

Relative Sizes of the Planets

Name: _____

Lab Section: _____

A) Table 1 Instructions:

Using the values in the following table convert the semi-major axis into units of AU, the distance from the Earth to the Sun by dividing each semi-major axis by that of Earth.

Next, you will do the same thing for each planet's diameter to convert them from kilometers into diameters relative to the Earth's diameter.

Finally, you will convert these values to scale values so that we can show representative sizes in the classroom. To do this, you will multiply all of your semi-major axes by 3 m. Then you will multiply all of your diameters (in terms of Earth diameter) by 8 cm.

Assigned planet from your TA: _____

Measure the front edge to the back edge of your shoe and record this distance.

_____ cm _____ m

Using the scale distance recorded in the last column of the table, determine how many heel to toe steps would you have to make in order to go from the Sun to your assigned planet by dividing that distance by the size of your shoe in meters from above.

Your teacher will mark the location of the Sun. Each of you will then measure out the distance. Be sure to label it so everyone knows what planet it is.

B: Supplemental Questions:

As always, *show work and units!*

1.) Name the planets in order of increasing mass!

_____, _____, _____, _____, _____, _____, _____, _____

2.) How many times more massive is Jupiter than Earth?

- 3.) How many times farther from the sun is Pluto than Jupiter?
- 4.) Which planet is closest in diameter to the Earth?
- 5.) What is the mass of Saturn in grams? (Multiply Saturn's mass by 1,000.)
- 6.) What is the radius of Saturn in centimeters? (Divide Saturn's diameter by 2 to find the radius, then multiply by 10^5 .)

7.) Find the density of Saturn in units of g/cm^3 using the equation:
$$\text{Density} = \frac{\text{Mass}}{\frac{4}{3} \pi \text{radius}^3}$$

- 8.) Would Saturn float or sink if it were placed over an ocean (density of water is 1g/cm^3)?
- 9.) Add up the masses of the planets. Divide the mass of the Sun by that number to find out how many times more massive the Sun is than the rest of the Solar System. What percentage of this total planetary mass is Jupiter?

10.) The closest star system to ours is Alpha Centauri, a bright binary in the Centaurus constellation. It's about 4.13×10^{13} km from the Sun (that's 4.37 light years!). First find out how far this is in AU using the same method you used before.

_____ AU

Now find out how far this will be in your scale distance where $1\text{AU} = 3 \text{ m}$. To give you a feel for how far you'd have to walk to put this star into the scale system we made earlier, convert this to miles by dividing your new answer by 1,600.

_____ m => _____ mi

For reference, New Orleans is about 480 miles from Atlanta.