Name: _____ Date: _____

Foundations Physical Science Lab
Measurements

Objective:

Students should be able to measure mass, length, volume and temperature, and then organize data into table and graphs.

Materials:

Meterstick, ruler, balance, small beaker, thermometer, hot plate, small block, metal cylinder, table salt, baking soda, sodium phosphate, stop watch, calculator, test tube, vials

Procedures: Check your lab station to ensure that you have all the materials in the materials list.

Lab one: Measuring temperature (only one person needed for this lab)

1. Half fill your beaker with tap water. Turn on the hot plate and plate your beaker on the hot plate. Place the thermometer the thermometer in the water and record the initial temperature. Continue recording the temperature of the water every 30 seconds for the next ten minutes.

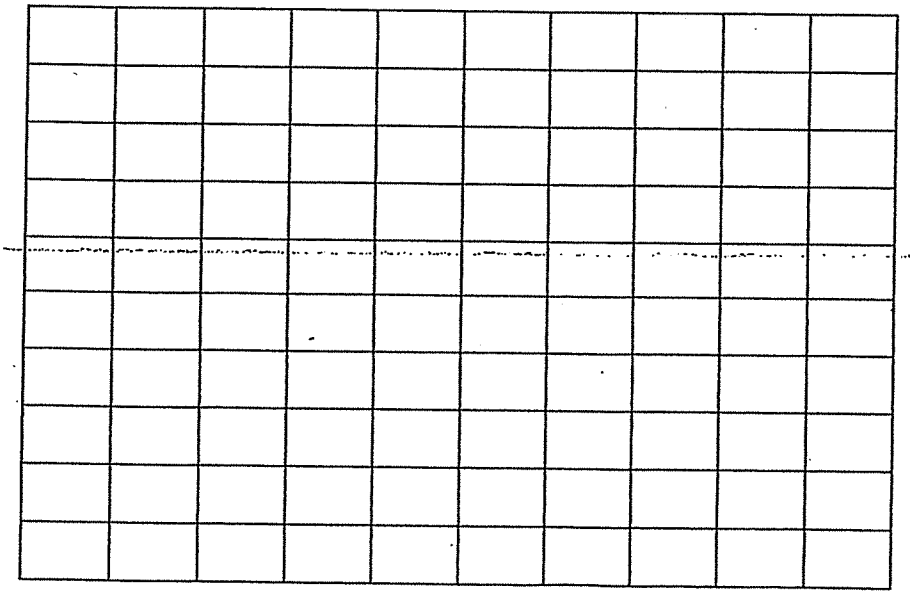
   Initial Temperature: _____

   Title: _____

Time (min : sec)	30	60	1.30	2.00	2.30	3.00	3.30	4.00	4.30	5.00
Temperature (°C)										
Time (min : sec)	5.30	6.00	6.30	7.00	7.30	8.00	8.30	9.00	9.30	10.00
Temperature (°C)										

2. Plot a graph to illustrate the change in temperature over time. Be careful when choosing you're your graph and axes that it is appropriate for showing change in temperature and that the independent variable goes on the y-axis. Be sure to follow all graph drawing rules when setting up your graph.

   Title: _____



Lab two: Measuring length (other lab partner)

3. Choose one of the three blocks at you lab station and record it number in the table that follows. Next measure the length, width and height of one of your blocks in centimeters and insert this data in the same table. Then use the equation volume = length x width x height, to calculate the volume of the block, record the calculated volume in the appropriate space on the table.

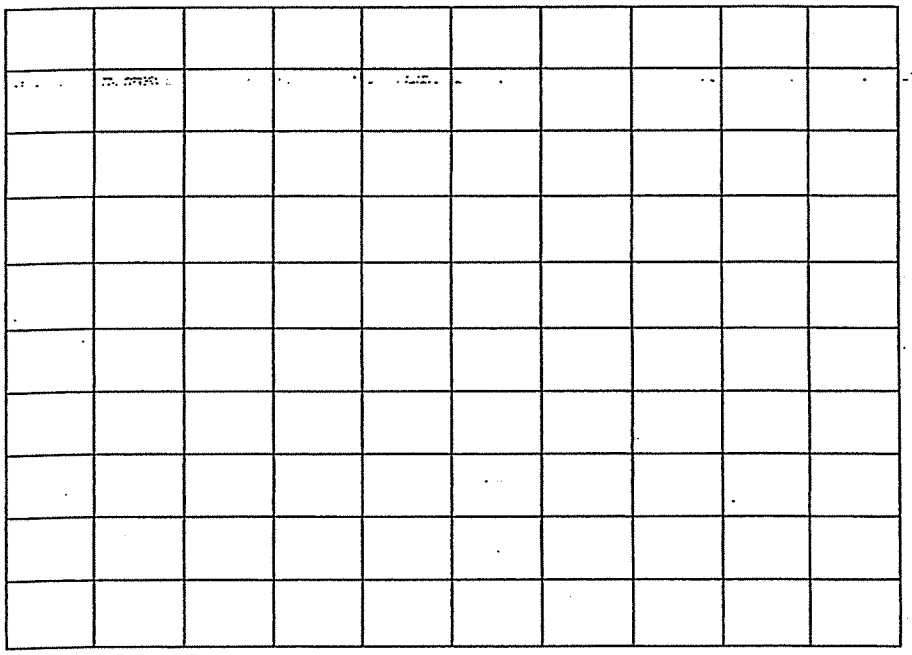
4. Repeat procedure 3 with two other blocks then calculate the average (mean) volume.

