University of Ai-Qadisiyah
College of Medicine
Department of Medical Chemistry

First Stage

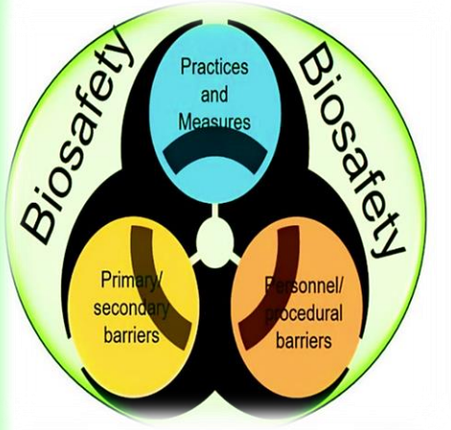
Lecture No.

1

Practical Medical Chemistry

1st year / (2022-2023) / 2nd Semester

Introduction of Biosafety and Biosecurity



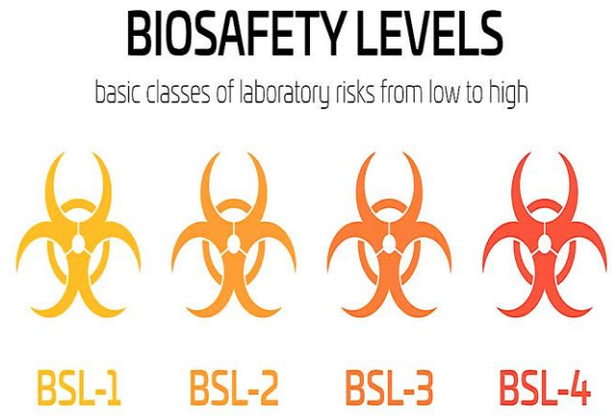
Introduction of Biosafety and Biosecurity

Laboratory Biosafety: containment principles, technologies, and practices implemented to prevent unintentional exposure to pathogens and toxins, or their unintentional release.

Laboratory Biosecurity: protection, control, and accountability for valuable biological materials within laboratories, in order to prevent their unauthorized access, loss, theft, misuse, diversion, or intentional release.

Biosafety: Reduce or eliminate accidental exposure of individuals and the environment to potentially hazardous and biological agents.

Biosecurity: The protection of pathogens, toxins, and sensitive information from loss, theft and subsequent misuse.



Introduction of Biosafety and Biosecurity

Biological Terrorism: Use of biologic agents or toxins (e.g., pathogenic organisms that affect humans, animals, or plants) for terrorist purposes.

Biohazard: A biological agent or a condition that constitutes a threat to humans, especially in biological work, research, or experimentation. The potential danger, risk, or harm from exposure to such an agent or condition. e.g.:

- Viruses, bacteria, fungi, and parasites and their toxins.

. Blood and body fluids, as well as tissues from humans and animals.

- Transformed cell lines and certain types of nucleic acids.
- A potential hazard to humans, animals or the environment caused by a biological organism, or by material produced by such an organism.

Introduction of Biosafety and Biosecurity

Risk Assessment: An analysis of the probability and the consequences of loss, theft and potential misuse of pathogens and toxins.

Decontamination: Free of contamination, the destruction of microorganisms to a lower level such that it removes danger of infection to individuals.

Sterilization: The complete destruction of all viable microorganisms.

Disinfection: Use of agents (physical or chemical) to destroy harmful organisms on inanimate objects (not necessarily all organisms).

Biomedical Waste: Discarded biological material from teaching, clinical and research laboratories, and operations. Biomedical waste includes but is not limited to animal waste, biological laboratory waste, human anatomical waste, human blood and body fluid waste and sharps.

General Laboratory Design Features

1. Ample space must be provided for the safe conduct of laboratory work and for cleaning and maintenance.

2. Walls, ceilings, and floors should be smooth, easy to clean, impermeable to liquids and resistant to the chemicals and disinfectants are used in the laboratory. Floors should be slip-resistant.

