## Solar System and Nebular Hypothesis Lab

### Adapted from Michael Stewart, 2006, downloaded from the SERC website

In this lab you will collect planetary data from the internet and evaluate those data in light of the nebular hypothesis. For this lab you will need to recall our lectures on the nebular hypothesis, and be familiar with Microsoft Excel. Complete your answers to the questions on the final pages of this document, cut and paste your two X-Y plots from Excel into the bottom of this Word document and upload the complete file in Canvas.

A) First, click on the following link or type the url into your browser: <http://nssdc.gsfc.nasa.gov/planetary/factsheet/> . Record these data for each of the eight planets plus Pluto: Distance from Sun, Mass, Diameter and enter them into an Excel spreadsheet like so add another column after Diameter with Density and enter those data too.

Notice that distance and mass values are exceedingly large. Enter these numbers as scientific notation. For example a number like 15 million (15,000,000) is written as 1.5x107 in scientific notation. Where the 7 is simply the number of decimal spaces to the right of the first digit. To enter 15 million as scientific notation in Excel, simply enter 1.5e7 and hit return. Alternatively, simply type in 15000000 and hit return. Then highlight the cells you want displayed in scientific notation, click on the Format menu, choose ‘cell’ and then click the ‘number’ tab and select ‘scientific’ from the list of options.

B) Create an X-Y graph of Distance from the Sun vs. Mass of the Planets. Notice how the first four planets (Mercury, Venus, Earth and Mars) are near the origin on this graph and except for Jupiter and Saturn, the other planets all lie nearly along the X-axis. Thus, this is a terrible graph because it masks all information regarding trends in mass relative to distance. To construct a more informative graph, you will have to adjust the axes to plot on logarithmic scales.

Change the axes to logarithmic scale by clicking on each axis, choose the ‘scale’ tab and check the ‘log scale’ box. Do this for both axes and also change the ‘minimum’ axis values (also in the Scale dialog box) as such: Distance minimum = 1x107km, and Mass minimum = 1x1022kg.

D) Create an X-Y graph of Distance from the Sun vs. Density of the Planets. Here, only the distance need be expressed on a logarithmic scale.

E) Answer the following questions. Please put your name in the space below to help me keep track.

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Compare the diameter of the smallest Jovian planet to the largest Terrestrial Planet. Express this quantitatively (e.g. as a percentage, or ratio).

2. How does mass of the planets vary with distance from the Sun?

3. How does density of the planets vary with distance from the Sun?

4. Explain why mass and density of the planets vary with distance from the Sun. Recall our discussion of the nebular hypothesis and pay particular attention to the solar winds during the early stages of the solar system, the thermal gradient across the solar system, and the materials (volatile vs. refractory) that compose the planets.

5. How does the mass and density of Pluto compare to the trends you observed in questions 2 and 3 above?

Paste your two X-Y plots from Excel here.