GENERAL CHEMISTRY LABORATORY SAFETY BOOKLET

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This booklet was prepared for only undergraduate General Chemistry Laboratories and contains the rules that must be followed in the aforementioned laboratories.

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PROTECTION IN LABORATORIES AND RULES OF SAFETY

There is always a possibility of danger in chemistry laboratories. Safety rules has high priority to avoid such danger. Despite, following such rules do not guarantee the safety, one cannot exclude following the procedures. Everyone working in the laboratory should never forget that one simple mistake would not only harm himself but the other people in the laboratory as well. The person in charge of the laboratory cannot avoid possibility of danger on his own. Therefore, do not forget that as soon as you get into the laboratory, you must obey the safety rules and take responsibility where necessary!

General Safety Rules

- One should enter a chemistry laboratory withot wearing a lab coat and safety glass. In addition, one should wear mask whilde performing espacailly dangerous experiments.
- Students in tha laboratory shouldn't wear make up or put eye lens on. In addition they must tie their hair up and cut their nails off.
- Wearing rings, neckless, bracelets etc. is not allowed in the laboratory since they increase contact area of theskin with the chemicals.
- If there is an open wound in hands, they must be bandaged and appropriate gloves should be worn.
- Hands must be washed and cleaned at the and of the experiments.
- Using mobile phones is strictly forbidden.
- Listening to music is not allowed.
- Eating, drinking and/or chewing gum is not allowed.

- No material should be used against experimental necessities.

- Any kind of action that may cause distraction must be avoided. It is forbidden to play games or making fun in the laboratory.

- No medication should be taken before coming to the laboratory. If taken under prescription, people responsible should be informed by the student.
- Chemicals should not be smelled or tasted. They should not be touched without wearing gloves, they must be weighed and transferred with appropriate materials.

- Bottle caps of chemicals should be closed immediately after use. Also they must not be mixed. Bottle caps should not be put downwards on the bench. Otherwise, caps can be contaminated with other chemicals and purity of that chemical may be spoiled.
- All chemicals used in the laboratory are produced with utmost purity during their production. Therefore, in order not to cause a dangerous situation or an accident, every chemical substance must be transferred with their own tool, say, a spatula, a spoon, or a pipette. The same spatula, spoon or pipette should never be used for another substance before being thoroughly cleaned.

Caution: Liquids must always be transferred by using a pipette filler; suction by mouth must never be exercised.

- Since graded glassware used in the laboratory are calibrated at the factory, when using them in precise experiments, they must never be dried in an oven and never be heated to elevated

temperatures. It must be considered that with temperature, glass substances tend to enlarge, destroying the calibration

- One must be very cautious when working with concentrated acids. Acids are generally in the form of concentrated liquids. It is therefore they must be diluted with water by using a stirring rod for easy transfer into the flask under the guidance of a teaching assistant; never pour water on concentrated acid.
- In laboratory, the place of the chemical substances shouldn't be changed without the observation of the laboratory's responsible assistant.
- Volatile (the compounds having low boiling point; ether, acetone, alcohol) and flammable materials shouldn't be kept close to open flame. Because of the fact that the vapors of this type compounds can reach the source of flame to the other benches and cause a fire, this must be taken into consideration.
- In laboratory the waste bottles is classified as solid and liquid. Liquid wastes are classified as with halogen-halogen free. Liquid and solid wastes shouldn't be poured in sinks, must be put into labeled suitable waste bottles that are showed by laboratory staff.
- Used containers shouldn't be left dirty in any condition, the compounds inside them shouldn't be let to dry and stick to walls of containers. After cleaning process, containers and other materials should be put into the places of them and experiment bench must be cleaned.
- All chemicals that are used in laboratory should be weighed in fume hood, taken in the scaled containers and transfer into reaction medium. Especially; with organic solvents, sulfuric acid, nitric acid, hydrochloric acid, hydrofluoric acid and with toxic gases like bromide, hydrogen sulfide, hydrogen cyanide, and chloride one should work in the fume hood.
- If heating process is applied during the experiment in laboratory, one shouldn't never leave the experiment. As long as you give heat in the experiment, the experiment should be observed. Any reaction system shouldn't be overheated. Reaction conditions should be obeyed.
- Because of the fact that flasks, Erlenmeyer flasks, beakers and bottles have low resistance to pressure, when they left to cool they shouldn't be closed with lid or cork. In such situations it should be known that containers can fracture and break.
- Taking into consideration, mixing of chemicals randomly can cause a lot of dangers, it should be avoided.
- The laboratory glassware are quite thin and delicate materials. Therefore, arbitrary force caused fracture of glass frit should not apply. If there are deep cuts, micro surgical intervention is required.
- The labels of chemicals used in the certainly should not be torn, blackened and should not be damaged in any way. The packages impaired labels should be reported to the technician or the concerned/responsible person as soon as possible.
- When the fluid is flowed from the bottles of liquid, the label side of the bottle should be facing up. Otherwise, it should be noticed that the drops flowing from the bottle may be damaged to the text on the label and also the last remaining drops should be wipe up with its cap.
- Not approved tests/operations should not be done.