3. Bench tops should be impervious to water and resistant to disinfectants, acids, alkalis, organic solvents, and moderate heat.

4. Illumination should be adequate for all activities. Undesirable reflections and glare should be avoided.

5. Laboratory furniture should be sturdy. Open spaces between and under benches, cabinets and equipment should be accessible for cleaning.

6. Storage space must be adequate for immediate use and thus prevent clutter on benchtops. Additional long-term storage space, conveniently located outside the laboratory working areas, should be provided.

General Laboratory Design Features

7. Space should be provided for the safe handling and storage of solvents,

8. Facilities for eating and drinking and for rest should be provided outside the laboratory working areas.

9. Hand-washing basins, with running water, should be provided, preferably near the exit door.

10 . Doors should have vision panels, appropriate fire ratings, and preferably be self closing.

11. Autoclave of decontamination should be available in the laboratory.

12. Safety systems should cover fire, electrical emergencies, emergency showers and eyewash facilities.

13. First-aid areas or rooms suitably equipped and readily accessible

14. Consideration should be given to the provision of mechanical ventilation systems that provide an inward flow of air without recirculation. If there is no mechanical ventilation, windows should be able to be opened.

General Laboratory Design Features

15. A dependable supply of good quality water is essential.

16. There should be a reliable and adequate electricity supply and emergency lighting to permit safe exit. A stand-by generator is desirable for the support of essential equipment, such as incubators, biological safety cabinets, freezers, etc.

17. There should be a reliable and adequate supply of gas. Good maintenance of apparatuses.

18. Laboratories and animal houses are occasionally the targets of vandals. Physical and fire security must be considered. Strong doors, screened windows and restricted issue of keys are compulsory.

19. Finally, a culture of biosafety and biosecurity should be built within the Institution.

General Laboratory Design Features

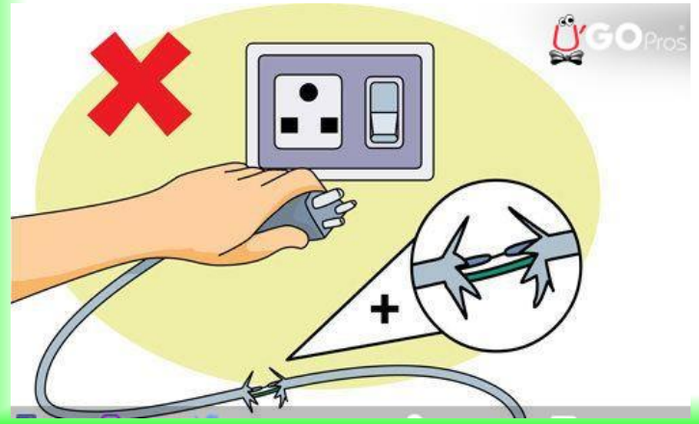
General Laboratory Safety Guidelines

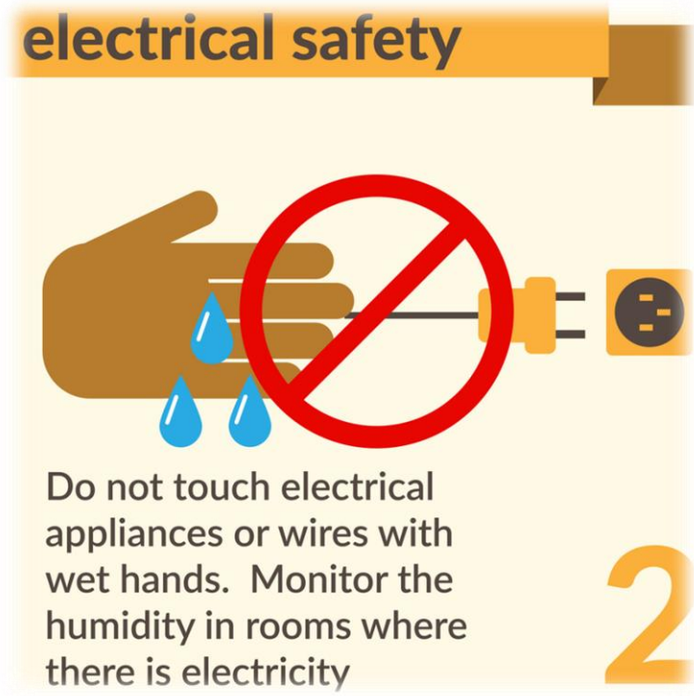
People who work in scientific laboratories are exposed to various hazards. Most workplaces have hazards that are well recognized. Laboratories, involve a greater variety of possible hazards as follow:

