How long would your adding machine tape have to be in order to fit our nearest star, Alpha Centauri, on to the scale?
2. How large would you have to make the sun in order to fit it on to the scale?
3. Why is this activity titled ñAn Impossible Alignment?ò
4. Is the Astronomical Unit (AU) an appropriate unit for measuring distances to stars? If not, what would be an appropriate unit?