Practical Work N° 1. Laboratory Safety Rules and Equipments

1. Introduction

Laboratory safety is a fundamental priority in any scientific environment to prevent accidents, protect individuals, and ensure the reliability of experimental results. Chemistry laboratories, in particular, can be hazardous if safety rules are not strictly followed, as they involve the handling of flammable, explosive, toxic, and carcinogenic substances, along with equipment that may cause severe burns or cuts if used improperly. Many laboratory accidents result from carelessness, impatience, unauthorized experimentation, or disregard for safety protocols. Therefore, it is essential for students and researchers to adhere to established safety guidelines at all times.

2. Objective

This practical work aims to familiarize students with essential safety rules, protective equipment, and emergency procedures necessary for laboratory work. By understanding and applying these regulations, students will develop responsible lab practices that minimize risks and promote a safe working environment.

3. Laboratory safety rules

3.1. Laboratory attire and behavior

- Use of lab coats, gloves, and safety goggles.
- Hair must be tied back.
- Do not eat, drink, or store food in the laboratory to prevent contamination and accidental ingestion of chemicals.
- Laboratory experiments must always be conducted under the supervision.
- Never attempt to identify chemical compound by touch, smell or taste.

3.2. Handling chemical substances

- Carefully read labels and safety data sheets (SDS).
- Explanation of hazard pictograms.
- Safe handling techniques for hazardous substances.
- Never pipette a chemical solution by mouth use a pipette rubber bulb.
- All experiments generating gases or vapors must be carried out under an extraction hood.

- Always add acid to water, never the reverse, to avoid any undesirable reaction and dangerous accidents.
- Never return unused chemicals to their original container to prevent contamination.
- After the experiment, it's important to clean all the equipment used, return them to their designated places in the laboratory, and make sure to wash your hands.
- Before leaving the laboratory, make sure to turn off the electricity and gas, and close the water supply to ensure safety and maintain order in the laboratory.

3.3. Emergency procedures

In case of an accident in the laboratory, it is essential to remain calm and act cautiously.

- **Exposure to a chemical substance**: Rinse immediately and thoroughly with plenty of water for at least 15 minutes.
- **Cut**: Clean the wound carefully and apply a sterile dressing.
- **Gas leak**: Ventilate the room immediately and shut off the gas supply if possible.
- **Fire**: Stay calm and follow the laboratory evacuation procedures.

4. Chemical storage conditions

Proper storage of chemicals is essential to ensure safety, prevent contamination, and reduce the risk of accidents. The following guidelines must be followed :

- All chemicals must be clearly labeled with their name, concentration, hazard symbols, and expiration date.
- Store chemicals according to their hazard classification (flammable, corrosive, toxic, reactive, etc.).
- Separate acids and bases to prevent dangerous reactions.
- Flammable liquids must be stored in fire-resistant cabinets.
- Oxidizing agents should be kept away from organic materials and reducing agents.
- Store chemicals in well-ventilated areas, away from direct sunlight and heat sources.
- Maintain appropriate temperature and humidity levels.
- Avoid storing volatile substances in non-ventilated spaces.
- Use chemical-resistant shelves and spill containment trays to prevent leaks or spills.
- Keep fire extinguishers and first-aid equipment near storage areas.

5. Hazard symbols and their meanings

Hazard pictograms on chemical product labels are standardized symbols designed to inform users of the potential risks associated with a substance. These pictograms help quickly identify dangers such as flammability, toxicity, corrosivity, and harmful effects on

health and the environment. Their presence on a label assists in taking the necessary precautions during the handling, storage, and disposal of chemical products.

