Lab Activities for Lab 1

Your name: _____ Lab Partners _____

For calculation practice with scientific notation, see the handout sheet on scientific notation.

1. Measure tables (height, width, and length). Aim for 1 mm accuracy, Express in meters, centimeters, and millimeters.

_____ m x _____ m x _____ m

_____cm x _____ cm x _____ cm

_____mm x _____ mm x _____ mm

2. Measure thickness of this paper with micrometer. Aim for 20 μm accuracy (smallest division on the micrometer). Express in m, cm, mm and μm using decimals and also scientific notation.

decimal: _____ m = _____ cm = _____ mm = _____ μm

scientific notation: _____ m

3. Measure a strand of hair (diameter). Aim for 20 μm accuracy. Express in m, cm, mm and μm using decimals and also in m using scientific notation.

decimal: _____ m = _____ cm = _____ mm = _____ μm

scientific notation: _____ m

4. Measure dimensions of lab room (length, width, height) and the calculate the room volume in m^3. Express in meters. Aim for 1 cm = 0.01 m accuracy. An 8 m steel tape measure is available.

_____ m x _____ m x _____ m V_{room} = _____ m^3

5. Measure the diameter of each of 5 marbles with 20 μm accuracy. Express in mm. (Hint: about 15.00 mm)

Calculate the average and standard deviation of your 5 measurements. You can use a computer or phone application or go to http://yosemitefoothills.com/Calculator/ and use my on-line application.

average d: _____mm +/- _____mm

6. Calculate the average volume of your 5 marbles. Express your result as mm^3, and cm^3.
(Hint: about 1767 mm^3 = 1.767 cm^3)

$$V_{average} = \frac{4}{3}\pi r^3 = \frac{1}{6}\pi d^3 =$$ _____ mm^3 = _____ cm^3

7. Weigh the 5 marbles one at a time with a digital scale (that I will provide) that has 0.01 gram (g) precision. (Hint: about 4.00 g)

8. Calculate the average and standard deviation of your 5 mass measurements. You can use a computer or phone application or go to http://yosemitefoothills.com/Calculator/ and use my on-line application.

$m_{average}$ = _____ g +/- _____g

9. Calculate the density of a typical marble by dividing your average mass in grams by your average volume in cm^3. Express your result with units of g/cm^3 and in kg/m^3. (Hint: 1 g/cm^3 = 1000 kg/m^3)

$\rho_{average} = \frac{m_{average}}{V_{average}}$ = _____ g/cm^3 = _____kg/m^3

Ways of counting

10. Direct: number of ABC blocks = _____ x _____ x _____ + _____ = _____

11. Estimate the number of marbles by mass = (total mass – jar mass)/your average marble mass.

mass of marbles $m_{marbles} = m_{jar\ with\ marbles} - m_{jar}$ = _____ g (tare capability used on scale)

$$N \approx \frac{m_{marbles}}{m_{average}} = \_\_\_\_\_$$

12. Number of marbles by volume = (volume water displaced) / your average marble volume

mass of water in filled jar $m_{water\ in\ filled\ jar} = m_{jar\ full\ of\ water} - m_{jar}$ = _____ g

mass of water and marbles in jar $m_{water\ +\ marbles} = m_{jar+marbles+water} - m_{jars}$ = _____ g

$m_{displaced\ water} = m_{water\ in\ filled\ jar} - (m_{water+marbles} - m_{marbles})$ = _____ g

$V_{marbles} = V_{displaced\ water} = \frac{m_{displaced\ water}}{\rho_{water}} = \frac{m_{displaced\ water}}{0.997\ g/cm^3}$ = _____ cm^3 $\quad N \approx \frac{V_{marbles}}{V_{average}}$ = _____

Note: 1 mL = 0.001 L = 1 $cm^3 = 10^{-6}\ m^3$

13. Number of marbles by counting (shared effort of entire class): N = _____

14. If the volume of an average grain of salt is about 0.03 mm^3, how big would a container of salt need to be that holds 6.02 x 10^{23} grains of salt? Hint: Multiply the volume of a grain by the number of grains. Express your result in km^3 and if it were in the shape of a cube, give the length of a side of that cube in km.

$V_{salt\ cube}$ = _____ mm^3 = _____ km^3 $\quad l_{side} = \sqrt[3]{V_{salt\ cube}}$ _____ km

15. How much mass would that amount have if the density of salt is ρ_{salt} = 2.16 g/cm^3 = 2160 kg/m^3 ? Hint: Multiply the volume by this density and adjust units. Express your answer in kg.

$m_{salt\ cube} = \rho_{salt} \cdot V_{salt\ cube}$ = _____ kg