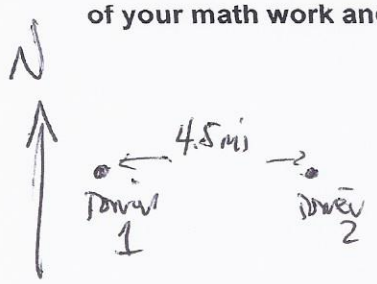
ES302 Quiz 1 (20 Pts) **Spring 2020** **NAME** KEY

1. (5pt) Two cell phone towers are located 4.5 miles apart on the ground in your hometown, oriented in an east-west direction with one another. Using your local topographic map, you measure 3.4 cm map distance between the two cell phone towers. Calculate the fractional ratio scale of the map. **Draw a sketch map with north arrow showing the cell tower relationships and distances. For your calculation, show all of your math work and unit algebra / conversions.**



$$3.4\text{cm} = (4.5\text{mi})\left(\frac{5280\text{ft}}{\text{mi}}\right)\left(\frac{1\text{m}}{3.28\text{ft}}\right)\left(\frac{100\text{cm}}{\text{m}}\right) =$$

$$\frac{3.4\text{cm}}{3.4\text{cm}} = \frac{724{,}390.2\text{cm}}{3.4\text{cm}} = 213{,}056$$

$$1 : 213{,}056$$

2. (5pt) The average density of planet Earth is 5.5 g/cm^3. Given that the average radius of the Earth is 3,959 mi, estimate the total mass of the planet in both kilograms and metric tons. **List the equation for density and explain all variables. Show all of your math work and unit algebra / conversions.**

$$\text{DENSITY} = \left(\frac{5.5\text{g}}{\text{cm}^3}\right)\left(\frac{100\text{cm}}{\text{m}}\right)^3\left(\frac{1\text{kg}}{1000\text{g}}\right) = 5{,}500\frac{\text{kg}}{\text{m}^3}$$

$D = \frac{\text{MASS}}{\text{VOL.}}$

$$\text{VOLUME SPHERE} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(6{,}373{,}024\text{m})^3 = 1.08\times10^{21}\text{m}^3$$

$$r = 3959\text{mi}\left(\frac{5280\text{ft}}{\text{mi}}\right)\left(\frac{1\text{m}}{3.28\text{ft}}\right) = 6373024\text{ m}$$

$$D = \frac{m}{\text{vol}} \Rightarrow m = D\cdot\text{vol} = \left(5500\frac{\text{kg}}{\text{m}^3}\right)(1.08\times10^{21}\text{m}^3) = 5.96\times10^{24}\text{kg} = 5.96\times10^{21}\text{t}$$

$$5.96\times10^{24}\text{kg}\left(\frac{1\text{t}}{1000\text{kg}}\right) = 5.96\times10^{21}\text{t}$$

3. (5pt) The average distance from the earth to the sun is 93 million miles. Given the speed of light is equal to 3 x 10^8 m/sec, calculate how long it takes electromagnetic radiation to travel from the sun to the Earth; answer in both minutes and hours. **List the equation for velocity and explain all variables. Show all of your math work and unit algebra / conversions.**

$V = \frac{d}{t}$ $\quad t$

$t \quad V$

$$t = \frac{d}{V}$$

$$t = \frac{(93\times10^6\text{mi})\left(\frac{5280\text{ft}}{\text{mi}}\right)\left(\frac{1\text{m}}{3.28\text{ft}}\right)}{3\times10^8\text{m/sec}} = 499\text{sec}\left(\frac{1\text{min}}{60\text{sec}}\right) = 8.3\text{min}$$

$$8.3\text{min}\left(\frac{1\text{hr}}{60\text{min}}\right) = 0.14\text{ hr}$$

4. (5pt) In astronomy, the distance from the Earth to the Sun is equal to 1 "astronomical unit" (AU), a measure of distance that astronomers use to characterize the dimensions of our solar system. Given that the average distance from the Earth to the Sun is 93 x 10^6 miles in the English measurement system, how many kilometers distant is a mystery planet that is located 9.6 AU from the sun? **Show all of your math work and unit algebra / conversions.**

$$9.6\text{AU}\left(\frac{93\times10^6\text{mi}}{\text{AU}}\right)\left(\frac{5280\text{ft}}{\text{mi}}\right)\left(\frac{1\text{m}}{3.28\text{ft}}\right)\left(\frac{1\text{Km}}{1000\text{m}}\right) = 1.5\times10^8\text{ Km}$$

Correction Answer = 1.4 x 10^9 km

(+1pt) **Bonus Internet Search Trivia Question:** Based on the distance from the sun, which mystery planet is it?

SATURN is ~ 9.6 AU from SUN