CHEMICAL

Guidelines for Chemical

1- LABORATORY SAFETY IN COLLEGE OF DENTISTRY

1.1 Introduction

The first principle of laboratory safety is to recognize the hazards of chemicals, equipment, and procedures. This section provides basic information on how to identify hazards.

When you are working in a chemistry laboratory, there is a certain level of risk associated with each chemical you will be using. Assessing the risks of hazards means thinking about how you might be exposed to the hazard and what would be the probable results of that exposure, should it occur; so risk assessment involves determining (estimating) the probability of some adverse event occurring.

This means that you will need to be thinking about the upcoming work with this chemical in terms of how you might be exposed during preparations before the experiment, use during the experiment, and after the experiment.

1.2 General Safety Rules

It is imperative to create a culture of safety in the science classroom from the first meeting of the class. Therefore, In an effort to ensure that students not only have read the safety guidelines but also understand them, that each student demonstrate knowledge in an assessment, such as a quiz.

1.3 Hazard versus Risk

The terms “hazard” and “risk” are frequently used interchangeably, but there is a distinct difference. A hazard is any source of potential damage or harm to an individual’s health or life under certain conditions, whether at work or in the home.

Examples of Hazards and Their Effects

Sq.	Type of Hazard	Example	Potential Harm
1	material	Broken glass	Cut
2	Substance	Sodium hydroxide	Blistering of skin
3	Source of energy	Bunsen burner	Burn
4	Condition	Wet floor	Slipping and falling

1.4 Globally Harmonized System for Classifying Hazardous Chemicals

The Globally Harmonized System (GHS) is an internationally adopted system for the classification and labeling of hazardous chemicals. It includes established criteria for classifying hazards and for further categorizing (or rating) the hazards according to their relative risks. The GHS provides established language and symbols for each hazard class and each category within a class.

This language includes a signal word (such as “danger” or “warning”), a symbol or pictogram (such as a flame within a red-bordered diamond), a hazard statement (such as “causes serious eye damage”), and precautionary statements for safely using the chemical.

An important part of this hazard classification system is the set of criteria that describe a given class of hazard (e.g., flammable liquids) and the ratings (categories) of the hazards within each hazard class. The hazard categories are numbered from 1 to perhaps as high as 5.

The important thing to know is that the LOWER the number, the GREATER the severity of the hazard; thus, Category 1 hazards are the most dangerous.

Sq.	GHS Symbol	GHS Class
1		❖ Explosive • Explosives • Self-reactive substances • Organic peroxides
2		❖ Flammable • Flammable gases, aerosols, liquids, and solids. • Pyrophoric liquids or solids. • Self-heating substances. • Self-reactive substances. • Substances that emit a flammable gas upon contact with water. • Organic peroxides
3		❖ Corrosive • Skin corrosion/burns. • Eye damage. • Corrosive to metals
4		❖ Oxidizer • Oxidizing gases, liquids, and solids
5		❖ Compressed gas • Gases under pressure

Sq.	GHS Symbol	GHS Class
6		❖ Toxic Substance • Acutely toxic substances that may be fatal or toxic if inhaled, ingested, or absorbed through the skin
7		❖ Irritant • Irritant (skin and eye). • Skin sensitizer. • Acute toxins. • Narcotic effects. • Respiratory tract irritants. • Hazardous to ozone layer (non-mandatory)
8		❖ Health Hazard • Respiratory sensitizers. • Carcinogens. • Mutagens. • Reproductive toxins. • Target organ toxins, single exposure or repeated exposure. • Aspiration toxins
9		❖ Environmental Hazard (non-mandatory) • Acute aquatic toxins. • Chronic aquatic toxins

1.5 Chemical Product Labels

Always read the label on a chemical bottle to obtain and review basic safety information concerning the properties of a chemical. It is the responsibility of Chemist to be fully aware of the hazards and risks of all chemicals they are using.

1.6 Routes of Exposure

A. Inhalation

Chemicals in the form of gases, vapors, mists, fumes, and dusts can enter through the nose or mouth and be absorbed through the mucous membranes of the nose, trachea, bronchi, and lungs.

B. Ingestion

Chemicals can enter the body through the mouth and be swallowed. They may be absorbed into the bloodstream anywhere along the length of the gastrointestinal tract.

C. skin

Although the skin is a good barrier to many substances, some chemicals can be absorbed through the skin, enter the bloodstream, and be carried throughout the body.

D. Injection

While uncommon in most workplaces, exposure to a chemical can occur when a sharp object (e.g., a needle or broken glass) punctures the skin and injects a chemical directly into the bloodstream.

E. Fetotoxicant

A substance that enters the maternal and placental circulation and causes injury or death to the fetus.

F. Flammable

A substance that easily catches fire. As defined by the GHS, a flammable substance is one that has a flash point at or above 73 °F (23 °C) and below 140 °F (60 °C).

