Name: Lab Station No. _____

Lab Partner's Name:

Lab 1-1: Measurement in Chemistry

Introduction

Most chemistry lab activities involve the use of various measuring instruments. The three variables you will measure most are mass, volume and temperature. Failure to obtain a satisfactory result in a lab is usually the result of improper or inaccurate use of measuring instruments. In this activity you will become familiar with the measuring instruments most often used in chemistry.

Materials:

Metal cylinder	Water
Weighing dish	400 mL beaker
Balance	250 mL beaker
Metric ruler	150 mL beaker
Bunsen burner	100 mL graduated cylinder
Wire gauze	10 mL graduated cylinder

Safety: Although there are no specific hazards involved with this lab, you must wear safety goggles.

Pre-Lab:

1. List all of the safety precautions you are taking to conduct this experiment?

2. What is the difference between weight and mass? Which will be measured in all lab activities?

Note: All answer are written on the Report sheet at the back of this packet.

PROCEDURE. Read the entire procedure for each part before you begin lab. Write a checkmark on each step once you completed it.

1. Graduated Cylinders

a. Obtain two graduated cylinders: 100mL and 10mL. Record the graduation interval of each cylinder.

b. Half fill each cylinder with water. Notice the shape of the surface of the water. Sketch a drawing of the shape of the water surface. This is called the meniscus. Always read the level of the liquid at the *bottom* of the meniscus.

c. Write down the measurement of the liquid you have placed in each cylinder. Remember to estimate the last digit.

2. Laboratory Balance

a. Go to an unoccupied balance. Record the balance's number.
b. Raise the lid and turn on balance. Make sure nothing is on the balance. Observe that the readout reads "0.00" If not, press the "zero" button.

c. Obtain 3 samples of the same item (pen, coin etc.). Measure and record the mass of each sample. Calculate mean mass of the samples for each item

d. Use a 3-beam balance to mass the same three items. Explain which balance is more accurate.

e. Place a weighing dish on the balance. Press the *zero* (*tare* on some balances) button. What happens? How can this be useful when measuring substances?

3. Ruler

a. Obtain a centimeter ruler. Record the smallest increment on the ruler. Be sure you are using the centimeter side of the instrument.

b. Measure and record the length and diameter of the cylinder. Be sure to estimate the last digit. Have your lab partner write down your data on your lab sheet. Repeat two more times. Calculate the mean mass.

c. Have your partner perform Step 3b, but you record your lab partner's data.

d. Calculate the volume of the cylinder using the mean lengths. Compare with partner.

4. Beaker

a. Obtain a 150mL, 250 mL and a 400 mL beaker. Record the graduation intervals of each beaker.

b. Place 100mL of faucet water in the 400mL beaker using the markings on the beaker as your guide. Pour the water into a 100mL graduated cylinder (if the water appears to be more than 100mL, stop at 100mL, pour out the water and determine the remaining amount of water with the graduated cylinder. Add to 100mL). Record the volume. Repeat this with the 250mL and 150mL beakers.

c. Calculate the percent error for each of the beakers. The formula for percent error is on the Lab Board. Assume the volume in the graduated cylinder is the true volume.

d. What does the percent error tell you about the accuracy of the markings on a beaker?

5. The Bunsen Burner

a. Make sure your safety goggles are on, hair is tied back, and sleeves are not loose.

b. Light the Bunsen burner according to the instructions given by your teacher. Open and close the needle valve gradually and note how the shape of the flame changes. Why does this happen?

c. Turn the barrel to adjust your flame so that there is a blue cone inside a lighter blue cone. There should be no red/yellow flame. Have your flame inspected by the teacher.

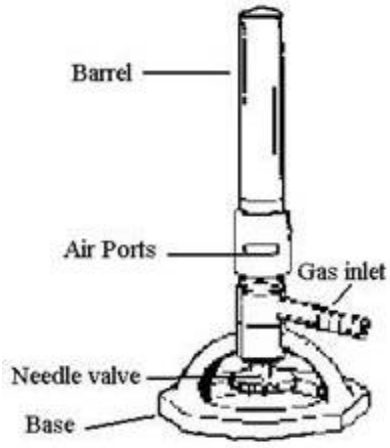

Figure 1: Bunsen Burner

d. Test the temperature in the different zones of a hot flame (air window open) by holding a wire gauze (one without the white center) **horizontally** with a crucible tongs about 1 cm above the burner (see diagram). Note color and appearance of gauze. Now move it up through the flame until it no longer glows.

e. Position the wire gauze **vertically** in the flame. This shows a vertical profile of the temperature regions of the flame. Sketch a profile of the flame and label the "cool" and "hot regions.

f. Close the air port and repeat steps *d* & *e*.

