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## Occupational safety and health in work in the laboratory

### Students' discipline in the laboratory

1. Students should follow strictly the instructions given by the teacher.
2. Students should not enter the laboratory unless a teacher is present.
3. Students should not remove anything from the laboratory without permission.
4. Students should not rush around or play in the laboratory.
5. Experiments under way should not be left unattended.
6. Laboratory reagents and chemicals should be returned to the appropriate places immediately after use, with their labels facing the front.
7. Students should immediately report all accidents and breakages to their teacher.
8. Students should not suck fingers or pencils when in the laboratory since these may be contaminated with chemicals as well as germs.

### Personal Precautions to be taken by all laboratory users

1. Eating, drinking and smoking are strictly forbidden in the laboratory
2. Long hair, loose ties or other loose clothing items must be properly secured.
3. Special care is needed when handling chemicals. It is important to foresee the potential hazards in each case and to take the proper precautions.
4. Wash hands after experiments, especially those involving the use of chemicals, living organisms and radioactive substances.
5. Pipette fillers should always be used to help transfer liquid chemicals. Mouth pipetting is strictly forbidden.
6. Appropriate safety facilities and personal protective equipment should be used whenever necessary.

### Safety facilities

#### 1. Fire-fighting equipment

Every laboratory must be equipped with at least one appropriate fire extinguisher: either the carbon dioxide or dry powder type.

In addition, there should be fire blanket in every laboratory. The fire blanket is used for smothering clothing which has caught fire. They should be kept in the laboratory solely for fire-fighting purposes and be located at readily accessible positions.



## 2. Eye Wash Unit

Each laboratory should be equipped with a first-aid box and an eye wash unit.



eye wash unit

### 3. Fume cupboard

The fume cupboard is constantly required for carrying out laboratory work which may generate unpleasant, toxic or flammable fumes and gases.



fume cupboard

### Personal Protective Equipment

Students, teachers and laboratory staff, when working in the laboratory, should wear suitable personal protective equipment (PPE) in all circumstances wherever there is any potential risk of bodily injury. All PPE should be kept clean and properly maintained in a serviceable condition. **Defective PPE should be replaced immediately.**

### 1. Safety Spectacles and Goggles

Safety spectacles must be put on when conducting experiments involving heating chemicals, handling acids, alkalis and other corrosive chemicals, working with glass apparatus under pressure, carrying out potentially violent or exothermic reactions, or when there is any potential risk of eye injury. Whenever safety spectacles are required, they should be continually worn by all until everyone has finished the relevant activity.



safety spectacles



goggles

Goggles allow the free movement of air but prevent the direct passage of liquid. It provides more protection than safety spectacles.

### 2. Face shield

Each laboratory is equipped with a face shield for use by students in preparatory work. It can be used when dispensing large volumes of concentrated acids, alkalis or corrosive chemicals and opening containers which are under pressure. A face shield provides maximum protection for the eyes and face, with a very wide angle of vision.



face shield

### 3. Protective Gloves and Laboratory coat (gown)

Appropriate protective gloves should be worn for hand protection while handling corrosive chemicals, hot objects, microorganisms, etc. Chemical resistant gloves made of appropriate materials, such as nitrile, should be worn when handling chemicals. Although thin surgical gloves made of latex are protective against biological materials, and provide good dexterity, some people are allergic to latex, and latex is NOT protective against many chemicals. Thin nitrile gloves are a good alternative, and nitrile also provides protection against common chemicals. Users should check the integrity of gloves by visual inspection or inflating them with air before usage; damaged gloves should be replaced immediately.



protective gloves

Laboratory coat should be worn for body. However, torn or ragged gowns can be dangerous instead of protective; such damaged items should be replaced immediately.



Laboratory coat (100% cotton)



## HAZARDOUS CHEMICALS AND THEIR STORAGE AND USE

Hazardous chemicals may be defined as those which may cause injury to persons or damage to property.

Chemicals may be hazardous because they are:

- corrosive,
- flammable,
- irritant,
- toxic,
- harmful,
- oxidising,
- explosive
- carcinogenic.






**Many hazardous chemicals may involve more than one hazard.**





## Information on chemical hazards

### 1. Hazard symbols

All containers of hazardous chemicals, including bench reagent bottles, should bear appropriate hazard warning symbols which depict the nature of the chemicals and hence serve to alert laboratory users. More than one symbol should be used for chemicals with more than one hazard. Hazard warning symbols in common use are shown in below.

#### GHS Hazard Symbols and their definitions

| GHS Symbol  | GHS Class   |
|---|---|
|    | Explosive <ul style="list-style-type: none"><li>• explosives</li><li>• self-reactive substances</li><li>• organic peroxides</li></ul>   |
|  | Flammable <ul style="list-style-type: none"><li>• flammable gases, aerosols, liquids, and solids</li><li>• pyrophoric liquids or solids</li><li>• self-heating substances</li><li>• self-reactive substances</li><li>• substances that emit a flammable gas upon contact with water</li><li>• organic peroxides</li></ul> |
|  | Corrosive <ul style="list-style-type: none"><li>• skin corrosion/burns</li><li>• eye damage</li><li>• corrosive to metals</li></ul>   |
|  | Oxidizer <ul style="list-style-type: none"><li>• oxidizing gases, liquids and solids</li></ul>  |
|  | Compressed gas <ul style="list-style-type: none"><li>• gases under pressure</li></ul>   |

|   |   |
|---|---|
|    | <b>Toxic substance</b> <ul style="list-style-type: none"><li>acutely toxic substances that may be fatal or toxic if inhaled, ingested, or absorbed through the skin</li></ul>   |
|    | <b>Irritant</b> <ul style="list-style-type: none"><li>irritant (skin and eye)</li><li>skin sensitizer</li><li>acute toxins</li><li>narcotic effects</li><li>respiratory tract irritants</li><li>hazardous to ozone layer (non-mandatory)</li></ul>        |
|    | <b>Health hazard</b> <ul style="list-style-type: none"><li>respiratory sensitizers</li><li>carcinogens</li><li>mutagens</li><li>reproductive toxins</li><li>target organ toxins, single exposure or repeated exposure</li><li>aspiration toxins</li></ul> |
|  | <b>Environmental hazard (non-mandatory)</b> <ul style="list-style-type: none"><li>acute aquatic toxins</li><li>chronic aquatic toxins</li></ul>   |

Source: UNECE. Globally Harmonized System of Classification and Labelling of Chemicals, 2015  
[www.unece.org/trans/danger/publi/ghs/ghs\\_welcome.html](http://www.unece.org/trans/danger/publi/ghs/ghs_welcome.html) (accessed Dec.2015)



## 2. Safety Data Sheets

The Material Safety Data Sheets (MSDSs), formerly known as the Safety Data Sheet (SDS), for all hazardous chemicals used should be readily available in each science laboratory. They provide important hazardous information about the chemicals, including the nature of the hazard, safe handling procedures, first-aid measures and emergency procedures, for reference of laboratory users at any instance. MSDSs also form an important basis for risk assessment of experimental procedures involving such chemicals.



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### SDS Section Numbers and Headings

|   |  |
|---|--|
| Section 1: Identification                               | Section 9: Physical and chemical properties  |
| Section 2: <b>Hazard(s) identification</b>              | Section 10: Stability and reactivity         |
| Section 3: Composition/Information on ingredients       | Section 11: <b>Toxicological information</b> |
| Section 4: <b>First-aid measures</b>                    | Section 12: Ecological information           |
| Section 5: Fire-fighting measures                       | Section 13: Disposal considerations          |
| Section 6: Accidental release measures                  | Section 14: Transport information            |
| Section 7: Handling and storage                         | Section 15: Regulatory information           |
| Section 8: <b>Exposure controls/personal protection</b> | Section 16: Other information                |

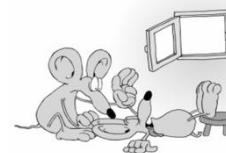
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### First AID in the laboratory

In the event of any serious injury, or whenever in doubt, medical aid should be sought without delay.

**All injuries to the eyes should be regarded as serious cases.**



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### Fainting

A certain degree of faintness or dizziness may result from any accident, and the following measures should be taken:

1. Ensure the patient's air passages remain open and clear and that he or she is breathing adequately. Loosen any tight clothing. If breathing and pulse stop, cardiopulmonary resuscitation must be applied immediately and call an ambulance at the same time.
2. Observe the level of responsiveness based upon eye opening, and verbal and motor responses. Note any changes in the state of unconsciousness.
3. Check breathing rate and pulse regularly
4. Examine and treat any serious injuries
5. Examine possible cause of fainting
6. Place the patient in the recovery position

7. Cover the patient with a blanket
8. If the patient recovers consciousness, reassure and observe him/her. Advise him/her to see a doctor.
9. Do not give anything to an unconscious patient by mouth.



### Electrical injury

1. Under safe circumstances, switch off the power supply, and remove the victim from contact with the electrical source. Never touch the patient with bare hands until you are sure that he/she is no longer in contact with the source. If you cannot break the current immediately, stand on some dry insulating material, such as a wooden box, and remove the patient from the source with other dry insulating objects.
2. Check the point of contact on the body for burn, which may be severe. Place a sterile dressing over the burn and secure with a bandage. Seek medical treatment.
3. It is essential that defibrillation and cardiopulmonary resuscitation must be started immediately if the shock has produced respiratory and cardiac arrest.



