Name: _____

Section: _____

Report Form – Measuring Density

Part A–Density of a Liquid: UNKNOWN NUMBER [ ]

Method 1–Graduated Cylinder

	Trial 1	Trial 2
Mass, liquid + graduate		
Mass, graduate		
Mass, liquid*		
Volume of liquid		
Density of liquid*		
Average density*		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page

Method 2–10.0 mL Volumetric Pipet

	Trial 1	Trial 2
Mass, beaker and liquid		
Mass, beaker		
Mass, liquid*		
Volume of liquid	10.00 mL	10.00 mL
Density of liquid*		
Average density*		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page.

Part B–Density of a Solid

UNKNOWN NUMBER

Method 1–Displacement of Water in a Graduate Cylinder.

Mass, metal	
Volume, Water + metal	
Volume, Water	
Volume, metal*	
Density*	

Method 2–Displacement of Water in an Ungraduated Vial

Mass, metal	
Mass, vial filled with water	
Mass, metal + Mass, vial filled with water	
Mass, vial with metal and water	
Mass, water displaced by metal*	
Volume, water displaced*	
Volume, metal	
Density, metal*	

Show the calculations for each of the entries in the Data Table marked with * on the calculations page.

Method 3–Measuring Volume with Calipers

	CALIPER	RULER
Mass, metal		
Height, metal		
Diameter, metal		
Radius, metal*		
Volume, metal*		
Density, metal*		

Densities of the Unknowns:

Part A– Average Density of Unknown Liquid from the two methods:

Density of Liquid (Graduated Cylinder)	
Density of Liquid (Volumetric Pipet)	
Average Density of Unknown Liquid*	

Part B– Average Density of Unknown Metal from all three methods:

Density of Metal (Graduated Cylinder)	
Density of Metal (Ungraduated Vial)	
Density of Metal (Ruler/Calipers)	
Average Density of Unknown Metal*	

Show the calculations for each of the entries in the Data Table marked with * on the calculations page.

Part C–Mass Versus Volume

Object	Mass	Diameter	Radius*	Height	Volume*
A1					
A2					
A3					

REPLACED WITH DATA IN HANDOUT

Object	Mass	Diameter	Radius*	Height	Volume*
B1					
B2					
B3					

Show the calculations for each of the entries in the Data Table marked with * on the calculations page.

Attach your Mass vs. Volume graph to your lab report.

Perform the calculation for determining the *slope* of each line from your Mass vs. Volume graph in the space provided below:

NEXT LAB PERIOD:
- TURN IN COMPLETED HANDOUT, PLUS COMPLETED QUES. PG. 24 AND CALCULATIONS (CLEARLY LABELED)

HANDOUT

Measuring Density (REPLACEMENT for Part-C page 19) = pg. 23

Part C-Mass Versus Volume

Select either Data Set for Metal A or Data Set for Metal B below to plot. You will do one and your partner will do the other Data Set.

Metal A

Volume (cm3)	Mass (g)
7.89	17.22
6.80	18.11
7.92	21.21
9.75	22.25
8.17	23.19
9.84	25.44
10.1	26.36
11.4	28.29
11.8	28.73
11.7	29.69

Metal B

Volume (cm3)	Mass (g)
6.63	53.90
6.45	54.53
6.42	57.15
6.61	57.34
7.97	69.15
8.40	69.43
7.98	72.24
9.65	84.84
9.65	86.14
9.84	87.67

1. Calculate the respective densities for the metals using an average of the Mass and Volume for each metal. (Report the values in the table on this page and attach it along with your graphs to the REPORT FORM pages and turn in.)
2. Graph the Mass (vertical axis) vs. Volume (horizontal axis) for your Data Set (graph paper is in Appendix C). Scale your graph to use as much of the graph paper as possible. Provide a Title, label the axes (include units), show each data point and draw the best possible straight line balancing the differences in the distance of the points on each side of the line using a ruler. Draw the line through the y-axis. Calculate the slope of the line, slope (m) = $\Delta y / \Delta x$, which equals the metal's density. (Report the values below.)
3. The respective metals are either aluminum, density = 2.64 g/cm^3 or copper, density = 8.94 g/cm^3. Using these as accepted values, identify A and B, then calculate and record the calculated % error in the experimental densities using the two methods.

	A	B
Metal *identified*		
Density (g/cm^3) *averaged*		
Error (%) *averaged*		
Density (g/cm^3) *graphed*		
Error (%) *graphed*		

Questions:

A. Liquid Unknown:

1. According to your data, which method used for determining the liquid density was more precise? Explain.

2. Can you determine which method is more accurate? Explain.

B. Solid Unknown:

1. Based on the number of significant figures in your answers, which of the three methods do you believe is least precise? Explain.

2. A student is told to determine the density of a solid unknown cylinder. The mass of the unknown cylinder is 56.38 grams. The unknown cylinder is 4.95 cm high and has a radius of 1.28 cm. The student measures the correct mass but measures the height as 4.96 cm and the radius as 1.30 cm. What will be the percent error in the student's **density** value?

$$Percent\ Error = \left| \frac{True - Experimental}{True} \right| \times 100$$

C. Mass Versus Volume:

1. State the physical meaning of the slope of each line.

2. Did your lines go to the (0,0) point? In theory **should** the lines go to the (0,0) point? Explain.

Calculations

Show the calculations for each of the entries in the Data Table marked with * below.