1. Electrical safety:

The severity and effects of an electrical shock depend on a number of factors, such as the:

a. Pathway through the body
b. The amount of current
c. The length of time of the exposure
d. Whether the skin is wet or dry.

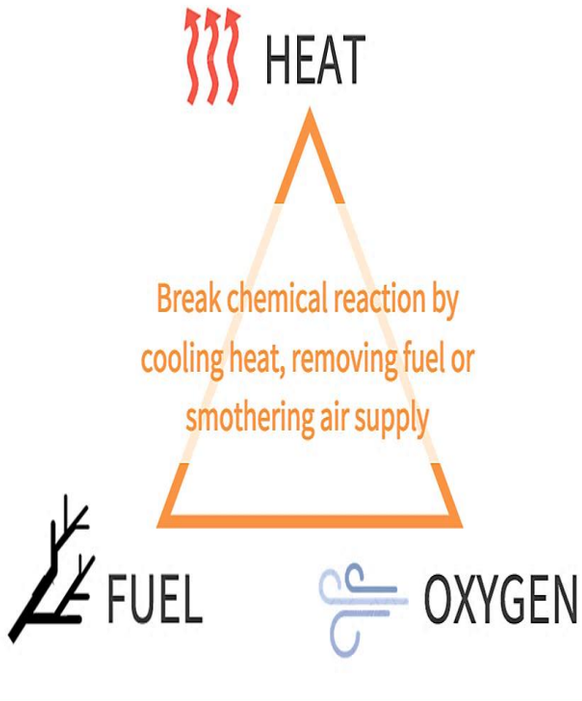


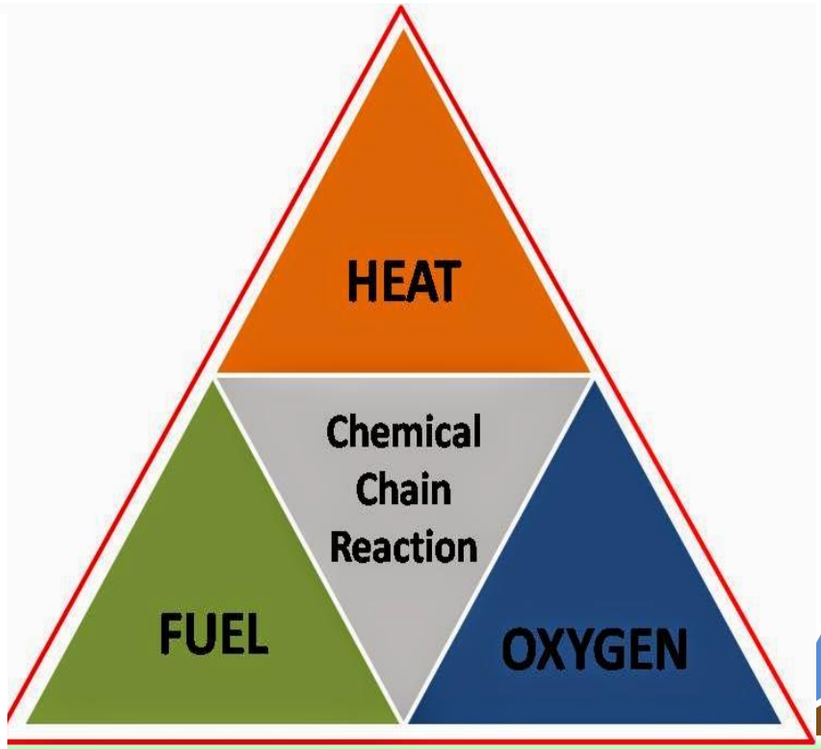


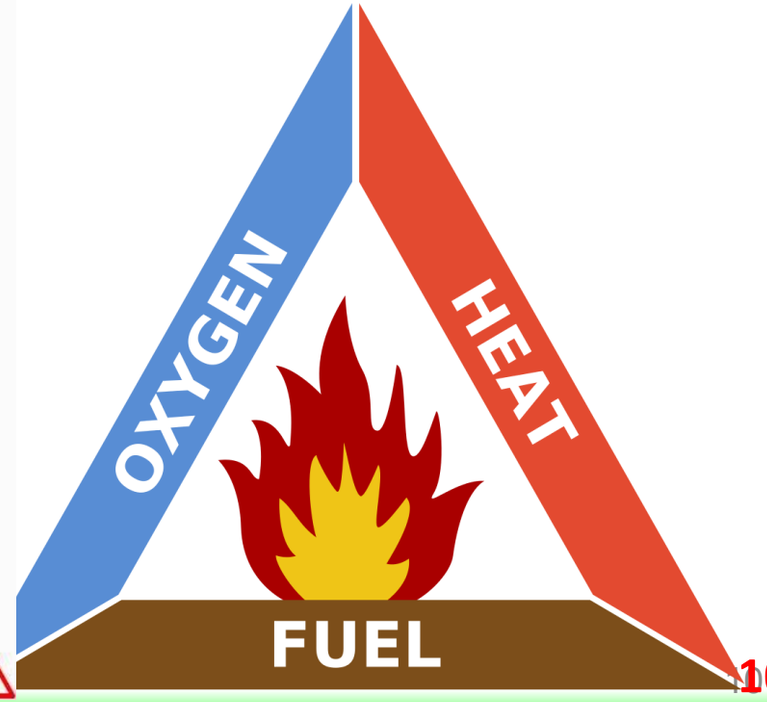
General Laboratory Safety Guidelines

2. Fire Safety:

The fire triangles or combustion triangles are simple models for understanding the necessary ingredients for most fires. The triangle illustrates the three elements a fire needs to ignite: heat, fuel, and an oxidizing agent (usually oxygen). A fire naturally occurs when the elements are present and combined in the