Northern Vermont UNIVERSITY

name: _____

date: _____

Introduction to Earth Science Lab

Scale of the solar system

Goal: to learn about the relative properties of some objects in the solar system.

Previous knowledge: formation of the solar system, names of objects, and relative positions of planets.

Required data: see solar system data table below.

	Mercury	Venus	Earth	Mars	Asteroid Belt	Jupiter	Saturn	Uranus	Neptune	Pluto
Distance from Sun (10^6 km)	57.9	108.2	149.6	227.9	403.5	778.6	1433.5	2872.5	4495.1	5906.4
Mass (10^{24} kg)	0.33	4.87	5.97	0.642	0.00032	1898	568	86.8	102	0.0146
Diameter (km)	4879	12,104	12,756	6792	530	142,984	120,536	51,118	49,528	2370
Density (kg/m^3)	5427	5243	5514	3933	1380-5320	1326	687	1271	1638	2095
Gravity (m/s^2)	3.7	8.9	9.8	3.7	na	23.1	9	8.7	11	0.7
Rotation Period (hours)	1407.6	-5832.5	23.9	24.6	na	9.9	10.7	-17.2	16.1	-153.3
Length of Day (hours)	4222.6	2802	24	24.7	na	9.9	10.7	17.2	16.1	153.3
Perihelion (10^6 km)	46	107.5	147.1	206.6	329	740.5	1352.6	2741.3	4444.5	4436.8
Aphelion (10^6 km)	69.8	108.9	152.1	249.2	478	816.6	1514.5	3003.6	4545.7	7375.9
Orbital Period (days)	88	224.7	365.2	687	1000-3000	4331	10,747	30,589	59,800	90,560
Orbital Inclination (°)	7	3.4	0	1.9	na	1.3	2.5	0.8	1.8	17.2
Orbital Eccentricity	0.205	0.007	0.017	0.094	na	0.049	0.057	0.046	0.011	0.244
Obliquity to Orbit (°)	0.034	177.4	23.4	25.2	na	3.1	26.7	97.8	28.3	122.5
Mean Temperature (°C)	167	464	15	-65	na	-110	-140	-195	-200	-225
Number of Moons	0	0	1	2	≈800,000*	79	62	27	14	5
Ring System?	No	No	No	No	No	Yes	Yes	Yes	Yes	No
Global Magnetic Field?	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Unknown

* asteroids (not moons)

from https://nssdc.gsfc.nasa.gov/planetary/factsheet/

Part 1: Lab work

Activity: Use six centimeter wide, four meter long, paper roll to plot the following (due in lab)

a) Distance from sun

- Use a map scale equivalent to 1 cm = 15,000,000 km.
- Mark the starting point a few cm from the edge of the roll.
- Measure, mark, plot, and label the distance for each planet (and the asteroid belt) at an appropriate location on the tape.
- Include the asteroid belt, but do not plot Pluto.

b) Radius of planets

- Use the reverse side of the paper roll used in 1a above.
- Use a map scale equivalent to 1 cm = 2000 km.
- Mark the starting point a few cm from the edge of the roll.
- Measure, mark, plot, and label the radius of each planet (zero is always the starting point).
- Note that radius is one-half of the diameter.
- Include the sun's radius in the plot (the sun's diameter is 1,392,000 km).
- Do not plot the asteroid belt or Pluto.

Part 2: Homework

Select three out of the five options below

1) Graph surface temperature vs. orbital distance.
Discuss: temperature change with distance from the sun.

2) Graph diameter vs. orbital distance.
Discuss: size of the planet with distance from the sun.

3) Graph orbital period vs. orbital distance.
Discuss: variation in the time it takes a body to orbit sun with respect to distance.

4) Graph density vs. orbital distance.
Discuss: variation in density with distance from the sun.

5) Graph density vs. planetary diameter.
Discuss: variation in density with planetary diameter.

Calculate the ratio scale
Calculate the ratio scale used for Part 1a of the roll paper activity.
Be sure to show all work and cancel the units appropriately.

Notes

- Avoid the asteroid belt and Pluto.
- Do your own work.
- Use Excel to plot the graphs.
- Import the graphs into Word.
- The title page should include: title of lab, your name, the date, and the course name.
- Write clearly and concisely.
- Use full sentences.
- Number all pages.
- Use one staple to hold all pages together.
- Label the axes of the graphs and include the units of measurement.