Homework #1: Familiarity with Units

1. Shown below is a table listing the properties listing the planets' sizes, distances from the sun, and their orbital periods (in days or years)

Planet	Mass	Diameter	density	rotation	axis tilt	distance	orbital period
	(× M_E)	(km)	(g/cm^3)		(deg)	(A.U.)	
Mercury	0.0553	4880	5.43	58.81 d	0.1	0.387	87.97 d
Venus	0.815	12,104	5.2	243.69 d	177.3	0.723	224.70 d
Earth	1	12,742	5.52	23.9345 h	23.45	1	365.26 d
Mars	0.107	6780	3.93	24.623 h	25.19	1.524	686.98 d
Jupiter	317.83	139,822	1.33	9.925 h	3.12	5.203	11.86 y
Saturn	95.162	116,464	0.687	10.50 h	26.73	9.539	29.46 y
Uranus	14.536	50,724	1.32	17.24 h	97.86	19.182	84.01 y
Neptune	17.147	49,248	1.64	16.11 h	29.56	30.06	164.79 y
Pluto	0.0021	2274	2.05	6.405 d	122.46	39.53	247.68 y

a. Let Earth have a diameter of 1 cm, and suppose it orbits the sun in 1 second. Replace the planet's sizes, distances, and orbital periods with their corresponding proportions (for example, a planet with a diameter of 6000 km would be something with a size of about 0.5 cm).

b. The sun has a radius of 7×10^5 km, and it rotates once every 30 days. What is its corresponding size and rotation period?

c. Recall that a light-year is the distance light travels in 1 year. The observable universe is 20 billion light years in diameter. How large is it in kilometers?

2. Now suppose the sun is a 100 Watt lightbulb. The density of stars is 1 star/(5^3 km^3). We can see a 100 Watt lighbulb out to 80 km. How many stars can we see? **Hint: the volume of a sphere of radius R is 4/3 π R^3**.