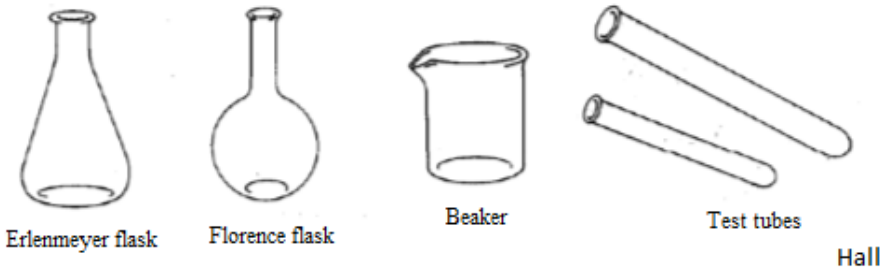
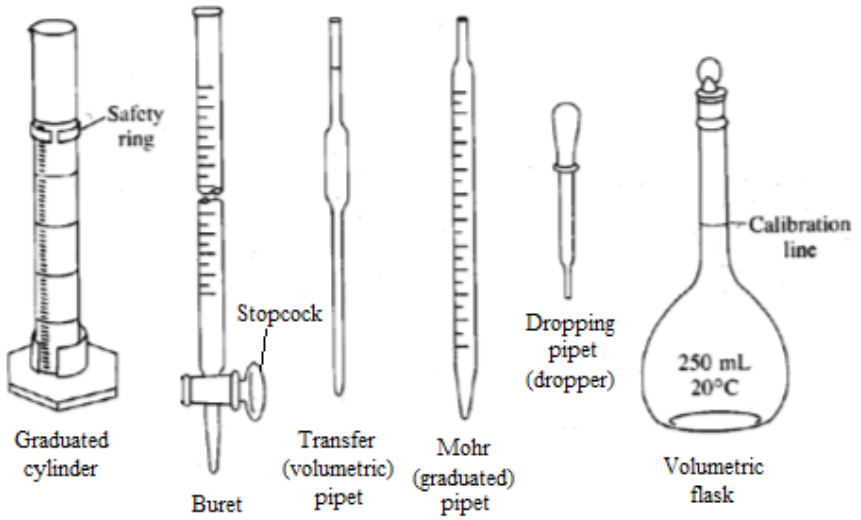
Subject Code	Chemistry 1	General Inorganic Chemistry 1
Module Code	1.0	Introduction and Review
Lesson Code	1.1	Definition of Chemistry and Scientific Method
Time Limit		30 minutes

Components	Tasks	TA[a]	ATA[b]
Target	By the end of this module, the students will have been able to: 1. Display aptitude in the use of common lab materials 2. Apply safety rules in conducting general lab procedures 3. Apply the concept of scientific method, experimentation and measurement in the laboratory	1 min	
Hook	*"No amount of experimentation can ever prove me right;* *A single experiment can prove me wrong."-Albert Einstein* Why do we conduct experiments? What are the things that we must know or consider before performing one? Do you think Einstein's statement is accurate? Why or why not?	3 min	
Ignite	Chemistry is the study of matter and the changes it undergoes. Much of what we will learn about matter is founded on centuries of arduous research and experiments that it is best to begin this course with an overview on the basics of experimentation. The scientific method is an essential part of scientific inquiry. As you may have already learned, this is the process which allows us to arrive at objective explanations about the natural world in a reproducible way: 1. Make an Observation / Ask a question 2. State or formulate a hypothesis 3. Conduct an experiment 4. Gather and analyze data 5. State a conclusion Throughout learning chemistry, we will follow the scientific method and conduct our own experiments in class. It is essential to first be familiar with various specialized glassware and materials you may find in the chemistry lab.  Glassware that are used to hold and mix substances are **flasks**, **beakers**, and **test tubes**. Flasks have narrow necks to prevent spills when mixing its contents by swirling. Beakers have a "beak" or spout to direct liquids when pouring. Test tubes are used to contain small amounts of chemicals. These can be stoppered at the opening, and these can also be used for heating in direct flame when held with a test tube holder. In general, these glassware are used to contain chemicals, and are not accurate in measuring volume.	10 min	

On the other hand, glassware with graduation marks can measure the volume of liquids more accurately. The **graduated cylinder** is a laboratory staple in measuring liquids. The **buret** can dispense an accurate volume of liquid by opening and closing the stopcock. **Pipets** are used to transfer small volumes of liquid from one container to another. A rubber aspirator (also called pipet bulb) is used to draw liquid into a pipet. There are glassware with only one mark, or *calibration line*, such as the **volumetric pipet** and the **volumetric flask**. These are designed to measure only one volume with very high accuracy.



