If The Sun’s a Tennis Ball

**Introduction**

In this lab, we will take real physical values for the Sun and the planets, calculate smaller proportional ratio lengths, and then recreate the solar system outside Millbrook High School. We will use a tennis ball to represent the size of the Sun and each group will stand to represent the planets’ positions relative to the sun.

**Part 1: Calculating Scales**

We will use a tennis ball to represent the Sun in our scale model of the solar system. The tennis ball has a circumference of 21 cm. We can calculate the radius of the tennis ball by doing the following:

 

In Table 1 we see that the Sun’s radius is 6.94 × 105 km. If we use the tennis ball’s radius as our reference scale, then in our scaled model of the solar system, we say that

 3.34 cm = 6.94 × 105 km or 1 cm = 2.08 × 105 km

In other words, every centimeter we measure in our scale model solar system represents 2.08×105 km.

How do we use this to build our scale model solar system?

To calculate how big each planet would be if the Sun were the size of a tennis ball, we must use our scale length to convert kilometers to centimeters.

Radius of planet (km) = Scaled Radius (cm)

 2.08 x 105 km

To calculate how far each planet would be if the Sun were the size of a tennis ball, we must also use our scale length to convert kilometers to centimeters. For our model outside, you will need to convert these distances into meters.

When we begin building our scale model outside, each group will be responsible for one planet.

1. Calculate and write in the scaled radius (in cm) of each planet listed in Table 1.
2. Calculate and write in the scaled distance from the Sun of each planet listed in Table 1. Note that our conversion takes kilometers and converts them into centimeters while the tables (and the distances we’ll measure outside) uses meters.
3. Using a large piece of paper, in large dark letters, write the name of your group’s assigned planet. Using the scaled radius you calculated, draw a scale model of your planet

**Part 2: Creating our Scaled Model of the Solar System**

Now we go outside and measure out our scale model of the solar system!

**Table 1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Object** | **Radius** (km) | **Scaled Radius** (cm) | **Distance** (km) | **Scaled Distance** (m) | **Light Travel Time** |
| **Sun** | 6.94 x 105 |  | 0 |  |  |
| **Mercury** | 2.42 x 103 |  | 5.85 x 107 |  |  |
| **Venus** | 6.05 x 103 |  | 1.08 x 108 |  |  |
| **Earth** | 6.37 x 103 |  | 1.50 x 108 |  |  |
| **Mars** | 3.40 x 103 |  | 2.25 x 108 |  |  |
| **Jupiter** | 7.14 x 104 |  | 7.80 x 108 |  |  |
| **Saturn** | 6.02 x 104 |  | 1.44 x 109 |  |  |
| **Uranus** | 2.55 x 104 |  | 2.88 x 109 |  |  |
| **Neptune** | 2.47 x 104 |  | 4.52 x 109 |  |  |

**Part 3: Understanding Our Scaled Model of the Solar System**

1. Which two planets are the closest to each other? What is the true and scaled distance between them?
2. Which two planets are the farthest from each other? What is the true and scaled distance between them?
3. How do the distances between the inner planets compare with the distances between the outer planets?
4. The next nearest star to us is Alpha Centauri. It is about 4.10 x 107 km. How far away is that using our scaled system?
5. Calculate the time it takes light to travel from the Sun to each of the planets, and fill in this time in the last column in Table 1. The speed of light is 3.0 x 108 m/s.