Grade 9 Science   **Name:** _____

Identifying Substances Using Density

Purpose: To measure the mass of different volumes of three liquids, to graph and to
          analyze the results.

Materials: 100 mL beaker, 25 mL graduated cylinder, balance, three unknown liquids,
          dropper, graph paper, ruler, coloured pencils

Procedure:
1) Find the mass of a 25 mL graduated cylinder and record in the Observations section.

2) Fill the beaker about ¼ full of liquid A. Use a dropper to help you fill the graduated
cylinder with exactly 5 mL of liquid A. Measure the mass of the cylinder and the water.
Record the mass of 5 mL of liquid A in the Observation chart. **(Don't forget to subtract
the mass of the graduated cylinder!)**

3) Repeat Step 2 for volumes of liquid A measuring exactly 10 mL, 15 mL, 20 mL and
25 mL.

4) Repeat Steps 2 and 3 for liquids B and C, filling the Observation chart as you go.

Observations:

Mass of 25 mL graduated cylinder: _____

Volume (mL)	Mass (g)		
	Liquid A	Liquid B	Liquid C
5			
10			
15			
20			
25			

Analysis:
Complete a straight line graph of mass vs. volume using a sharp pencil and the graph paper provided:

1) Place volume (mL) on the x-axis (horizontal axis), and choose a scale which will allow you to graph up to 100 mL.

2) Place mass (g) on the y-axis (vertical axis), and choose an appropriate scale which will allow you to graph **beyond** your collected data.

3) Plot your data using a different coloured pencil for each liquid. Include a key or **legend** on your graph indicating which substance is which colour.

4) Draw a line of best fit through the plotted points for each substance using the appropriate colour. Should the line go through the point (0,0)?

5) Ensure your graph includes headings, units, and a descriptive title.
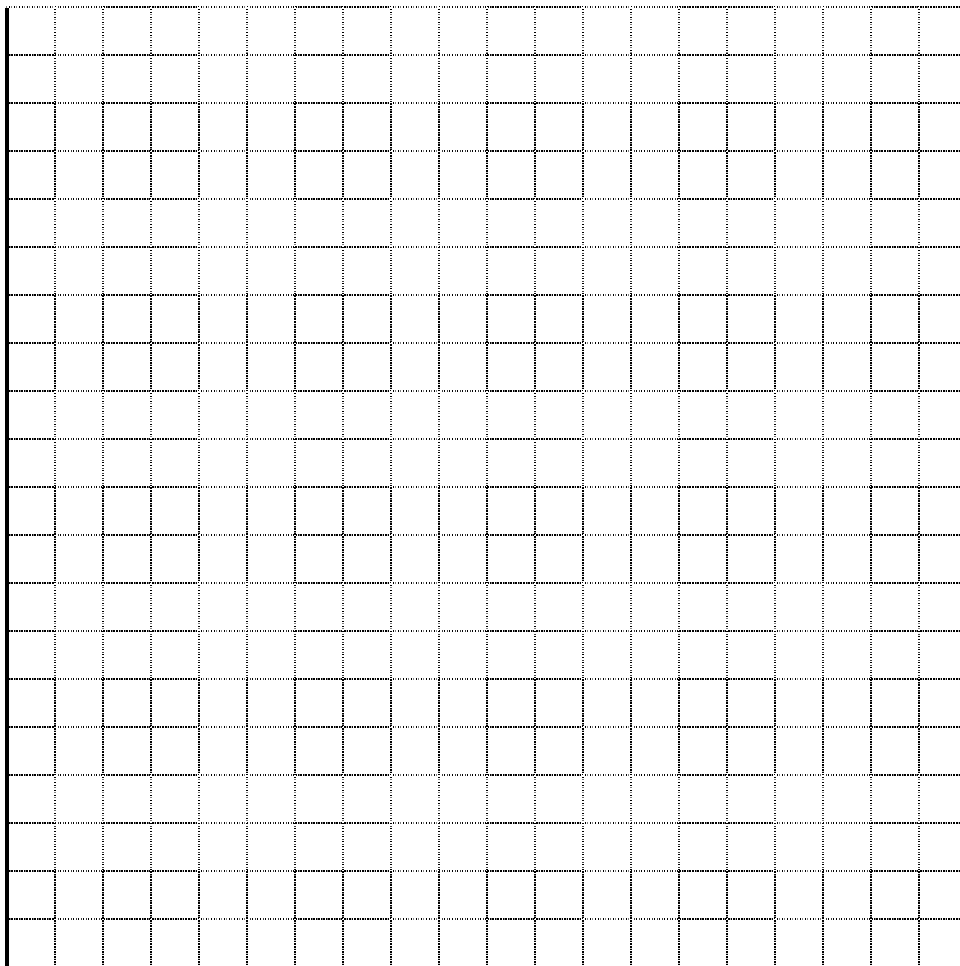
Questions:
Answer the following questions on a separate piece of paper using *full sentences*:

1) The **independent variable** is the part of an experiment that the scientist changes herself. It is the "cause" in a "cause-and-effect" relationship. What is the independent variable in this lab?

2) The **dependent variable** is the part of an experiment that the scientist measures. It is the "effect" in a "cause-and-effect" relationship. What is the dependent variable in this lab?

3) Which liquid has the steepest line of best fit (greatest slope)? Which liquid has the least slope on the graph?

4 a) Density is defined as the amount of mass per unit volume. Given this definition, state the order of the substances from the most dense to the least dense.

b) What do you think the slope of the line on a volume vs. mass graph signifies?

5) Density can be expressed as a formula: density (g/mL) = $\frac{\text{mass (g)}}{\text{volume (mL)}}$ or d = $\frac{m}{V}$.

a) Calculate the density of liquid A, using one point **on its slope**, including the formula and all units. Show the point you used on your graph. . Enter all the value in the chart below.

b) Pick two more points for liquid A, and calculate the slope two more times. Average the three values. Enter all the values in the chart below. DO NOT SHOW YOUR WORK!

c) Repeat for liquids B and C. Enter all the values in the chart. DO NOT SHOW YOUR WORK!

6 a) Pick two points on the line for liquid A and make a "rise over run" triangle below the line (see teacher demonstration from previous day's work). Calculate the slope of the line, using the formula:
        slope = $\frac{\text{rise}}{\text{run}}$
Show all of your work, including the formula and all units. Enter the values in the chart below.

b) Now calculate the slope of the line for liquid B and liquid C. Enter the values in the chart. DO NOT SHOW YOUR WORK.

Liquid	Volume (mL)	Mass (g)	Density (g/mL)	Average Density (g/mL)	Slope of Line
A	1) 2) 3)	1) 2) 3)	1) 2) 3)		
B	1) 2) 3)	1) 2) 3)	1) 2) 3)		
C	1) 2) 3)	1) 2) 3)	1) 2) 3)		

7) Make a statement comparing the slope of the line of a volume vs. mass graph to the calculated density.

8) Density is a characteristic physical property that helps scientists identify different kinds of matter. Use Table 1 on page 24 of your text to identify the three liquids.