right mixture. A fire can be prevented or extinguished by removing any one of the elements in the fire triangle.





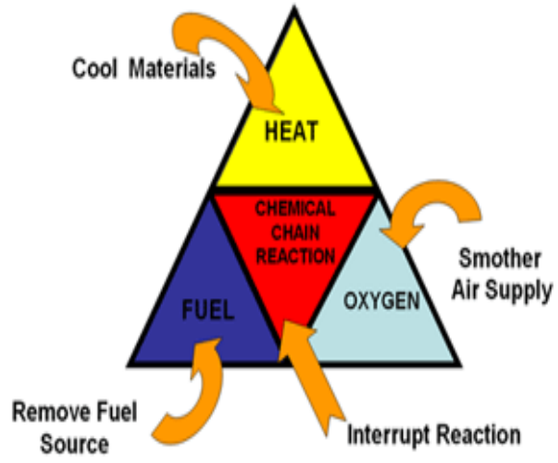


General Laboratory Safety Guidelines

2. Fire classes:

There are different types of fire. Before extinguishing a fire, determine what exactly is burning. All combustible substances are divided into groups (classes). These fire classes range from A (solids) to F (oils and fats). see figure below.

Fire Extinguishers: Not all fires are the same. Different fuels create different fires and require different types of fire extinguishing agents. if the right firefighting equipment is used.
Fire extinguishers put out fire by taking away one or more elements of the fire triangle.



