

DENSITY

PURPOSE: To obtain the mass of a specific volume of a designated liquid, use a graphing calculator to graph class data, use the graph to determine the density of each liquid, use the calculator to obtain the slope of graphed data and to display a best fit curve of experimental data.

DISCUSSION: The density of a substance can be determined by obtaining the mass of a specific volume of that substance. This provides a value of density based on one trial or one set of experimental data. A more accurate density can be obtained by multiple trials. Then the data can be graphed. The slope of the graph will provide a more accurate value of density.

To save time, each lab team will obtain one set of data, both mass and volume, for one of two liquids. Then the class data will be pooled so that a graph of each liquid can be prepared. Since the final results depend on each lab team, you must be very careful in all measurements.

The mass of the liquid depends on the amount or volume of the sample. Therefore the volume is the independent variable in this experiment. The mass is the dependent variable. Remember that the slope of a graph is best determined by selecting points that are further apart on the graph. Slope (m) equals a change in y divided by a change in x or $m = \Delta y / \Delta x$.

The calculator provides a quick and efficient way to determine the slope of a graph. You will determine the slope of the data for Liquid A and B during this lab. Experimental data is never perfect. Therefore, the lines were not perfectly straight. The calculator can be used to determine the best fit line and allow you to more clearly see the points that are not on the slope.

Every pure substance has its own unique value of density. Density is considered to be an intensive property, and can be used to identify a substance

EQUIPMENT: 10 mL and 25 mL graduated cylinders, balance, graphing calculator

PROCEDURE:

PART 1:

1. Mass an empty graduated cylinder.
2. Measure the volume of the specified liquid as indicated on the card at your station.
3. Remass the cylinder. Record your data in the table below, and on the class transparency.
4. Determine the density of your liquid from your individual trial. Show your work here, and put your final answer in the part 1 data table.

Individual Data	
Unknown liquid (A or B)	
Volume of liquid	
Mass of empty cylinder	
Mass of cylinder and liquid	
Mass of liquid	
Density of liquid	

Class Data:

LIQUID A		LIQUID B	
Mass	Volume	Mass	Volume

PART 2:

1. Follow your teacher's instructions to produce a graph for both liquids on your graphing calculator. You may also refer to the handout for calculator graphing off of the web site.
2. Follow your teacher's instructions to graph the best-fit line for both liquids on your calculator. Complete the data table for part 2 below.
3. Get your teacher's signature when you have successfully produced a graph with two best-fit lines.

Calculator Data:

Liquid	A	B
Slope		
Correlation coefficient		
Teacher signature		

POST-LAB QUESTIONS:

1. Which liquid has the greater density? How can you tell by simply looking at the graphs?
2. According to the linear regression analysis, what is the density of Liquid A?
3. According to the linear regression analysis, what is the density of Liquid B?
4. Assuming the densities listed in questions 2 and 3 are the true values; calculate the percent error of your individual trial's density from Part 1?
5. On a separate sheet of graph paper, graph the data for both liquid A and liquid B. Draw a best-fit line and calculate the slope of these two lines. Be sure to follow all rules for graphing on the graphing handout on the web site.
6. Using your hand drawn graph, choose 2 points on each graph and determine the slopes of your best fit lines.
7. Calculate the percent error between your hand calculated slopes and the calculator's slopes.

Density

Name _____

PRE-LAB QUESTIONS:

1. In what units should density be recorded in this lab?
2. For correct graphing technique, on what axis should the independent variable be placed?
3. What specific variable will be graphed on the x-axis in this lab?
4. What specific variable will be graphed on the y-axis in this lab?
5. How is the slope of a line calculated?
6. Which gives more accurate results; one trial or repeated trials of lab measurement?