- Metallic laboratory tools should not be left damp in order to avoid corrosion.
- In places with commonly used and direct sunlight, the bottles of the chemicals should not be kept even if empty.
- In laboratory, the color coding for solvents and wash bottles must never be changed.
- The responsible person in the laboratory has to be acknowledged immediately in case of an unexpected occurrence during the experiment.
- Places and usage of the fire extinguishers in the laboratory have to be learned.
- The experiment under examination has not to be left unattended without knowledge of the responsible in the laboratory.
- After the experiment all electrical instruments have to be turned off and left unplugged, all taps have to be checked. After final examination with laboratory responsible laboratory could be left with permission.

Accidents generally occur due to following reasons

- **Lack of knowledge:** Insufficient information about materials and instruments that are (going to be) used, experiment is (going to be) under examination, experiment/laboratory medium, orientation, etc.
- **Overconfidence:** Instructors/students may think the experiment may be done easily as it has been done before many times.
- **Unawareness and negligence:** Leaving hazardous materials and instruments unattended, not securing electric plugs, not doing necessary control in time, unattended electric wires with power, inappropriate behaviors, and not using/obeying security rules.
- **Loss of attention:** Working without rest, persistence on conducting experiment although feeling exhausted, improper laboratory medium and body position, perceiving the work is done is monotonous, trying to finish the work at once.
- **Ignoring the possibility of accident:** Thinking that accidents always happen to someone else, instead of taking cautions be living in superstition, drifting apart from work discipline, protective safety rules/instruments are used by inexperienced specialist, not applying rules that are relative with safety.
- **Negative physical circumstances:** Insufficient instruments, the media that you are doing your experiments being a distractive place or surrounded by distractive medium, air-conditioning, heating, lighting, lack of cleanliness and sanitation.
- **Psychological effects:** Students which are doing experiments can be influenced by their family, friends, a news they heard, a scenery they have seen, the air they breathe. These may result students cannot focus on their experiment.

PERSONAL PROTECTION

Safety glasses

Safety glasses with side shields must be worn in the laboratory to protect your eyes from chemicals, radiation or various harmful particles. Prescription glasses or sun glasses are not suitable because they do not have side shields. Contact lenses are not used in laboratory. Please learn the place of the eye wash bottle and do not relocate them.

Caution: Any kind of dissolver or chemical which is contacted with your eyes should be removed by washing with plenty of water.

Full protected

Full protected

Side protected

Face protection

Face protection should be worn to protect face, eye and throat from impact, dust and chemical splash and always be used with safety glasses. It must be known that liquid droplets and splashes of chemicals can still be effective around and the bottom of the shield of face.

Masks

Masks should be used in order to avoid exposure to dust and liquid particles which is composed of solid or liquid chemicals. Mask as is handy use and compatible with the skin, different types of filter masks are also available depending on the chemicals used.

Disposable dust masks

Gas masks

Lab Coat

It is required to wear a lab coat in order to protect from the effects of burning and piercing of chemicals which is leaping onto the employees. Apart from this, it should be avoided flammable clothing made from synthetic materials.

Gloves

Considering variations in laboratory conditions, one type of gloves cannot be able to provide full protection. It should be noted that latex gloves do not resist many chemicals and solvents and also may cause allergic reactions in some people. So neoprene (rubber) or disposal nitrile based gloves should be preferred for protection. Heavy work gloves should be used for protection from liquid nitrogen and heat.

Latex

Butyl

Neoprene

Nitrile

NOTE: These information were taken from the open source which declined not to take any responsibility from these contents, it should be considered that permeability of the material can be changed through the thickness of the material and/or the contact time.

The suitable protective gloves for various chemicals

Excellent	Good	Fair	Poor	No information

Chemical	Glove Type			
	Latex	Neoprene	Nitrile	Vinyl
Acetaldehyde	G	G	E	G
Acetic Acid	E	E	E	E
Acetone	G	G	G	F
Acrylonitrile	P	G	-	F
Ammonium Hydroxide, saturated	G	E	E	E
Aniline	F	G	E	G
Benzaldehyde	F	F	E	G
Benzene[a]	P	F	G	F
Benzyl Chloride[a]	F	P	G	P
Bromide	G	G	-	G
Butane	P	E	-	P
Butyraldehyde	P	G	-	G
Calcium Hypochlorite	P	G	G	G
Carbon Disulfide	P	P	G	F
Carbon Tetrachloride[a]	P	F	G	F
Chloride	G	G	-	G
Chloroacetone	F	E	-	P
Chloroform[a]	P	F	G	P
Chromic Acid	P	F	F	E
Cyclohexane	F	E	-	P
Dibenzyl Ether	F	G	-	P
Dibutyl Phthalate	F	G	-	P
Diethanolamine	F	E	-	E

