Metric System Exercise.

Name : _____

Section # _____

Length Measurements : Use a coin assigned by the instructor Describe it and record the code # given on the envelope

Code: ____ Describe the coin _____

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1. Using a metric ruler, measure the diameter of the coin to the nearest 0.1 cm (1mm) . _____
2. Calculate the area of the surface of the coin. (show units)

$A = \pi r^2$ (radius r = ½ diameter) $\pi = 3.14$ **A** = _____ cm^2

(show set-up of calculation here)

Mass Measurements:

3. Weigh the coin to the nearest centigram (2 dec places) . _____ g

4. Record the density of the coin given on the envelope _____g/cm^3

Volume

5. Now that you know the density and the mass, in grams, of the coin, you can calculate its <u>volume</u> in cubic centimeters . recall, d = mass / vo**l**

show set-up of your
. calculation

Write the answer here , including units

6. Assuming the quarter has the shape of a cylinder, its volume is given by:
V = Area ^{x} h where **h** = thickness (height) of the coin. Calculate h in cm (volume is from question 5 above). (area is from question 2,) rearrange the formula to find **h** , the unknown thickness.
Show set-up of calculation

Write your answer here incl. unit

7. Question. Why is it better to calculate the thickness of the coin from the mass and the density rather than measuring it directly ?

Dimensional Analysis. Converting Units. Name: _____

Section: _____

Units are treated as algebraic variables, i.e. they can be multiplied or divided in the same way as x and y, in algebraic operations.

$2\ cm \times 3\ cm = 6\ cm^2$ $\qquad 5\ cm^3 / 2\ cm^2 = 2.5\ cm$

Units can be set up in conversion factors . 1 cm = 10 mm , thus dividing both sides of this equation by the same quantity, say 10 mm , we get a ratio which is equal to 1

$$\frac{1\ cm}{10\ mm} = \frac{10\ mm}{10\ mm} \longrightarrow \frac{0.1\ cm}{mm} = 1$$

Converting 123 mm to cm, set up the given quantity, multiply by the ratio that cancels the units

$$123\ \cancel{mm} \times \frac{0.1\ cm}{\cancel{mm}} = 12.3\ cm$$

A formula approach is also useful, i.e. with temperature

$F = 1.8\ (^oC) + 32$ or $K = C + 273$

Exercises. Show an organized set-up for each problem

1, Convert 78^oF to ^OC .

2. Convert -13^oC to ^oF

3. An object weighs 8.22 pounds . What is its mass in grams ?

4. A stick is 12.0 cm long. What is the length in inches ?

5. The water in a flask measures 423 mL. How many quarts is this ?

6. A piece of lumber measures 98,4 cm in length. What is its length in

   a) millimeters

   b) feet

7. A block is found to have a volume of 35.3 cm^3 . Its mass is 31.7 g . Calculate the density of the block.

8. A graduated cylinder is filled to 25.0 mL with a liquid . A metal object weighing 73.5 g was immersed in the liquid , raising the liquid level to 43.9 mL. Calculate the density of the solid metal object.

10. The density of the liquid in problem 8 is 0.874 g/mL . What is the mass of the liquid ?

11. What is the mass in grams, of 0.400 ft^3 of gold ? (1 inch = 2.54 cm , d of Au = 19.3 g/cm^3)

12. How much is the gold in problem 11 worth, given its price is $1500 / troy ounce.(1 tr.oz = 31.1 g)

Graphing Data **Class Exercise** Name: _____

Section _____ Date _____

Graphing two variables that are directly proportional for example: we wind up with a straight-line graph. We can choose the x variable or the y variable to most efficiently make use of the graph paper by matching the units with the available divisions.

1). Find the range (hi-lo) for each set.

Density: Range = 2.95 – 0.084 = 2.86

Mass: Range = 70 – 2 = 68

Gas	Density(g/L)	Mass (amu)	
H_2	0.084	2.0	lo
He	0.17	4.0	
N_2	1.17	28.0	
F_2	1.58	38.0	
CO_2	1.83	44.0	
Cl_2	2.95	70	hi

Graph paper with 10 sq/inch is used for this exercise – You may choose to use a larger sheet and lay it out vertically or horizontally – whichever is more efficient.

2) Divide the range by the available divisions on the graph paper. We are using graph paper with 10 minor divisions per inch. Just count the inch markings. Lay the paper vertically so we have 7 inches on the x coordinate and 10 inches on the y coordinate. If you are using another sheet of graph paper, it can be laid out vertically or horizontally whichever is most efficient. Try the vertical format first.

Let's call the y axis the Density coordinate. Divide the range by the # of inches : 2.86 / 10 = _____

Obviously we don't want each inch marked by 0.286 units. Each major division must be a nice whole number such as 1 or 2 or 5 (or 0.1 or 0.2 or 0.5) but never 3 or 4 or 7 etc, such that the scale can be readily interpolated. To accomplish this : *increase the range until the units/inch is a nice #.*

Doing a similar analysis of the Mass data vs available divisions (7 in) thus: 68 amu / 7 = _____

3) Now label each scale. In this case you can start each axis at 0 units. This need not always be the case. Label only the major (inch divisions) and where space is available title each axis (i.e. density (g/L)) Units are always given in parentheses.

4). Plot the points with a fine pencil. Draw just fine points and circle them.

5). Use a ruler to draw the best straight line through the set of points, such that the points are either on the line or that the points straddle the line uniformly. Do not connect points from point to point. !!!!

6). Mark 2 new (not plotted) points on the line – at two coordinates fairly far apart. Outline each with a small square (to differentiate these from the points outlines with circles). Determine the x and y coordinates. Calculate the slope of the line "m" = $(y_2 - y_1) / (x_2 - x_1)$. Determine the y intercept "b" – this is where the line crosses the y axis.

7) Record the equation of the line on the graph paper (see below graph)

The slope setup can also be done on the graph paper where space allows.

This exercise may be done during lecture period. Bring 2 sheets of graph paper (10 sq/inch) – one extra in case you make a mess. Also bring a ruler. Graph paper is available from the chem stockroom across the 301 lab at 10c per sheet. If you can do this at home prior to coming to lecture – by all means do so, but your lecturer will lead you through this procedure. *All graphs done in this course will be done by hand in this manner. Later in the course – you may do additional work on a graphing program such as Excel, but that would be for an additional point or two – you must still do <u>all</u> graphing by hand on graph paper with 10 sq/inch or finer for ex 20 sq/inch or 5 or 10 sq/cm if you can find it, for ex on a website.*

We'll deal with curves later.