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

Earth Science
Mr. Traeger
Name: $\qquad$ Period: $\qquad$ Date: $\qquad$

## 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

- 400 cm of 7.5 cm (3वे) Adding
- Meter Stick
- Textbook
- Colored Pencils
- Protractor
- Drawing Compass


## 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 $A U \hat{\Phi}$, then determine a scaling factor that will allow your farthest distance away from the sun to fit on to your 400 centimeter long tape.
3. Convert your distances into centimeters using the scaling factor.
4. Unroll your adding machine tape. Draw in the sun to its appropriate size. Measure the distance that each planet would be away from 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 |  |  |  |  |
| Earth's Moon at Full Phase | 150,384,400 |  |  |  |  |
| Mars | 228,000,000 |  |  |  |  |
| Asteroid Belt | $\begin{array}{\|l\|} \hline 400,000,000 \text { to } \\ \mathbf{6 0 0 , 0 0 0 , 0 0 0} \end{array}$ |  |  |  |  |
| Jupiter | 778,000,000 |  |  |  |  |
| Saturn | 1,430,000,000 |  |  |  |  |
| Uranus | 2,870, 000,000 |  |  |  |  |
| Neptune | 4,500,000,000 |  |  |  |  |
| Pluto | 5,900,000,000 |  |  |  |  |

## 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.

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| :---: | :---: | :---: | :---: | :---: | :---: |
| Planet | Diameter (Km) | Scaling Factor to Convert to Earth Diameters | Earth Diameters | Scaling Factor to convert to $\mathbf{c m}$ | Scale Diameter in cm |
| Sun | 1,392,000 |  |  |  |  |
| Mercury | 4,880 |  |  |  |  |
| Venus | 12,104 |  |  |  |  |
| Earth | 12,756 |  |  |  |  |
| Earthê 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 $90^{\circ}$ is spinning in the opposite direction of Earth.

| Planet | Angle From Vertical | Planet | Angle from Vertical |
| :--- | :--- | :--- | :--- |
| Mercury | $2^{\circ}$ | Jupiter | $3^{\circ}$ |
| Venus | $177.3^{\circ}$ | Saturn | $27^{\circ}$ |
| Earth | $23.5^{\circ}$ | Uranus | $97.9^{\circ}$ |
| Earth $\widehat{s}$ Moon | $7^{\circ}$ | Neptune | $30^{\circ}$ |
| Mars | $25^{\circ}$ | Pluto | $122^{\circ}$ |

## 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. Why is this activity titled ñan Impossible Alignment?òWhat is impossible about it?
2. How small do you feel now? Explain in a paragraph of no fewer than 25 words.