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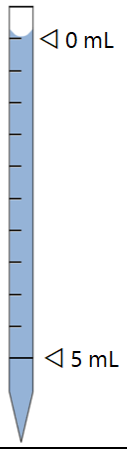
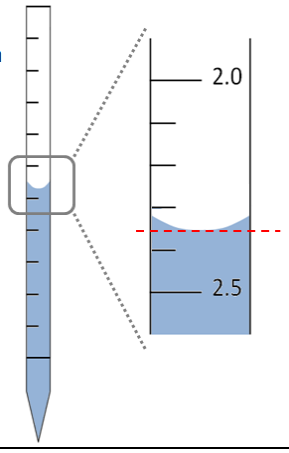
The direction of the volume marks on graduated glassware may vary. A graduated cylinder would have its zero mark at the bottom and the maximum volume mark at the top. Burets and pipets, on the other hand, have the zero mark at the top. Burets and pipets are filled with liquid up to the zero mark, so any volume of liquid dispensed or transferred can be measured.

Take for example a 5-mL pipet shown in the image below. In (a), the pipet is filled up to the zero mark. After liquid is dispensed in (b), the remaining liquid has its lower meniscus in between 2.3 and 2.4. The volume of the liquid dispensed can be read as 2.35 mL, where "5" in the hundredths place is an approximation.

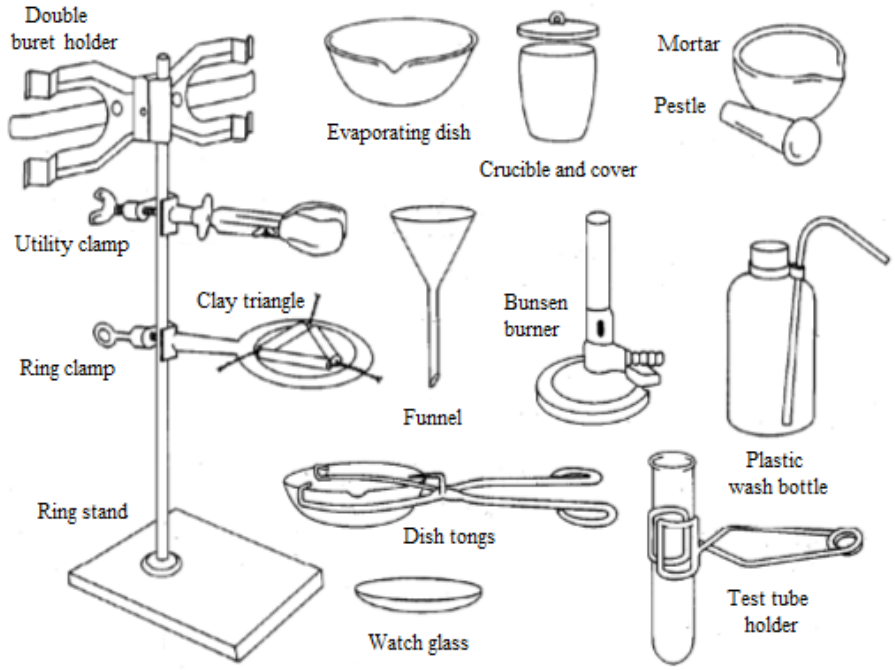
a.) A 5-mL pipet is filled up to the zero-mark.



b.) Liquid is dispensed from pipet. Volume of dispensed liquid is measured as 2.35 mL.



Other common laboratory apparatus shown below vary in use, from practical purposes such as holding samples and washing, to complex set-ups such as heating and distillation.



