Lab 1: Safety Lab; Introduction to Volumetric and Weighing Techniques

Objectives:

1. Be aware of safety practices, procedures outlined in the safety video.
2. Introduction to WHMIS and MSDS.
3. Locate the laboratory emergency safety equipment and understand why and when to use them.
4. Understand the tolerances of lab glassware, bottle-top dispenser and the analytical balance.
5. Learn and practice volumetric and weighing lab techniques.

Introduction:

Part A: Lab Safety

Safe working practices are essential and mandatory part of all work activities. You will be given a tour of the safety features in the lab. It is important that you know where to locate the emergency safety equipment and have an understanding of their use. Students are expected to act professionally in the lab environment.

WorkSafeBC is an independent agency governed by a Board of Directors appointed by government. Their core mandates are:

- prevent workplace injury illness and disease,
- rehabilitate, and
- provide fair compensation

In order for WorkSafeBC to be effective, their focus to promote healthy and safe workplaces through enforcement, consultation and education. In 1988, an emphasis on worker safety is launched with a public awareness campaign on Alcohol and Drug Abuse in the Workplace and the Workplace Hazardous Materials Information System (**WHMIS**). Read more about WorkSafeBC historical milestones.

WorkSafeBC website

WHMIS

The Workplace Hazardous Materials Information System (WHMIS) provides information about many hazardous materials used in the workplace. WHMIS refers to these hazardous materials as **controlled products**. Under WHMIS, ***workers*** have the right to receive information about each controlled product they use---its identity, hazards, and safety precautions.

Classification

Each controlled product is classified into one or more of the six hazard classes, Class A to F. Once classified, they are assigned one or more of the appropriate hazard symbols. There are eight WHMIS hazard symbols. Workers need to recognize these symbols and recognize what they mean.

After a controlled product has been classified, the means to communicate health and safety information about the controlled products are via:

1. WHMIS labels

2. Material Safety Data Sheets (MSDSs) are used to communicate health and safety information.

Material Safety Data Sheets (MSDSs)

A Material Safety Data Sheet (MSDS) provides both workers and emergency personnel with the proper procedures for handling or working with a particular substance. MSDS's include information such as physical data (melting point, boiling point, flash point), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill/leak procedures. These MSDS are particular use when a spill or an accident occurs.

3. WHMIS education and training programs. In a teaching environment where students are expected to handle controlled products, students need to be educated to ensure the understanding of WHMIS and the hazards of the controlled products that they work with. In a work place, education programs about WHMIS are far more extensive. Workers must be trained in safe work procedures for handling, storing, disposing of the controlled products, as well as emergency procedures in the event of an accident or spill.

Introduction:

Part B: Introduction to Volumetric Glassware

When performing a chemistry lab, the procedure may include the use of various types of glassware for measuring volumes. In order to accurately perform the lab procedures such that the accuracy of measurements is not compromised, an understanding of the different types of glassware is required. Each piece of glassware is made to certain specifications. That is, there is a maximum measurement error associated with the glassware known as the tolerance. For example, a flask which holds 5.00 mL of liquid has a tolerance of $\pm$ 0.02 mL (or $\pm$ 0.4 %). This means that the actual volume that the flask holds is in the range of 4.98 to 5.02 mL. In order to avoid introducing a significant error to the analytical result, the tolerance specifications of each piece of volumetric glassware must match the required accuracy of the procedure.

The following is a summary of the various types of glassware and their tolerance.

Type of Glassware	Target Volume	Tolerance	Accuracy Range
Graduated Erlenmeyer flask	125 mL	$\pm$ 5%	125 mL $\pm$ 6 mL Graduation interval=25 mL roughly accurate
Graduated beaker	100 mL	$\pm$ 5%	100 mL $\pm$ 5 mL Graduation interval=10 mL roughly accurate
Graduated cylinder	10 mL	$\pm$ 0.5%	10 mL $\pm$ 0.05 mL Graduation interval=0.1 mL accurate
Graduated cylinder	100 mL	$\pm$ 0.4%	100 mL $\pm$ 0.40 mL Graduation interval=1 mL accurate
Volumetric flask	100 mL	$\pm$ 0.08%	100 mL $\pm$ 0.08 mL No graduation interval very accurate
Volumetric pipette	25 mL	$\pm$ 0.12%	25.0 mL $\pm$ 0.03 mL No graduation interval very accurate
Burette	50 mL	$\pm$ 0.1%	50 mL $\pm$ 0.05 mL Graduation interval=0.10 mL very accurate

Erlenmeyer flask
Accuracy: +/- 5%
Capacity: 250 mL

graduated beaker
Accuracy: +/- 5%
Capacity: 250 mL

graduated cylinder
Accuracy: +/- 0.4 %
Capacity: 100. mL

volumetric flask
Accuracy: +/- 0.08 %
Capacity: 100.0 mL

volumetric pipette
Accuracy: +/- 0.12 %
Capacity: 25.00 mL

burette
Accuracy: +/- 0.1 %
Capacity: 50.00 mL

Mechanical Dispenser	Target Volume	Tolerance	Accuracy Range
Bottle-Top Dispenser 	50 mL	± 1-2%	50 mL ± 1 mL

The student must be able to use the different glassware and bottle-top dispenser with proper lab techniques such that correct measurements can be made. In this lab, the proper lab techniques will be demonstrated. It is expected that students will practice these techniques until they become proficient with handling all the lab equipment.