Title: _____

	Length (cm)	Width (cm)	Height (cm)	Volume (cm^3)
Block _____				
Block _____				
Block _____				
Average				

5. Plot a graph to illustrate a comparison between the volumes of the three blocks. Be careful when choosing your axes that the independent variable goes on the y-axis. Draw a line on your graph that best illustrates the average volume. Be sure to follow all graph drawing rules when setting up your graph.

Title: _____



Lab three: Measuring mass

6. Obtain four vials, the first of sodium chloride (NaCl), the second of sodium bicarbonate ($NaHCO_3$), the third with sodium phosphate (Na_3PO_4) and the fourth empty. Each of the vials containing a chemical should be filled so that each vial contains the same amount of solid. The fourth vial is empty so that just can calculate the mass of each solid by subtracting the mass of the vial. Write the masses in the table below and calculate the average (mean) mass of the three solids.

Title: _____

	Mass of vial and solid (g)	Mass of vial (g)	Mass of solid (g)
Sodium Chloride			
Sodium Bicarbonate			
Sodium Phosphate			
		Average mass of solids	

7. Plot a bar graph comparing the masses of each solid and draw the line across the bar that illustrates the average mass of the solids.

Title: _____

Lab four: Measuring Volume

8. Fill test tube 1 with tap water. Then pour the water into the most appropriate graduated cylinder to measure the volume of the test tube. Ensure when you observe the volume of the water in the graduated cylinder that you have the cylinder on the lab station and that you have your eyes level with the meniscus. Repeat this procedure with test tubes 2 and 3. In the space provided construct a table to report this data. Ensure that all your data is recorded to 0.1 of a milliliter. Estimate if the scale on the graduated cylinder does not have this marked. Then take the mean average of your volumes.

Create your own data table on the space provided on the next page.

Title: _____

Lab five: Measuring volume by liquid displacement.

9. Pour about 25mL into a 50mL graduated cylinder and record the volume to 0.1 of a milliliter. Estimate if your graduated cylinder does not have this marked. Record your volume in the table below.

10. Gently allow the metal cylinder marked 1 to slide down the side of the graduated cylinder so that no water splashes out. If water splashes out start from the beginning again (procedure 9). Tilting the cylinder may make this slightly easier to do. Measure the new volume to accuracy of 0.1mL and by subtraction work out the volume of the solid. Record all your observations in the table below.

11. Repeat procedures 9 and 10 with three other metals and record the volumes given in the table below.

Title: Table showing volumes of metal cylinders by liquid displacement.

	Volume of water and metal (mL)	Volume of water (mL)	Volume of metal (mL)
Metal 1			
Metal _____			
Metal _____			
Metal _____			

Lab six: Graphing Mass and volume

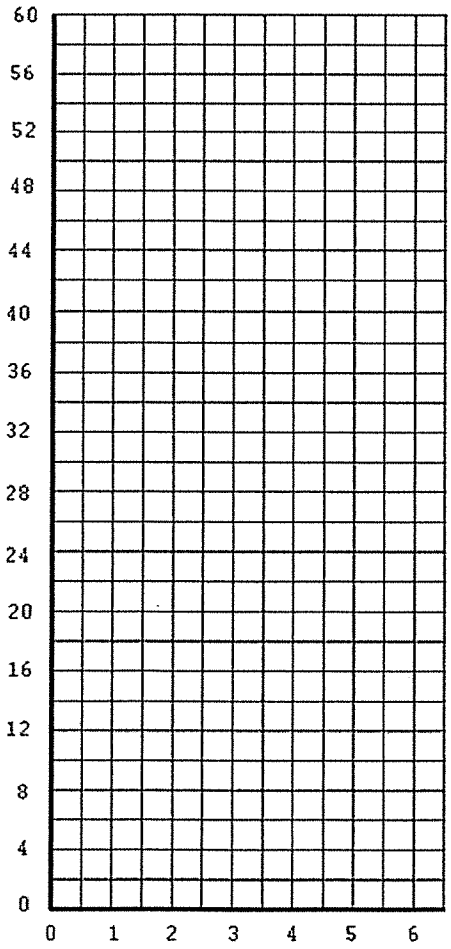
12. Using the table below, plot the data points for copper and aluminum on the graph provided. Label the y-axis "mass" and the x-axis "volume" with the appropriate units and create an appropriate scale. Using a ruler, draw a best-fit line for each set of data points.

13. Then, solve for the slope of each line. What would the units be of these slopes?

14. What do the slopes represent? Answer in the spaces provided below.

Aluminum	
Mass (g)	**Volume (cm^3)**
9.0	1.0
18.0	2.0
36.0	4.0
54.0	6.0

Copper	
Mass (g)	**Volume (cm^3)**
2.7	1.0
5.4	2.0
10.8	4.0
16.2	6.0



Slope of a line formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope for aluminum:

Slope for copper:

Units for slopes:

The slopes of the lines represent: