Pre-Assessment: Metrics, Significant Figures and Conversions

Name: _____ Date: _____ Period: _____

1. Briefly state why significant figures are important in scientific investigations.

2. What is the purpose of putting the graduation marks on the strip of paper in a series of steps?

3. Why do scientists tend to prefer measurements using the metric system as opposed to traditional (Imperial) units?

4. Solve the following to the correct number of significant digits and include proper units:

(2.54cm)(0.67cm)(1.005g) / (12.04cm/s)

5. A student uses the water displacement method to determine the density of an irregular rock. The rock is placed into a graduated cylinder containing 23.0mL of water. When totally submerged, the water level rises to 27.3mL. If the rock had been previously measured to have a mass of 23.856g, to the correct number of significant digits, what is the density of the rock in g/mL?

Notes:

Metrics, Significant Figures and Conversions

Name(s) _____

_____, _____

Date_____ Period_____

Purpose: *In this laboratory activity you will explore techniques used in chemistry to calculate experimental values to the correct precision, and how to convert one type of units to another.*

Part I. Cubic Centimeters, Milliliters and Determining Density by Water Displacement.

Materials: *3 pennies, dropper or pipet, 50mL graduated cylinder, water and a mass balance.*

1. The volume occupied by three pennies stacked together is very close to 1 cubic centimeter ($1cm^3$).
2. Using a balance, determine the mass of a stack of three copper pennies and record the value to the appropriate significant digits in *Table 1*.
3. Fill a 50mL graduated cylinder with tap water to the 20.0mL mark. Use a pipet to adjust the volume and record the initial volume (V_i) in *Table 1*. Again, use appropriate significant digits here and throughout the remainder of this lab. *Always read to the bottom of the meniscus.*
4. Gently, without splashing, slide the pennies into the graduated cylinder and record the final volume (V_f) of the water.
5. Record the volume of water displaced by the pennies (V_f-V_i).
6. Determine the number of cm^3 in 1mL.
7. Calculate the density of copper to the precision possible using your laboratory equipment. Remember Density = mass/volume.
8. Look up the accepted value for the density of copper and record.

Questions:

1. What is the meniscus? _____ _____
2. Was your value for the density of copper accurate? Explain. _____ _____
3. Which measurement was the least precise and why? _____ _____
4. Explain how you determined the number of significant digits to use in your calculation of the density of copper. _____ _____

	Value	Number of significant figures
Mass of pennies:		
V_i	mL	
V_f	mL	
ΔV	mL	
1 cm^3	mL	**Exact**
Density of copper (calculated):	g/cm^3	
Density of copper (published):	g/cm^3	

Table 1

Calculations area:

Part II. Precision and Significant Digits.

In this part of the activity you will be making and using measuring devices of various precision to make measurements.

Materials: *Strip of heavy stock paper (4.0cm x 40.0cm), meter stick.*

1. Using a pencil and meter stick, mark off the long edge of your paper in 1 decimeter (dm) increments. Have your instructor initial your work.

Initial: _____

Using your measuring strip, measure the edge of a floor tile in **decimeters** *to the best precision possible* and record in *Table 2*.

2. Further mark off the long edge of your paper in 1 centimeter (cm) increments. Have your instructor initial your work.

Initial: _____

Measure the same edge of a floor tile in **decimeters** *to the best precision possible* and record in *Table 2*.

3. Again, mark off the long edge of your paper this time in 1 millimeter (mm) increments. Have your instructor initial your work.

Initial: _____

Measure the same edge of the floor tile in **decimeters** *to the best precision possible* and record in *Table 2*.

Increments	Length of Edge	Significant Digits
Decimeters	dm	
Centimeters	dm	
Millimeters	dm	
Area of Tile	dm^2	
Area of Tile	in^2	

Table 2

4. Assuming that the floor tile is square, using your most precise measurement, calculate the area of the floor tile in dm^2. Record in *Table 2*.

5. Look up the following conversion:

   1 inch = _____ cm

6. Calculate the area of the tile in in^2. Show your calculation below.

Questions:

1. What happens to the number of reportable significant digits as the graduations become more refined? _____

_____

2. How does the number of significant figures change as you calculate a) from length to area and b) from dm^2 to in^2?

_____

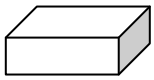
_____

_____

Part III. Volume and Units Conversion:

Materials: Paper strip with millimeter graduations.

1. Fold your strip of paper in half, then unfold. Fold the outer edges of your strip into the center fold so that you create four equal lengths. Open the folds and create an "open" box with four equal sides.



2. Calculate the volume of the box in dm^3. (Assume the box is 4.00cm from bottom to top)

_____dm^3

3. Calculate the volume of the box in cm^3.

_____cm^3

4. Determine the ratio of the volume of the box in cm^3 to the volume in dm^3.

_____cm^3/dm^3

5. Given that 1 liter (1L) is equal to 1 dm^3 and using what you learned in Part I of this activity, state the relationship between milliliters (mL), cubic centimeters (cm^3), liters (L), and cubic decimeters (dm^3).

_____L = _____dm^3 = _____mL = _____cm^3