Diethyl Ether	F	G	E	P
Dimethyl Sulfoxide[b]	-	-	-	-
Ethyl Acetate	F	F	G	F
Ethylene Dichloride[a]	F	F	G	P
Ethylene Glycol	G	G	E	E
Ethylene Trichloride[a]	P	P	-	P
Fluoride	G	G	-	G
Formaldehyde	G	E	E	E
Formic Acid	G	E	E	E
Glycerol	G	G	E	E
Hexane	P	E	-	P
Hydrobromic Acid, 40%	G	E	-	E
Hydrochloric Acid, conc.	G	G	G	E
Hydrofluoric Acid, 30%	G	G	G	E
Hydrogen Peroxide	G	G	G	E
Iodide	G	G	-	G
Methylamine	G	G	E	E
Methylchlorid[a]	P	E	-	P
Methyl Ethyl Ketone	F	G	G	P
Methylenechloride[a]	F	F	G	F
Monoethanolamine	F	E	-	E
Morfoline	F	E	-	E
Naphthalene[a]	G	G	E	G
Nitric acid (concentrated)	P	P	P	G
Perchloric acid	F	G	F	E
Phenol	G	E	-	E
Phosphoric acid	G	E	-	E
Potassium hydroxide (conc.)	G	G	G	E
Propylen dichlorid[a]	P	F	-	P
Sodium hydroxide	G	G	G	E
Sodium hypochlorite	G	P	F	G
Sulfuric acid (concentrated)	G	G	F	G
Toluen[a]	P	F	G	F
Trichloroethylene[a]	P	F	G	F
Tricresyl phosphate	P	F	-	F
Triethnolamine	F	E	E	E
Trinitrotoluen	P	E	-	P

[a] Aromatic and chloro hydrocarbons penetrates and swells all kind of synthetic gloves including latexs. Hence, during studying with such chemicals frequent changing of gloves is recommended.

[b] There is no data about the effects of dimethyl sulfoxide on latex, neoprene, nitrile and vinyl based gloves.

* www.microflex.com, www.ansellpro.com, www.hazmat.msu.edu:591/glove_guide

PROTECTION AGAINST CHEMICALS

For every chemical a label contains with information about warnings, risks and precautions. Before handling a chemical these labels should carefully be read and blind spots must be asked to the laboratory instructor. See below modern and vintage label examples for methanol.