 **Explosive** When handling these substances, avoid friction, impacts, electrical sparks, and heat sources (butane gas- propane gas).	 **Corrosive** Avoid exposure to its fumes and prevent direct contact with skin or clothing. Most acids, such as hydrochloric acid and phosphoric acid, are corrosive.	 **Toxic** A highly toxic and deadly substance. Avoid skin contact, inhaling its fumes, tasting it, or using mouth pipetting.In case of accidental ingestion, seek medical attention immediately.
 **Environmental hazard** These substances pose a threat to living organisms and the environment. Store them properly, use them responsibly, and do not dispose of them in nature.	 **Oxidizing** These substances can fuel combustion and intensify fires, making them harder to extinguish. Store them away from flammable materials, heat sources, and open flames.	 **Flammable** Materials that can ignite quickly when exposed to a heat source or an open flame. Their combustion can occur at relatively low temperatures. Therefore, it is essential to keep them away from flames, direct sunlight, and any heat source.
 **Biological hazard** These substances can endanger the health of living organisms, particularly humans, and may also be harmful to animals. They include medical waste, microbiological samples, viruses, and toxins of biological origin.	 **Carcinogen** These hazardous substances have the potential to cause cancer in humans. They must be handled with great caution, avoiding direct skin contact or inhalation of their vapors.	 **Radiation hazard** These materials emit radioactive radiation and pose potential health risks. Safety measures include wearing protective equipment such as respirators with filters, protective footwear, gloves, and specialized clothing.

6. List of equipments and tools used in chemical laboratory


Boiling flasks


Beaker


Erlenmeyer flask
Cronical flask


Volumetric flask


Graduated Cylinder


Ajustable Volumetric Pipette


Volumetric pipet


Graduated pipet


Burette


stand and clamp


Watch Glass


Funnel


Separatory funnel


Thermometer


Spatula


Tongs

Filter paper


Reagent bottles


Wash bottles


Rubber bulb


Test tubes


Test tube stand

Crystallising dish


Petri dishes


Weighing machine


pH Meter


Conductometer


Calorimeter

Hotplate magnetic stirrer


Magnetic stirrer

7. Correct reading when using a graduated cylinder, burette, or pipette

When using a graduated cylinder, burette, or pipette, it is essential to ensure an accurate reading of the liquid level. For water and most aqueous solutions, a concave meniscus forms inside the measuring instrument. The correct reading is obtained by positioning the meniscus at eye level and recording the volume at the lowest point of the curve, as illustrated in Figure 1.

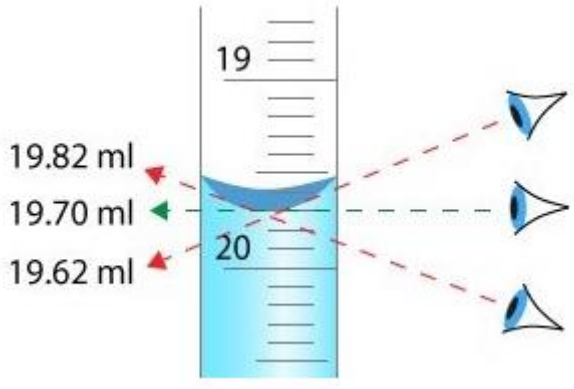

Figure 1. Proper reading of the meniscus

8. Laboratory report

To achieve the desired goals of the practical works, students are provided with several detailed of the experimental protocols utilized in the practical work. A lab report is required from students to assess their level of understanding and analysis, its goal is not to simply copy what is written in the lab manual, but to present high-quality results a strong analysis and interpretation of the findings. In general, a lab report is typically composed of the following parts.

1- **Cover page:** It include the title of experiment and the name(s) of the authors.

2–**Introduction:** Providing a concise explanation of the principle and objective of the experiment.

3-**Objetif of the practical work:** The student to clearly define the purpose or objective of the experiment in concise terms, typically within one or two sentences.

4-**Presentation:** It is beneficial to include some definitions and theoretical frameworks relevant to the experimental work, supported by appropriate references for clarity and credibility.

5-**Materials and equipments:** Compile a comprehensive a list of all the chemicals and equipments required for the experiment.

6-**Methodology:** Povides a detailed and organized explanation of the procedures, ensuring clarity and enabling replication of the experiment by anyone.

7–**Results:** To include the procedures used in the lab manual. Also to present obtained results (tables, graphs).

8-**Discussion:** Discuss the obtained results using a theoretical approach.

9–**Conclusion:** Summarize the results with emphasizing the key findings.