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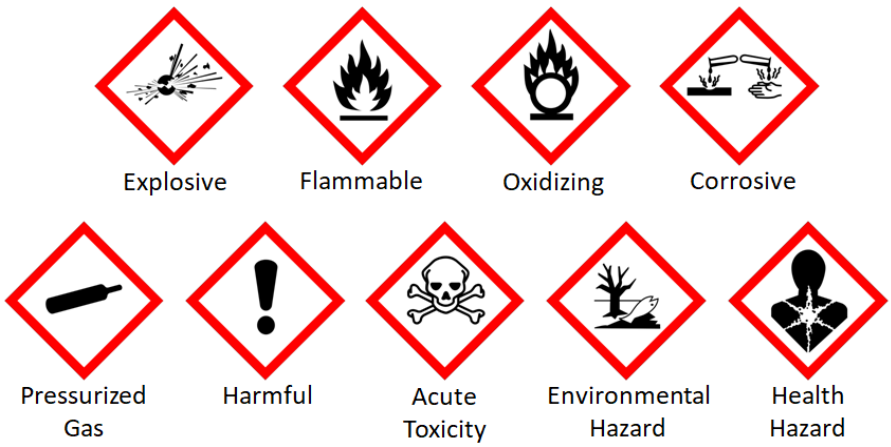
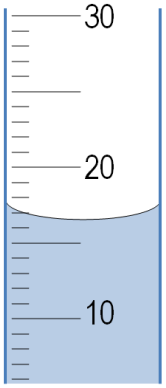
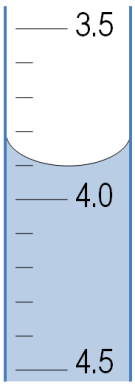
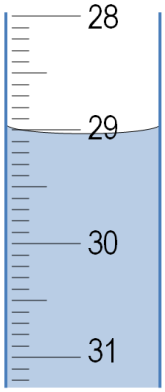
Dealing with chemicals and fire in experiments may pose serious risks and hazards. Although first-aid kits and other emergency equipment are found in the lab, it is essential for anyone working in the area to follow safety practices to prevent any accidents. Some **general safety rules** are as follows:

1. Before an experiment, consult the safety data sheet (SDS),[(1)] also known as materials safety data sheet (MSDS), of each chemical before handling. The SDS of a chemical provides information such as its physical and chemical properties, hazards, proper handling, and disposal.
2. Learn the pictograms[(2)] implemented by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).[(3)] These are found in safety data sheets and chemical containers.



	3. Personal protective equipment (PPE) such as safety goggles, laboratory coat, and closed shoes should be worn at all times in the laboratory. Secure long hair and loose clothing. Clothing that exposes torso and legs, contact lenses, jewellery, and make-up should not be worn in the lab. 4. Do not taste or ingest any chemical in the laboratory. Food and drinks are prohibited to avoid accidental contamination by chemicals. 5. Work only when your teacher is present, and only perform experiments as instructed. 6. Never leave experimental set-ups unattended unless you are permitted by your teacher. 7. When ask to smell the odor of a chemical, waft fumes toward the nose using your hand. Do not smell the chemical directly from the container. 8. Never add water to a concentrated reagent. Always add the concentrated reagent to water. 9. Keep personal and common areas clean. Wipe off spills or sweep debris that may possibly injure someone. 10. Immediately flushed with cold water any minor skin burns until the burning sensation lessened. 11. Immediately wash with plenty of water any chemicals that gets into the eyes for 10 to 15 minutes or until professional assistance arrives. 12. Report any toxic reagent spills, accidents, or injuries to your teacher. 13. Throw all chemical waste in appropriately labelled waste containers. 14. Always wash your hands with soap and water after handling chemicals		
Navigate	Let's test what you've learned! A. Answer questions 1-4 on your own. These will not be graded. 1. What is the volume reading (in mL) in each glassware? Provide answers with correct significant figures.  Graduated cylinder: _____ mL  Mohr pipet: _____ mL  Buret: _____ mL	15 min	