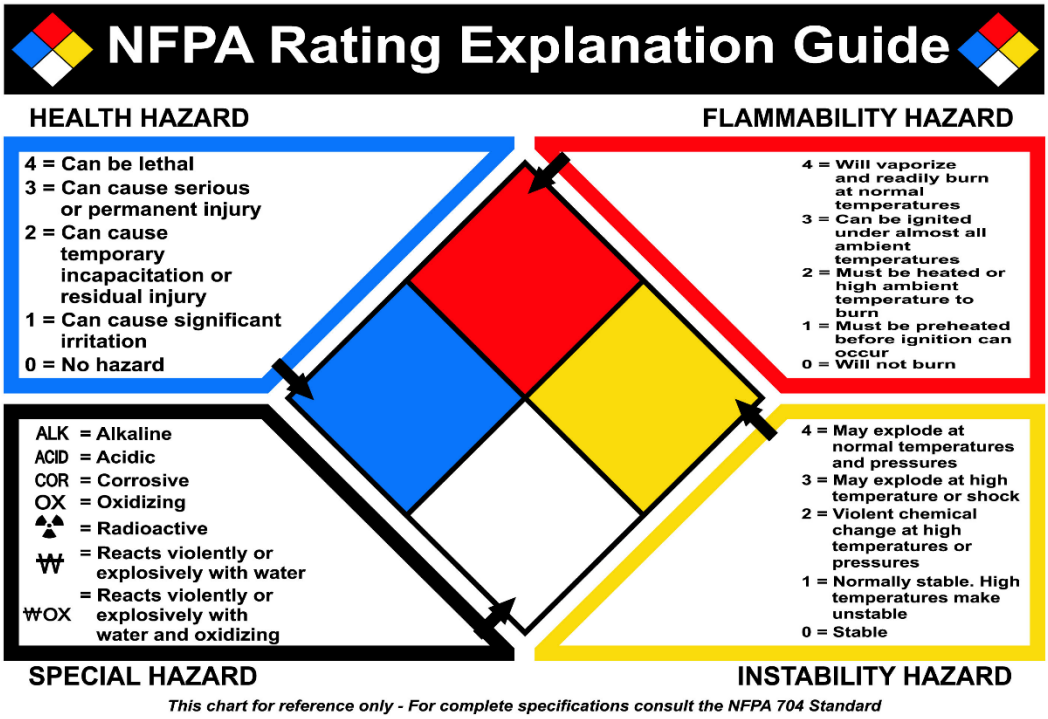
Labels

OLD			NEW			
Symbols		**Description**	**GHS-Symbols**		**Description**	**Hazard statement examples**
	E	Explosive		GHS01	Exploding bomb	Explodes due to fire, shock, friction or heat; danger due to fire, blast and projectiles.
	F+ F	Extremely flammable Highly flammable		GHS02	Flame	Flammable; catches fire spontaneously if exposed to air; in contact with water releases flammable gases which may ignite spontaneously.
	O	Oxidizing		GHS03	Flame over circle	May cause fire or explosion; strong oxidizer.
No equivalent				GHS04	Gas cylinder	Contains gas under pressure; may explode if heated; contains refrigerated gas; may cause cryogenic burns or injury.
	C	Corrosive		GHS05	Corrosion	May be corrosive to metals; causes severe skin burns and eye damage.
	T+ T	Very toxic Toxic		GHS06	Skull and crossbones	Small quantities are harmful or fatal.
	Xn	Harmful	No direct equivalent			
	Xi	Irritant				
No equivalent				GHS07	Exclamation mark	Harmful, irritates eyes, skin or respiratory system; large quantities are fatal.
No direct equivalent				GHS08	Health hazard	Causes allergic reactions; may cause cancer, may cause genetic defects; may damage fertility or the unborn child; causes damage to organs.
	N	Dangerous for the environment		GHS09	Environment	Harmful, toxic or very toxic to aquatic life with long lasting effects.

Some Important GHS Symbols (Pictograms)

New symbol		Old symbol
	**F (Flammable), F+ (Extremely Flammable)** Flammable and combustible (R10-R12). Liquids of Flash point below zero and boiling point maximum 35 degree. It should be kept away from fire, sparks and heat.	
	**C (Corrosive)** Substances destroying living tissue or causes corrodes/corrosion of iron (R34, R35). They cause skin and eye damage. Special precautions should be taken to protect eyes and skin, vapor protective clothing should be worn and shouldn't be taken by inhalation. They should be kept away from metals.	
	**Xi (Irritant), Xn (Sensitizing)** They cause skin and eye damage (R20–R22, R36-R38). Their vapor shouldn't be breathed. They shouldn't be contacted with the body. Special precautions should be taken to protect eyes and skin. Protective clothing should be worn. They harm the ozone layer.	
	**N (Toxic to environment)** They harm to livings in water and nature. It shouldn't be spilled and released to nature.	
	**H (Health effect)** It reflects serious longer term health hazards such as carcinogenicity and respiratory sensitization. (R40, R45-R47).Avoid body/skin contact and, ingestion and inhalation of these substances should be avoided.	
	**G (Gas)** Contains gas under pressure. Evolving gas might be cold if heated, explosion might be occurred.	

NFPA Ratings



Caution: Compounds, having low Flash point values are easily flammable.

Health Hazards	Flammability	Reactivity (Instability)
4 Very short exposure to material can cause death or major residual injury even if prompt medical treatment is given.	**4** Material will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or will burn readily when dispersed in air.	**4** Material is readily capable of detonation, explosive decomposition or instability at normal temperatures and pressures.
3 Short exposure to material can cause serious temporary or residual injury even if prompt medical treatment is given.	**3** A liquid or solid that can be ignited under almost all ambient temperature conditions.	**3** Material is capable of detonation or explosive reaction but requires a strong initiating source; or which must be heated under confinement before initiation; or may react explosively with water.
2 Intense or continued exposure to material can cause temporary incapacitation or possibly residual injury unless prompt medical treatment is given.	**2** Material that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	**2** Material is normally unstable and readily undergoes violent chemical change but does not detonate. Also may react violently with water or may form potentially explosive mixtures with water.
1 Exposure to material will cause irritation but only minor residual injury, even if no treatment is given.	**1** Material that must be preheated before ignition can occur.	**1** Material is normally stable but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.

Please avoid your skin from the contamination of chemicals. Please check you have all the protective equipment on and check the safety rules before experiment (especially if you're working with poisonous and carcinogenic chemicals) from:

- Materials safety data sheets (MSDS),
- Handbook,
- Catalog of chemicals,
- Posters on the laboratory walls,
- Internet:
    - www.ilpi.com/msds
    - www.msds.com
    - www.msdsonline.com
    - www.setonresourcecenter.com
    - msds.ehs.cornell.edu
    - hazard.com
    - www.sigmaaldrich.com
    - www.vwrsp.com
    - www.understandthelabel.org.uk/chemical-hazard-symbols-ghs-free-memocard.asp or from other sources.

MSDS contains following information

- Name of the chemical and contents
- Manufacturer's information
- Hazardous ingredients/identity information
- Physical/chemical characteristics
- Fire and explosion hazard data
- Health hazard data
- First aid data
- Storage data
- Reactivity and stability data
- Data about spillage and leakage
- Ecological and toxicological characteristics
- Special precautions
- Special protection data
- Transportation data
- Disposal data
- Data about regulations
- Other data

MSDS is related with the chemicals that are using during experiments are stand in the laboratory. Please find and remind the places.

Missing information should be learned from other sources or laboratory assistants. Do not regard non-authorized persons during your experiments.

The Hazards of Chemicals

- Tags of hazardous materials like chemicals, in addition to hazard signs, must display the dangers these chemicals pose and must inform about the necessary precautions.
- R (Risk) factors express the hazard levels of the chemicals.
- In the Regulations for Hazardous Chemicals are given some R codes and their combinations, with clear descriptions of the dangers, to be used on the tags of hazardous materials and products.