G. Toxic:

Any substance that has the capacity to produce personal injury or illness to humans through ingestion, inhalation, or absorption through anybody surface.

H. Acute toxicity

The adverse effects of a substance resulting from a single exposure or multiple exposures over a very short time span (less than 24 hours). Acute toxicity is usually determined by exposing animals to a given chemical to determine the lethal dose, 50% (LD50). This is an experimental measure determined by administering varied doses of a chemical by some route to animals, observing the percentage lethality at these doses, and extrapolating to estimate the dose that would kill 50% of the animals.

Examples of Acute Toxicants

Sq.	Type of Acute Toxicant	Examples
1	Asphyxiant: A gas or vapor that can cause unconsciousness or death by suffocation due to lack of oxygen.	Carbon monoxide, methane, hydrogen sulfide
2	Irritant: A noncorrosive chemical that causes reversible inflammation at the point of contact with the skin.	Acetone, heptane, ethyl acetate, sodium carbonate
3	Neurotoxicant: A chemical that interferes with the peripheral and central nervous systems.	Mercury, lead, acetone, carbon disulfide
4	Organ toxicant: A chemical that adversely affects one or more organs or body systems.	Toluene, carbon tetrachloride, arsenic, chlorine
5	Sensitizer/allergen: A chemical that produces its effects by evoking an adverse response in the body's immune system.	Formaldehyde, latex
6	Teratogen or fetotoxicant: A chemical that adversely affects the embryo or fetus.	Ethanol, ethylene oxide, mercury compounds

1.7 Incompatible Chemicals

Many chemicals are incompatible with each other. According to Laboratory Safety for Chemistry, "Incompatible chemicals are combinations of substances, usually in concentrated form, that react with each other to produce very exothermic reactions that can be violent and explosive and/or can release toxic substances, usually as gases." Care should be taken when handling, storing, or disposing of chemicals in combination.

Below is a short list of common laboratory chemicals and the substances with which they are incompatible.

Sq.	Chemical	Incompatible with
1	Acetic acid	Nitric acid, peroxides, permanganates
2	Acetic anhydride	Ethylene glycol, hydroxyl-group-containing compounds
3	Acetone	Hydrogen peroxide
4	Ammonium nitrate	Acids, flammable liquids, powdered metals, finely divided organic or combustible materials
5	Chlorate salts, such as sodium or potassium chlorate	Acids, ammonium salts, metal powders, finely divided organic or combustible materials
6	Chlorine	Ammonia, butane, hydrogen, turpentine, finely divided metals
7	Copper	Hydrogen peroxide
8	Hydrocarbons	Bromine, chlorine, peroxides
9	Hydrogen peroxide	Combustible materials, copper, iron, most metals and their salts, any flammable liquid
10	Iodine	Ammonia
11	Nitric acid, concentrated *Note: There have been many explosions from inappropriate or inadvertent mixing of nitric acid with organic chemicals in waste containers.*	Acetic acid, acetone, alcohol, flammable substances, such as organic chemicals
12	Oxalic acid	Silver, mercury
13	Oxygen	Flammable materials, hydrogen, oils
14	Phosphorus, white	Air, oxygen
15	Potassium permanganate	Ethylene glycol, glycerol, sulfuric acid

16	Sodium (Alkali metals: lithium, sodium, and potassium)	Carbon dioxide, water, alcohols
17	Sodium nitrite	Ammonium salts
18	Sulfuric acid	Chlorates, perchlorates, permanganates

1.8 Common Laboratory Hazards

Sq.	Hazards	Cautions	Examples
1	Acids and bases	Due to their corrosive nature, they can irritate or even burn the eyes, irritate the skin, and cause respiratory distress. The risk is higher when they are concentrated, but even when diluted they can be hazardous. Protective equipment, including chemical goggles, aprons, and gloves, is essential.	Acids: hydrochloric acid, nitric acid, sulfuric acid, acetic acid, phosphoric acid Bases: sodium hydroxide, potassium hydroxide, ammonia
2	Biological agents	These are chemicals or organisms that increase the rate at which natural biodegradation occurs. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions, even death.	Bacteria, fungi

1.9 Before an Experiment

1. Know what you are working with. You should always identify the substance you are working with and think about how you can minimize exposure to this in the experiment.

2. Find and evaluate hazard information.

1.10 During an Experiment

1. Use the lowest concentrations and smallest volumes possible for all chemicals. Do not handle solids that are classified as fatal or toxic if swallowed.

2. Wear appropriate eye protection that offers both impact and splash protection. This is not only for your safety but also as a precaution in the event that an accident is caused by someone else in the laboratory.

3. Wear appropriate protective clothing (laboratory coat, Lab glasses, Lab Mask and Lab gloves).

4. After transferring a chemical (solid or liquid) from a reagent bottle into a secondary container, be certain that the reagent bottle and the container are properly closed.