2. Which lab glassware or apparatus should you use to perform each task below? Choose the answer from the two choices provided.
    - Mix and contain 25 mL of ethanol and 10 mL of water:
        a. 100 mL Erlenmeyer flask
        b. 100 mL graduated cylinder
    - Crush solids into fine powder:
        a. Funnel
        b. Mortar and pestle
    - Transfer 8.5 mL of hydrochloric acid:
        a. 10-mL transfer pipet
        b. 10-mL graduated pipet
    - Heat using a blue flame:
        a. Bunsen burner
        b. Crucible

3. Which of the following statements do not follow lab safety rules?
    a. In case of chemical burn on skin, immediately place burn ointment on affected area.
    b. Food and drinks in sealed containers may be brought inside the laboratory.
    c. The correct way of smelling the odor of a chemical is by wafting.
    d. Safety goggles are optional if one is wearing eyeglasses.
    e. Spills in the work are must be immediately cleaned to avoid injury to self or someone else.

4. You are asked to compare the amount of vitamin C among four fruit juices: lemon, kalamansi, orange, and pineapple. It is observed that with enough vitamin C, it can change the color of iodine solution from dark brown to colorless. For the experimental set-up, you are provided with the following:

    1 Graduated cylinder (10 mL) 4 Droppers (no graduation)
    50 mL iodine solution 4 Erlenmeyer flasks

    Design an experiment by drawing a probable experimental set-up with labels and by writing a sample procedure. (Hint: use droppers for fruit juices.)

    ☺ Challenge: Can you think of other set-ups, such as positive and negative controls, that may be added to make your results more reliable?

B. Get a sheet of paper and answer the activity below. This activity will be graded using the rubric in the next page. Email your teacher a photo or scanned copy of your answers.

    In which liquid will sugar dissolve best:
    Water, cooking oil, or alcohol?

    Design an experiment to answer the question above. Provide the ff.:
    i. List of materials and reagents needed. (Note how many/much of each).
    ii. Drawing of experimental set-up with labels.
    iii. Procedure. (Use appropriate glassware and measuring apparatus. You may use stirring rods, mass balance, and weighing boat.)

Knot	In summary: • The scientific method allows us to either validate or reject a hypothesis through experimentation. • A variety of laboratory glassware and equipment have practical purposes in handling different chemicals and carrying out the steps in an experiment. • Laboratory safety rules are practiced at all times to minimize risk and hazards when handling chemicals or fire in the work area.	1 min	

[a] suggested time allocation set by the teacher
[b] actual time spent by the student (for information purposes only)

Rubric for the activity

	Excellent (5 pts)	Very good (3 pts)	Good (2 pts)	Incomplete (1 pt)
Material list (5 pts)	List of materials is complete including the measurements in metric system.	List of materials is complete but few or no given quantities.	List of materials is not complete and quantities are missing.	This part of the report is missing or doesn't provide enough learning evidence.
Procedure (10 pts)	Procedure is written in logical sequence. The sentences are complete and the directions are clear.	Procedure is written in logical sequence but missing steps. Some incomplete sentences.	Procedure needs more steps and the sentences are incomplete to understand.	This part of the report is missing or doesn't provide enough learning evidence
Set-up (5 pts)	The set-up is well labeled and appropriate to the laboratory design.	The set up is well labeled but not appropriate to the laboratory design presented.	The set up is labeled but missing some parts to appropriately use in the laboratory design.	Set up was presented but labeling is incomplete but appropriate to the lab design.

Endnotes:
(1) Safety Data Sheets
(2) GHS hazard symbols and their definitions
(3) About GHS

References:
American Chemical Society (n.d.). Safety Data Sheets. Retrieved from https://www.acs.org/content/acs/en/chemical-safety/basics/safety-data-sheets.html
American Chemical Society (n.d.). GHS Hazard Symbols and Their Definitions. Retrieved from https://www.acs.org/content/acs/en/chemical-safety/basics/ghs.html#pictograms
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Image references:
Hall, J. F. (2014). Experimental Chemistry Lab Manual (9th ed.). Brooks/Cole, Cengage Learning. pp.x-xi. Retrieved from: https://books.google.com.ph/books?id=5qgZBQAAQBAJ
United Nations Economic Commission for Europe (n.d.). GHS Pictograms. Retrieved from www.unece.org/trans/danger/publi/ghs/pictograms.html

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