Risk Conditions

R factor	Description of the R factor
R1	Explosive in dry conditions
R2	Risk of explosion in case of impact, friction, fire or contact with other sources of
R3	High risk of explosion in case of impact, friction, fire or contact with other sources of ignition
R4	Forms very sensitive explosive metallic compounds
R5	Heating may cause explosion
R6	Explosive in contact with air
R7	May cause fire
R8	Contact with combustible materials may cause fire
R14/15	Severe reaction that led to the formation of highly flammable gas with water
R15/29	Forms toxic and flammable gases in contact with water
R20/21	Harmful by inhalation and in contact with skin
R20/22	Harmful by inhalation and if swallowed
R20/21/22	Harmful by inhalation and in contact with skin and if swallowed
R21/22	Harmful when in contact with skin and if swallowed
R23/24	Toxic by inhalation and skin contact
R23/25	Toxic by inhalation and if swallowed

Safety Precautions for Some Special Chemicals

The following chemicals requires special precautions due to their high dangerous structures.

Chemical carcinogens

Benzene, chloroform, formaldehyde which is widely used chemicals are suspected or known carcinogens.

- Choose to use alternative chemicals with less toxic effects
- Use a fume hood when working with this chemical
- Store chemicals in a safe place when not in use
- Use the most appropriate gloves against chemicals, always wash your hands after each use.

Mercury

The widespread use of mercury and its compounds in the laboratories may be overlooked because of its dangerous structure.

- Elemental mercury; severe toxic volatile vapors. Therefore, when poured, it should be cleaned very well.
- Inorganic and organic forms of mercury are highly toxic.
- All transactions will be made in accordance with mercury should be done in a fume hood.
- Spills should be cleaned immediately with appropriate methods.
- Do not heat the surface contaminated with mercury; heating increases the vapor pressure of mercury.
- If possible, use special thermometers including non-toxic material instead of mercury ones.

Procedure for cleaning up mercury spills

1. If people were in the room when the spill occurred, be sure that their shoes, clothing, and other articles have not been splashed with mercury before they leave the room. Keep people away from spill area.
2. Turn off the oven and similar tools and allow them to cool to room temperature. It should be known that odorless and colorless mercury vapors will be released into the air faster with increase in temperature. Turn off air conditioning or ventilating systems.
3. Close interior doors and windows leading to other rooms.
4. Avoid skin contact with mercury, breathing of mercury vapor and, using a vacuum cleaner to clean up a mercury spill. Because mercury vapors are readily absorbed through the lungs into the bloodstream, they are particularly hazardous. Mercury vapors are also heavier than air and may linger in higher concentrations at the site of the spill. Ventilate the room with the spill to the outdoors by opening windows and any exterior doors. Continue ventilating the room with outside air for a minimum of two days.
5. Remove all jewelry from hands and wrists so the mercury does not bond to the metals (Put on rubber gloves, goggles, and appropriate clothes before cleaning).
6. Locate all mercury beads, then carefully use the cardboard to gather them together. Use slow sweeping motions to prevent accidentally spreading the mercury. Slowly and carefully transfer the mercury into an unbreakable plastic container with an airtight lid (such as a plastic film canister). Place the plastic containers or bags inside a second plastic container or bag to provide additional containment protection. Place the container in a zip-lock bag. Label the bag as containing items contaminated with mercury. If there are any mercury beads which could not be collected, pick them up with duct tape and be sure to carefully inspect the entire room.
7. Sprinkle elemental sulfur in powder form or fine powder zinc, if available, on the spill site, if feasible, to bind any remaining mercury.
8. Wash contact area that came into contact with mercury using alkaline soap and a paste of water and “flowers of sulfur,” if available. Sulfur combines with mercury sulfide becomes insoluble. Never pour washing water into the sink and never contact with this water.

Perchloric acid (concentrated, 70%)

Perchloric acid can be dangerously reactive. Aqueous perchloric acid, 70% or weaker, is a strong acid at room temperature. At elevated temperatures and concentrations (above 70%) it is a strong and active oxidizing agent. Anhydrous perchloric acid is unstable and may cause explosion. Contact with oxidizing agent may cause fire or explosion.

- Store on glass or ceramic trays that are large enough to hold the volume of the container in case of a spill.
- Using perchloric acid at the concentration above 70% is not recommended.
- Separate perchloric acid from sulfuric acid and metals.
- Perchloric acid must only be heated in the perchloric acid rated fume cupboard in room.
- Perchloric acid and organic chemicals should never be used in the same fume hood.

Corrosives

- Aqua must not be added onto corrosive substance. It can be diluted by adding into water.
- They must be store in acid proof cabinet and polyethylene container.
- They must not be stored high.
- They must be kept away from metal cover and heat.
- Hydrogen fluoride gas is an acute poison that may immediately and permanently damage lungs and the corneas of the eyes. Aqueous hydrofluoric acid is a contact-poison with the potential for deep, initially painless burns and ensuing tissue death. Over 50% concentration of HF is very flammable. HF must be stored in plastic bottle which is durable pressure. Take security measures while corrosive substances being used.