Fire class	Fuel source
A	Ordinary combustibles
B	Flammable liquids
C	Flammable gases
D	Combustible metals
E	Electrical equipment
F	Cooking oils and fats

General Laboratory Safety Guidelines

1. Extinguishers categories

Different types of fire extinguishers are designed to fight different classes of fire. It is important to know what types of fire you can attempt to extinguish with them. Below is an overview of each type of fire extinguisher including what fire classes they tackle.

(AFFF – Aqueous Film Forming Foam

ABC Powder extinguisher	Wet Chemical fire extinguishers	Water Mist fire extinguishers
		
It is so named due to the fact it can be used on **Class A, Class B** and **Class C** fires, as well as **electrical**.	They are the most effective against Class F fires (cooking oils and fats) e.g fats, grease and oil.	They tackle Class A, Class B and Class C fires, rated risks as well as Class F and Electrical fires.

Water fire extinguishers	AFFF Foam fire extinguishers	Carbon Dioxide (CO_2) fire extinguishers
		
They are suitable for fighting **Class A** fires (combustible solid materials) .	They are highly effective on **Class B** fires (flammable liquids) such as petrol.	It was originally designed for use of flammable liquids therefore is highly suited for **Class B** fires.

How to Use a Fire Extinguisher

It is easy to remember how to use a fire extinguisher if you can remember the acronym **PASS**, which stands for Pull, Aim, Squeeze, and Sweep.

i. **Pull the pin:** This will allow you to discharge the extinguisher.

ii. **Aim at the base of the fire:** If you aim at the flames, you must be hit the fuel at the base of the fire.

iii. **Squeeze the top handle or lever-** This depresses a button that releases the pressurized extinguishing agent in the extinguisher.

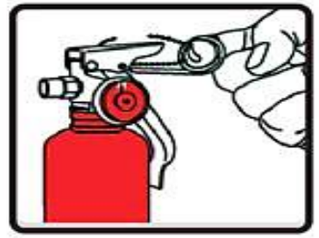
iv. **Sweep from side to side-** Until the fire is completely out. Start using the fire extinguisher from a safe distance, then move forward. Once the fire is out, keep an eye on the area in case it reignites.

How to Use a Fire Extinguisher

Remember the P A S S Word

Pull

Pull the pin (or other motion) to unlock the extinguisher.

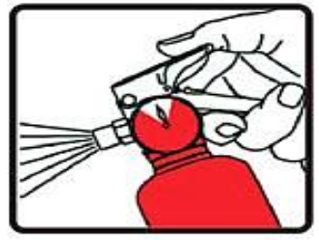


Aim

Aim at the base (bottom) of the fire and stand 6 - 10 feet away.