Part C: Introduction to the Analytical Balance

An analytical balance

Weighing a sample is often the first step in many quantitative analytical methods. An analytical balance measures masses to within 0.0001 g.
Balances are sensitive to drafts, changes in temperature, or the vibrations caused by moving people. The balances are stored in a separate room to minimize these variables and are placed on concrete tables.

The balance room

Balances are very expensive and are sensitive to attack by corrosive chemicals. ***Do not take liquid into the balance room.*** When possible, chemicals should be added to the weighing container outside of the balance chamber. It is important that you clean up all chemical spills.

In this experiment, you will learn to use the balance properly and be aware of the common errors encountered in weighing.

Apparatus:

1. 1- 125 mL Erlenmeyer flask
2. 1- 100 mL graduated beaker
3. 1- 10 mL graduated cylinder
4. 1- 25 mL pipette
5. 1- 50 mL burette
6. analytical balance
7. a glass vial
8. a pair of tongs
9. drying oven set at 70^{o}C.
10. a small dessicooler
11. 100.00 mL. volumetric flasks
12. burette funnels
13. Pasteur pipettes & bulbs
14. pipette racks & bulbs
15. bottle-top dispensers

Solution:

a coloured solution

Procedure:

Part A - Lab Safety

Visit the links and look up the WHMIS symbols and classifications. Complete the datasheet.

Part B - Introduction to Volumetric Glassware

1. Your instructor will demonstrate the following volumetric measurement techniques:
   - Use of a Burette
   - Use of a Pipette
   - Use of a Volumetric Flask
   - Use of a Bottle-top Dispenser

    Download the volumetric measurement techniques as reference.

2. Using the techniques demonstrated, carry out the following tasks:
   a. Acclimatize the burette with the coloured solution provided. Fill the burette with the coloured solution.
   b. Obtain approximately 50 mL of distilled water in a graduated beaker. Transfer 25.00 mL of distilled water with a volumetric pipette into an Erlenmeyer flask.
   c. Make a 1:4 dilution of the coloured solution provided. Transfer 25.00 mL of the coloured solution into the volumetric flask. Use distilled water to fill the volumetric flask to make it up to the mark. Mix well.
   d. Measure 7.10 mL of distilled water using your graduated cylinder. Use a Pasteur pipette to carefully add the last drops to bring the bottom of the meniscus to the 7.10 mark.
   e. Read the preset volume of the bottle-top dispenser. Use a graduated cylinder and measure the volume dispensed by the bottle-top dispenser. The volume collected should be within 2% of the preset volume. If the volume being dispensed is outside the preset volume, make sure that the bottle-top dispenser is not pumping air and try again.

   Ask your instructor to check your work before you clean the glassware.

Part C - Introduction to the Analytical Balance

1. Zero the balance.
2. Use a pair of tongs and transfer a plastic vial into the balance. Determine the mass of the vial.
3. Use a pair of tongs and place the vial in a drying oven for 5 minutes. Remove the vial and place it in a desicooler for transporting the warm vial to the balance room. Reweigh immediately while it is still warm. Record the change in weight every 30 seconds for the next 5 minutes or until the mass stabilizes.
4. Touch the vial with your hand. Roll the vial in your palm for 10 seconds. Reweigh the vial.
5. Record all the mass measurements in the datasheet.

Datasheet:

Part A: Lab Safety

Go to the Worksafe BC website and identify the following hazard symbols.

WHMIS SYMBOLS	Classification
	_____
	_____
	_____
	_____
	_____
	_____
	_____
	_____

Datasheet:

Part B: Introduction to Volumetric Glassware

Proper techniques in using the following glassware:

burette	**Instructor initial:**
volumetric flask	**Instructor initial:**
pipette	**Instructor initial:**
graduated cylinder	**Instructor initial:**
bottle-top dispenser	**Instructor initial:**

Datasheet:

Part C: Introduction to the Analytical Balance

Mass of clean vial: _____ g

Mass of warm vial:

_____ g (immediately from the oven)

_____ g (30 sec)

_____ g (60 sec)

_____ g (90 sec)

_____ g (120 sec)

_____ g (150 sec)

_____ g (180 sec)

_____ g (210 sec)

_____ g (240 sec)

_____ g (270 sec)

_____ g (300 sec)

Mass of the vial touched by your hands: _____ g

Postlab Questions:

Part A:

1. Look up the MSDS for nitric acid.
   (a) List 3 physical properties.
   (b) Which section of the MSDS can you find information on treatment when nitric acid is causing skin irritation?
   (c) What is the treatment for nitric acid causing skin irritation?
   (d) How should nitric acid be stored?
2. Cite the reference of your nitric acid MSDS source.

Part B:

1. What is the function/use for each of the following glassware?
   (a) graduated beaker
   (b) Erlenmeyer flask
   (c) graduated cylinder
   (d) volumetric flask
   (e) volumetric pipette
   (f) burette
   (g) bottle-top dispenser

Part C:

1. What can you conclude about weighing an object that is not at room temperature?
2. Compare the mass of the vial that is handled by tongs and the mass of the vial that is handled by your hands. What is the mass difference and state some reasons to account for the difference in mass?