Peroxides

Ethers, liq. paraffin, olephines etc. particular chemicals formed peroxides in the presence of light and air. You must be careful by using ether (acyclic or cyclic). Ethers having peroxides can be explode by heat. Unsealed or partially empty bottle can accelerate the forming of peroxides when it exposed to light and air. So, you must take some precautions by using these chemicals;

- The unsealed date must be written onto the bottle.
- The unsealed ether must not be used over one year.
- Ethers must be stored cool dry and sunlight cannot be penetrate into the bottle.
- These chemicals must be kept away from heat, friction, impact.

Aqua reactants (pyrophobic compounds)

Some chemical can react with water. Therefore, these chemicals must be stored at dry places. They must not be stored under a sink to prevent unwanted accidents. Corresponded chemicals Na, Li, K, etc. must not be contact with water. While working these chemicals, the sealed syringes must be used.

Some chemicals must be avoided to mix

Chemical	Do not mix with
Carbon:	CaCl, oxidants
Alkaly metals (Na, K, vb.)	H_2O, Hydrocarbons, aq. Solution
Liq. Ammonia	Hg, Cl, I, Br, Ca
Ammonium nitrate	Metals, flammable liq., S, acids, nitrites
Aniline	HNO_3, H_2O_2
Acetic acid	H_2CrO_4, HNO_3, Hydroxyl group having compounds. Ethylene glycol, acid perchloride
Acetylene	F, Br, Cl, Cu, Hg, Ag
Acetone	HNO_3, H_2SO_4
Copper	Acetylene, H_2O_2
Bromine	NH_3, acetylene, butane, petrol gases
Mercury	Acetylene, ammonia
Fluorine	All Substances

Silver	Acetylene, oxalic acid, tartaric acid, ammonia, carbon dioxide
Hydrofluoric acid	Ammonia
Hydrogen peroxide	Copper, chrome, iron, metal and metal salts, inflammable liquids, aniline,
Hydrogen sulfide	Nitric acid, oxidant substances
Hydrocarbons	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkalines
Iodine	Acetylene, ammonia
Calcium oxide	Water
Chlorine	Ammonia, acetylene, butane and other petroleum gases, turpentine
Chlorates	Ammonia, metals in powder
Chromic acid	Acetic acid, glycerin, some alcohols, inflammable liquids, turpentine
Sulfurous hydrogen	Nitric acid, oxidant gases
Nitric acid	Acetic acid, chromic acid, hydrocyanic acid, hydrogen sulfide, inflammable
Oxygen	Oils, grease, hydrogen, inflammable liquids, inflammable solids and
Oxalic acid	Silver, mercury
Perchloric acid	Acetic anhydride, alcohols, carbon tetrachloride, carbon dioxide
Potassium	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Sodium nitrate	Ammonium nitrate, other ammonium salts
Sulfuric acid	Chlorates, perchlorates, permanganates
Inflammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, halogens

PRECAUTIONS WHILE USING LABWARES AND INSTRUMENTS

Pipette Bulb

- It is used for taking solvents, used in laboratory, from their bottle. Solvents should not be pulled through mouth.
- It can is applicable to all types of pipettes. There are three glass balls inside the bulb, which can be controlled by finger pressure. There should be attentive to avoid solvents to come contact with the bulb. If solvent contact with bulb, liquid should be drained and bulb should not be used until solvent evaporate.
- When bulb will be used; first, air inside the bulb should be emptied by pushing A (air) on it and then, solvent should be drawn by pushing S (Suction) button after immersing pipette to the solvent bottle and finally, solvent should be drained to desired place by hitting E (Empty) button.

pH meter

- Each pH meter has different calibration methods.
- It should be checked whether the pH meter calibrated or not. If not, it should be calibrated with the information given by the pH meter.
- Calibration solutions should be kept clean. In order for solution to be clean, probe should be washed and dried with distilled water after dipping calibration solutions.
- pH meter that is calibrated should not shut down. In case of cut of electricity, pH meter should be calibrated again. By the time of measuring, the probe should be kept vertical. Liquid that is measured, should not be mixed with prob. Probe should be fixed. Magnetic stir should be used for the purpose of stirring. Magnet should be touched the prob.
- The probe should be kept in protection solution once it is not used.
- Protection solution should be poured, and not add water on it.

Filtration Apparatus

- Be sure that filtering set is attached with water jet.
- Water valve should be checked for not slip off water in it.
- Water valve should be shut after filtering is done.
- Filtering set should be clean after use.

Calibrated Balance

- Air bubble should be balanced on water scale.
- Horizontal position of scale should be checked.
- There should be any spill of chemical on and around the sensitive scale.

- In case of any spill of chemical should be cleaned with brush.
- Device should be kept close when it is not on use. Covers should be closed as well.

Water Bath

- The water level of the device should be checked frequently and if the level is low it must be filled with distilled water (at least one finger from the surface of the above the heater.
- Attention should be paid to steam when working with device; necessary protective equipment should be used.
- The water bath should be closed after finishing the study.