### Heat burns and scalds

1. Place the affected area under slowly running cold water until the pain fades.
2. Remove any rings, watches, belts, shoes or other constricting clothing from the injured area before it starts to swell, but do not remove any clothing adhering to the burn.
3. Do not apply lotions, ointments or any other chemicals to the injured area.
4. Do not break blisters or remove any loose skin.
5. Cover the affected area with a dry, sterile dressing / gauze and then secure with bandage. Never use adhesive dressing.

6. As far as possible, immobilize the affected part so as to minimize pain.
7. For severe burns, medical aid should be sought without delay.



### Chemical burns

When handling chemical burns, only water should be used for first-aid treatment. Do not apply any chemical to the affected area.

1. Place the affected area under slowly running cold water until the pain fades.
2. Remove any contaminated clothing carefully, but avoid making contact with the chemical yourself.
3. For severe burns, medical aid should be sought without delay. It is essential that flooding of the affected area be continued until an ambulance arrives. The Material Safety Data Sheet of the chemical should also be taken to the hospital for reference or identification.



### Eye injuries

1. All eye injuries should be regarded as serious cases and medical treatment should be sought without delay.
2. If any chemical has entered into the eye, flush the eye with cold running water or use the eye wash unit immediately for 10 minutes. Ensure that water drains away from his/her face and not into the other eye. Do not attempt to neutralize the chemical in the injured eye with acid or alkali. Advise the patient not to rub his/her eye.
3. Do not attempt to remove foreign objects such as glass pieces from the eye. Keep the patient still and send for medical immediately.
4. Cover the eye with a sterile eye pad.



### Cuts and bleeding

1. Avoid touching the wound with bare hands or having direct contact with blood. Always use a pair of disposable plastic/vinyl gloves
2. Protect the wound with a sterile swab. Clean the area around the wound with water, using liquid soap if necessary. Take care not to wipe off any blood clots.
3. If bleeding persists apply direct pressure. Apply a proper dressing after bleeding has stopped.
4. In serious cases, the patient should lie down with the injured part raised. Apply direct pressure to the wound over a clean dressing. If bleeding continues, do not remove the dressing, but apply further pads on top of the original one. Then bandage the wound firmly. Excessive blood loss may lead to shock. Medical assistance should be summoned immediately.
5. Blood-contaminated materials should be properly handled and the following precautionary measures need to be taken:
  - Avoid touching blood-contaminated materials with bare hands. Always use a pair of disposable plastic/vinyl gloves
  - Use household bleach (diluted with water in the proportion of 1:5) to clean up the contaminated areas.
  - Blood-soiled gloves, dressings and swabs, etc. should be placed in double plastic bags and then sealed for disposal.



### Swallowing chemicals

1. If the chemical has not been swallowed, ask the patient to spit out and wash the mouth with plenty of water.

2. If the chemical has been swallowed, give the patient plenty of water or milk to drink. Medical assistance should be summoned immediately.
3. If medical consultation has to be sought, the Material Safety Data Sheet of the swallowed chemical should be sent along to hospital.



### Inhalation of toxic gases

1. Open any doors and windows. Remove the patient to a safe without endangering yourself.
2. Check his/her airway and ensure it is not blocked.
3. Place him/her in the recovery position even if he/she is conscious. This allows him/her to aspirate even if he/she vomits.
4. If the patient's breathing stops, induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If the pulse also stops, start cardiopulmonary resuscitation and defibrillation if necessary.
5. Seek medical aid immediately.

### **First –aid facilities**

Each science laboratory should be equipped with a first-aid box marked clearly with “First aid”. The following is a list of first-aid items recommended for school science laboratories:

- Adhesive plaster
- Antiseptics, e.g. OCTENISEPT
- Bandages (of different sizes)
- Elastic bandage
- CPR masks
- Forceps
- Safety pins
- Scissors

- Sterile adhesive dressings
- Sterile cotton wool
- Sterile dressings/ gauze
- Sterile eye pad
- Triangular bandages



first-aid box

## Fire evacuation



In the event that the university needs to be evacuated, please expect the following:








1. The alarm system will sound a pre-signal,
2. Proceed to the nearest stairwell and toward the building exit. Never take the elevator.
3. Make your way to the evacuation assembly area for your building:
4. Once the building is declared safe, authorities will tell those in the assembly area that they may re-enter the building.

Fire evacuation symbols

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## Symbols

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|   |                    |
|---|--------------------|
|    | Emergency Exit     |
|    | Emergency Exit     |
|    | Arrow              |
|    | Use Stairs in Fire |
|   | Assembly Point     |
|  | Fire Break Glass   |
|  | Slide Door         |