Squeeze

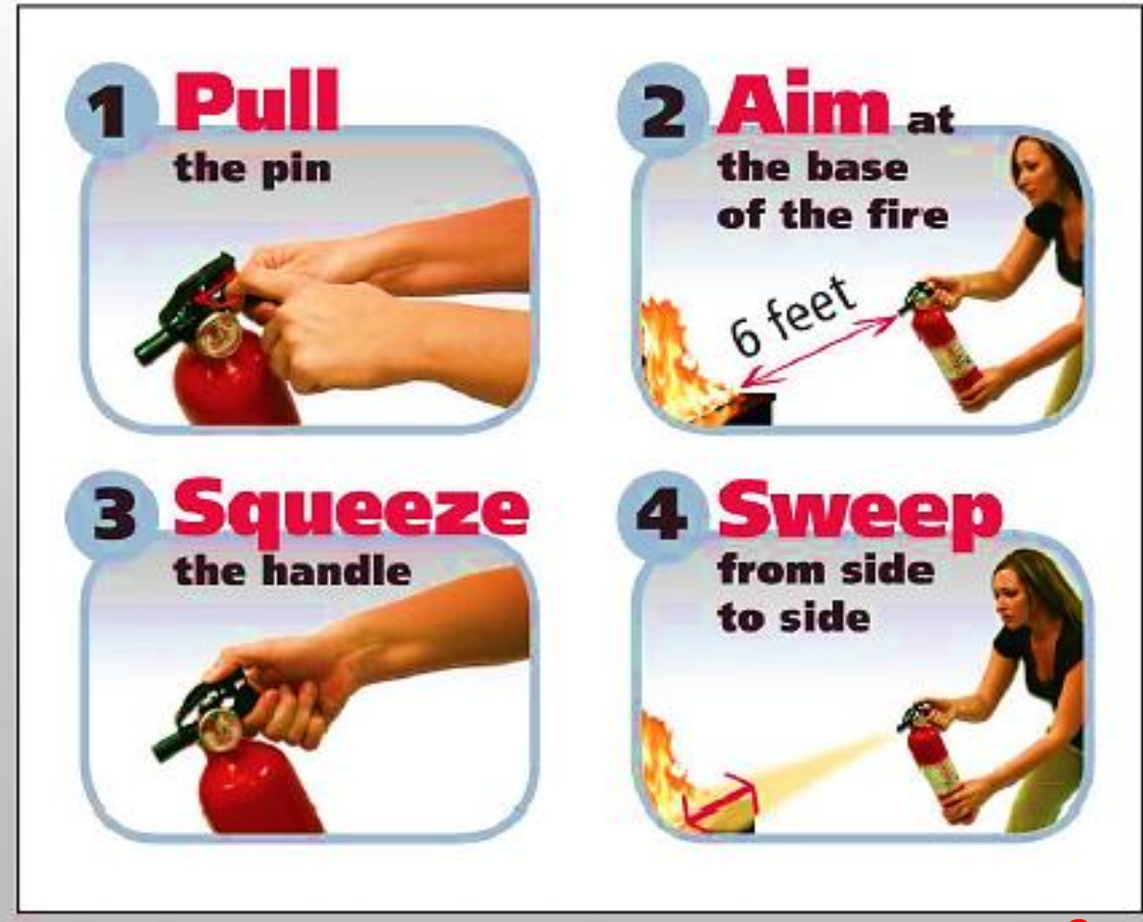
Squeeze the lever to discharge the agent.



Sweep

Sweep the spray from left to right until the flames are totally extinguished.

Remember the Phrase PASS



How to Use a Fire Extinguisher

Fire evacuation plan

In case of fire alarm triggering, all personnel have to stop immediately their work, leave all their belongings behind and proceed calmly to the evacuation of the building to gather on the parking and assisting other personnel.

In summary one shall use **"RACE"** which is an acronym for:

R=Rescue persons in danger (this can be done without putting your life in danger.

A=Activate or sound alarm

C=Confine the fire by closing doors and windows

E=Extinguish the fire with the nearest fire appropriate fire extinguisher

Healthcare Fire Safety

*There are **four** essential steps to take if you discover a fire:*

R

Rescue

anyone in immediate danger of the fire.

A

Alarm

Pull the nearest fire alarm and call fire response.

C

Contain

fire by closing all doors in the fire area.

E

Extinguish

small fires. If not, leave the area and close the door.

Fight A Fire

Never fight a fire if:

i. You do not know what is burning.
ii. The fire is spreading rapidly beyond the spot where it started
iii. You do not have adequate or appropriate equipment.
iv. If there is the probability of inhaling toxic smoke.
v. Always keep an exit at your back.

Common causes of fires in laboratories:

Common causes of fires in laboratories:

1. Electrical circuit overloading
2. Poor electrical maintenance
3. Excessively long gas tubing or long electrical leads
4. Equipment unnecessarily left switched on
5. Equipment that was not designed for a laboratory environment
6. Open flames
7. Deteriorated gas tubing
8. Improper handling and storage of flammable or explosive materials
9. Improper segregation of incompatible chemicals
10. Sparking equipment near flammable substances and vapors
11. Improper or inadequate ventilation

For your listening..

Medical Chemistry

Biochemistry-1