Fume Hood

- Concentrated acids, bases and volatile solvents should be studied in fume hood to avoid inhalation of the toxic gases and steams.
- Before using the fume hood, ventilation system should be operated.
- The protective goggles should be used during the all kinds of operation made in fume hood.
- When working with organic compounds heat treatment should be carried out only in fume hood.
- Chemicals should be placed at least 15 cm from the front of the fume hood and the glass of the fume hood should be kept closed as much as possible.
- Electrical connections of all equipment which will be used with explosive/flammable chemicals in fume hood must be made before.
- Explosive / flammable chemicals in fume hood when working with

Vacuum Oven

- While working under vacuum, the door of the oven never should be forced to open.
- The inside of the oven should be kept always clean and dry.
- Vacuum pump should be switched off when the desired level is reached.
- The vacuum should be evacuated before opening the door of the device.

Incubator/Oven

- Temperature settings mustn’t be changed.
- The covers of the instruments mustn’t be left open for a long time.
- Ordinary plastic gloves mustn’t be worn. While working at high temperatures fire iron must be used and/or protective gloves which are resistant to heat must be worn.
- Equipment which is washed with solvents mustn’t put into drying oven due to possible explosion risk.
- Plastic equipment mustn’t put into drying oven.
- Sample vessel and the fire iron mustn’t contact to the oven jacket.

Gas Tubes

- While placing gas tubes care must be taken to prevent them from tumbling.
- Gas tubes must be transported using transporters which are designed to transport them properly.
- The caps of gas tubes must be covered while transporting or while they are not in use.
- Gas tube joints must be united by laboratory technicians.

- Empty gas tubes must be marked and laboratory staff must be informed.
- Joint hoses, regulator etc. must be examined frequently.

Magnetic Stirrer/Heater

- Plastic/elastic materials mustn’t put onto the heating surface.
- Care must be taken to prevent spilling of any chemical material onto the heating surface.
- Care must be taken not to touch to the heating surface.
- To prevent spilling of the solvent outside environment and to maintain a stable stirring of the magnet, stirring rate must be increased gradually.

Heating Mantle

- Water or any other liquid must not be spilled into the heating mantle.

STEPS TO BE FOLLOWED AT EMERGENCY

First Aid

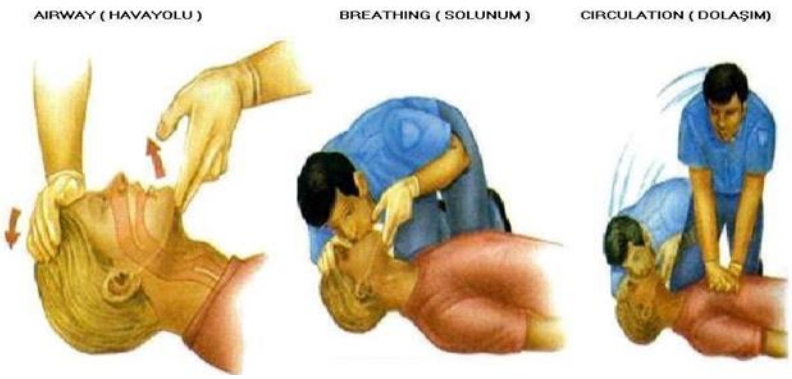
ABC of First Aid

Consciousness must be examined; if the person is not conscious the following steps must be checked immediately then appropriate first aid must be applied.

A: Airway space

B: Breathing (look, listen, feel)

C: Circulation (Carotid is examined for 5 seconds).



Local Wash Units

Chemicals may cause burns when they contact with human skin. In such cases, chemicals should be removed immediately by washing with water to minimize the risk. Emergency showers and eye wash stations have been developed for this purpose.

Eye wash station

Emergency shower and eye wash unit

In case of contact with chemicals

Acids

In the contact of skin or clothes with acid, the area should be washed with flowing water. If the chemical was swallowed, vomit is not advised, magnesium oxide suspension should be drinken. In the case of breath of acid mist, gas poisoning precautions should be applied, mouth and nose should be washed with water.

Bases
In the case of contact with bases, the area should be washed with water. Washing should be finished with 1% acetic acid solution. The diluted acid and base solutions shouldn't be irritant.

Eye contact with acids or bases
Rinse immediately with water and apply salve to eye.

Gas Poisoning
In all accidents, you must be calm and assist injured person to be calm too. Patients should be removed to fresh air to refresh their lungs with deep breathing. Do not induce vomiting them besides that don't attempt to give water or another foods. In severe cases, turn patient's head sideways and help he or she to lie on stomach then call the doctor. Drying and bitterness in the mouth, dizziness, nausea and burning throat are symptoms of poisoning.

Bromine and Chlorine Poisoning
Drop absolute alcohol on cotton and help them to smell it in a place with fresh air and then call the doctor.

Ethyl Alcohol Poisoning

Gastric lavage, artificial respiration should be done, drink dark coffee, hot bath and then cold shower are advised.

Swallow Toxic Substances
Insert a finger to throat or give solution of salt to the patients in order to remove toxic substances from their body immediately. Learn and remember the name of the toxic substance and state it to the doctor.