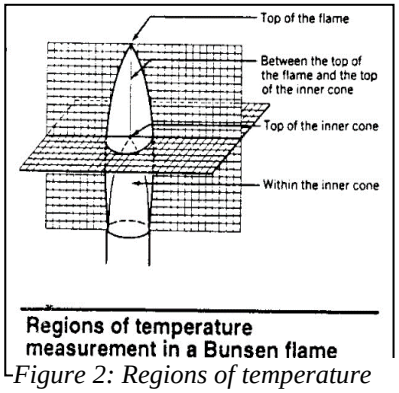

Figure 2: Regions of temperature in a flame

6. Thermometer Calibration

(**Caution:** Thermometers are very easily broken. If a thermometer breaks, inform your instructor immediately.)

- Place about 100 mL of **deionized** water in a 250 mL beaker. Measure the temperature of the deionized water.
- Set up the ring stand with the wire gauze that has the white circle and place your beaker on the white part of wire gauze.
- Heat the water strongly with your Bunsen burner.
- Measure the temperature of the water at one-minute intervals for 5 minutes.
- Once the water begins rapid boiling record the temperature to the nearest 0.5°C.
- Allow water to cool to 30°C then discard water into the trough.
- Calculate the percent error of your thermometer.

7. Clean Up

1. Make sure all glassware has been dried before placing in your drawer.

2. DO NOT PUT AWAY A HOT RING STAND!! The ring stand is always the last item to put away in order to make sure it is cool.

3. Make sure your station is clean. Wipe up area with sponge and squeegee if needed.

4. Wash your hands with soap & water after the experiment.

5. Neatly put away your safety goggles into the goggle cabinet.

6. Put away your apron into the apron closet.

Report sheet

Data:

1. **Graduated Cylinder**

a. Graduation interval: 100 mL _____ 10 mL _____

b. Sketches of meniscus:

c. Measurement of each liquid volume: 100 mL _____ 10 mL _____

2. **Laboratory Balance**

a. Precautions:

b. Balance no. _____ Name of Item: _____

Mass of Sample 1: _____

Mass of Sample 2 _____

Mass of Sample 3 _____ Mean mass: _____

c. What happens when you press *zero* button? How can this be useful?

3. **Ruler**

a. Smallest increment of ruler _____

b. Length of cylinder: Trial 1 _____ Trial 2 _____ Trial 3_____ Mean length _____

c. Diameter of cylinder: Trial 1 _____ Trial 2 _____ Trial 3_____ Mean length _____

d. Volume of the cylinder (show your work with units): _____

e. Partner's calculated volume: _____

4. **Beaker**

a. Graduation interval: 400 mL _____ 250 mL_____ 150 mL _____

b. Actual volume of 100 mL of water in: 400 mL _____ 250 mL _____ 150 mL _____

c. Percent error for each beaker: 400 mL _____ 250 mL _____ 150 mL _____

d. How accurate would you say are the markings on the beaker?

5. The Bunsen Burner

b. What happens to the flame?

c. Teacher's initials for correct flame: _____

d. Sketch of flame for 5e.

Sketch of flame for 5f

6. Thermometer

Minute	Temperature
0	
1	
2	
3	
4	
5	

Accepted value for the boiling point of water: _____

Experimental value for boiling point of water: _____

a.

$$\text{percent error} = \frac{(\text{average of measured value}) - (\text{accepted value})}{(\text{accepted value})} \times 100\%$$

% error = _____

Analysis:

1. If you were asked to measure approximately 200 mL of water what instrument would you use?

2. If you were asked to measure exactly 100.0 mL of water what instrument would you use?

3. Why should you use the same balance for an entire lab activity?

4. Why is it important to perform repeated trials, especially when measuring?

5. Explain, step by step, how 5.0 g of a liquid chemical solution should be massed on a balance.

Problems:

1. A student recorded the temperature of boiling water as 100°C. Her partner recorded the same measurement as 100.0°C. Which is the more precise measurement? What is the relationship between precision and significant digits of a measurement?

2. Explain what you would do if you found a beaker containing colorless, odorless liquid at your station. (hint: "Asking everybody in the room "Who did this?" is not acceptable.)

Bonus +1: Why is called a beaker called a "beaker"?