1.11 After an Experiment

1. Ensure that all chemicals are properly stored. Make sure that the caps on the reagent bottles are tightly secured.

2. Ensure that benches are clean before the next class comes in. One of the major causes of accidents is carelessness on the part of someone else.

1.12 GENERAL GUIDELINES

1. Students should behave in a mature and responsible manner at all times in the laboratory or wherever chemicals are stored or handled. All inappropriate behavior is especially prohibited.

2. Students must follow all verbal and written instructions carefully. If you are unsure of the procedure, ask your teacher for help before proceeding.

3. Students should not touch any equipment or chemicals unless specifically instructed to do so.

4. Students must not eat, drink, apply cosmetics, or chew gum in the laboratory. Wash hands thoroughly after participating in any laboratory activities.

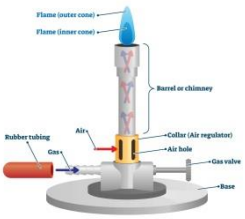
5. Students must perform only those experiments authorized by the teacher.

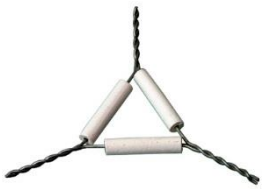
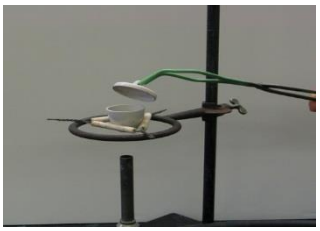
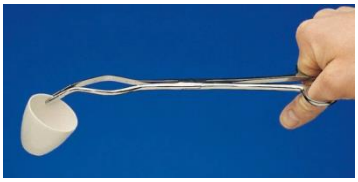
6. Students will receive training related to the locations and operating procedures for all applicable laboratory safety equipment and personal protective equipment (PPE).

2- BASIC LABORATORY GLASSWARE AND EQUIPMENT

Below is a table of common laboratory equipment and the appropriate use. Knowing the proper use will help ensure safe laboratory practices.

2.1 Basic Glassware and Equipment

Sq.	Equipment Type	Description of Use	Representative Image
1	Balance	Used for measuring mass.	
2	Beaker	Used to hold, mix, and heat liquids	
3	Beaker tongs	Used to pick up beakers	  
4	Bunsen burner	Frequently used as a heat source in the absence of flammable materials	

5	Buret	Used for dispensing an accurate volume of a liquid	
6	Clay triangle	Used to support a crucible during heating	 
7	Crucible	Used for holding chemicals during heating to very high temperatures	
8	Crucible tongs	Used to hold crucibles	 

9	Conical flask	Used to hold and mix chemicals. The small neck is to facilitate mixing without spilling	
10	Evaporating dish	Used to heat liquids for evaporation	
11	Forceps	Used to pick up or hold small objects	
12	Funnel	Used to transfer liquids or finegrained materials into containers with small openings. Also used for filtration	
13	Graduated cylinder	Used to measure a precise volume of a liquid	
14	Mortar and pestle	Used to crush and grind materials	

15	Pipet bulb	Used to draw liquids into a pipet	
16	Ring clamp	Used with a ring stand to hold glassware, such as a beaker or a funnel	
17	Ring stand	Used to hold or clamp laboratory glassware and other equipment in place, so it does not fall down or come apart	
18	Stirring rod	Used for stirring and mixing	
19	Test tube	Used to hold and mix liquids	 
20	Test tube clamp	Used to hold a test tube, particularly when hot	 

21	Test tube rack	Used to hold several test tubes at one time	
22	Thermometer	Used to measure temperature in Celsius	
23	Utility clamp	Used to secure glassware to a ring stand	
24	Volumetric flask	Used to prepare solutions to an accurate volume	
25	Volumetric pipet	Used to measure small amounts of liquid very accurately. Never pipet by mouth! Use pipetting aids	
26	Wash bottle	Used to rinse pieces of glassware and to add small quantities of water	
27	Watch glass	Used to hold solids while they are being weighed or to cover a beaker	

28	Filter paper	Used to for funnel to the purpose of separating liquid substances and separating insoluble substances in liquids.	

2.2 How materials and glassware are used in the chemistry lab

1- Balance

A chemical balance varies depending on the purpose for which it is used, in its quality and sensitivity. Knowing how to use the balance must be kept clean, and do not weigh hot or cold materials in it.

There are two methods of weighing:

Direct weight: by yellowing the balance and placing the weighing vessel on it, then adding the material to be weighed. And the difference between the weight is equal to the weight of the material.

Weight in difference: the vessel is weighed with the material inside, then the material is emptied from it in the baker and its weight is measured. The difference in weight expresses the weight of the material.