Burns
If you have pain in burning location, cold it with ice, washed it with cold water then rub tannen or olive oil to the burning location. Should be bandaged with a clean cloth lightly and should drink cold water at frequently. Use ice in a plastic bag on the external of wound position. After doing all of the above aid procedures call the doctor as soon as possible.

Cut-outs
Missing a liter of blood in a lacerations represent a serious danger situation. In an injury situation, inform responsible person to provide making the necessary interventions for stopping the bleeding. Wounds should be cleaned with oxygen water which can be found in first aid cabinet. Wounded must be paid properly and then bleeding part of body should be lifted. The pressure (using thumb) on the wound should be applied with a clean cloth for ten minutes. If the wound split, it should be provided adjacent to the stop of the edge by applying pressure from two sides of the wound. For deep cuts in body, inform to responsible person and call 112 as fast as possible.

Chemical Spill-Clean Up Procedures

Small Quantities
Liquids should be absorbed with paper towels while using appropriate gloves. Wastes should put in a plastic container or a plastic bag and immediately delivered to the laboratory supervisor. Solids should gently swept using brush and scoop. Use mask if it is necessary.

Large Quantities
Large quantity spills should be reported to laboratory supervisor immediately without interfering.

Fire Types

For an effective intervention in the early stages of fire in the laboratory, fire extinguisher should be selected according to the type. Therefore, first, what type of fire extinguisher is suitable for which type of fire should be known.

Caution: Each laboratory has A, B, C and CO_2 (carbon dioxide) extinguishers and fire blankets. Please learn their locations.

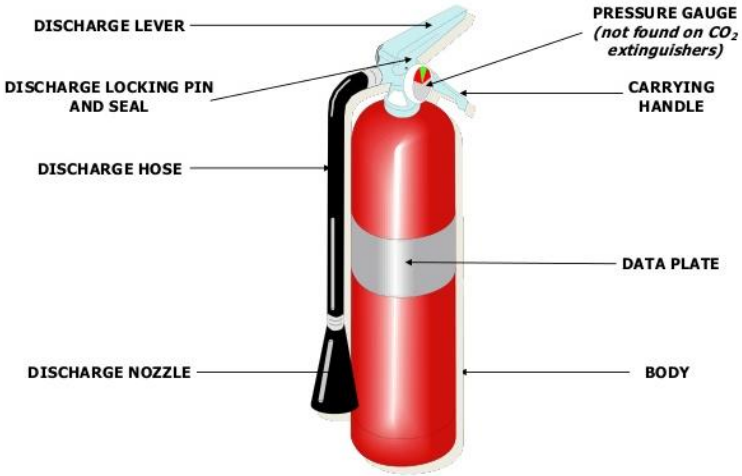
Fire Type	Extinguisher
 **Class A** fires are those fueled by materials that, when they burn, leave a residue in the form of ash, such as paper, wood, cloth, rubber, and certain plastics.	 Water or fire extinguisher appropriate for Class A, B and C type fires. Cut oxygen contact of fire.
 **Class B** fires involve flammable liquids and gasses, such as gasoline, paint thinner, kitchen grease, propane, and acetylene.	 Use foam or A, B, C or CO_2 type fire extinguisher.
 **Class C** fires that involve energized electrical wiring or equipment (motors, computers, panel boxes) are Class C fires. Note that if the electricity to the equipment is cut, a Class C fire becomes one of the other three types of fires.	 Use A, B, C type fire extinguisher or Halon 1301 or Halon 1211.
 **Class D** fires involve exotic metals, such as magnesium, sodium, titanium, and certain organometallic compounds such as alkyl lithium and Grignard reagents.	 Use sand or A, B, C, D type fire extinguisher. DO NOT use water or foam!

Things to Do In Case of Fire

Students	Laboratory directors
• Don't panic • Keep away flammable and explosive materials • Notify the authorized personnel • If a person has received the flame into place, lay down and cover with a fire blanket. Definitely do not use fire extinguishers • If you are not trained to use fire extinguishers to intervene in a fire, move away • Close any open windows and doors • Move away from the Laboratory	• Prevent Panic • Keep away flammable and explosive materials • Please interfering with fire extinguisher. Try to suffocate the flames • If a person has received the flame into place, lay down and cover with a fire blanket • Move away the students from the Laboratory • Run the fire alarm • Close any open windows and doors • Call 110 if it is required • In case of severe burns, call 112 • Notify the department and faculty managers

Fire Extinguisher

CO_2 type | **Fine dust type: A, B, C**



How to use fire extinguisher (PASS)

During an Earthquake

Students	Laboratory directors
• Do not panic. • Stay away from flames, furnaces, gas containers, glassware, and fume hoods • DROP under a desk or sturdy table. Stay away from windows, bookcases, file cabinets, and other objects that could fall. • COVER until the shaking stops. • HOLD ON to the desk or table. If it moves, move with it. • Do not leave the building until the tremors have stopped.	• After earthquake help people to evacuate the laboratory. • Check if laboratory is safe. If not do not allow to anyone to enter the lab. • Inform building managers about the situation of the lab.

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