CHAPTER

TWO

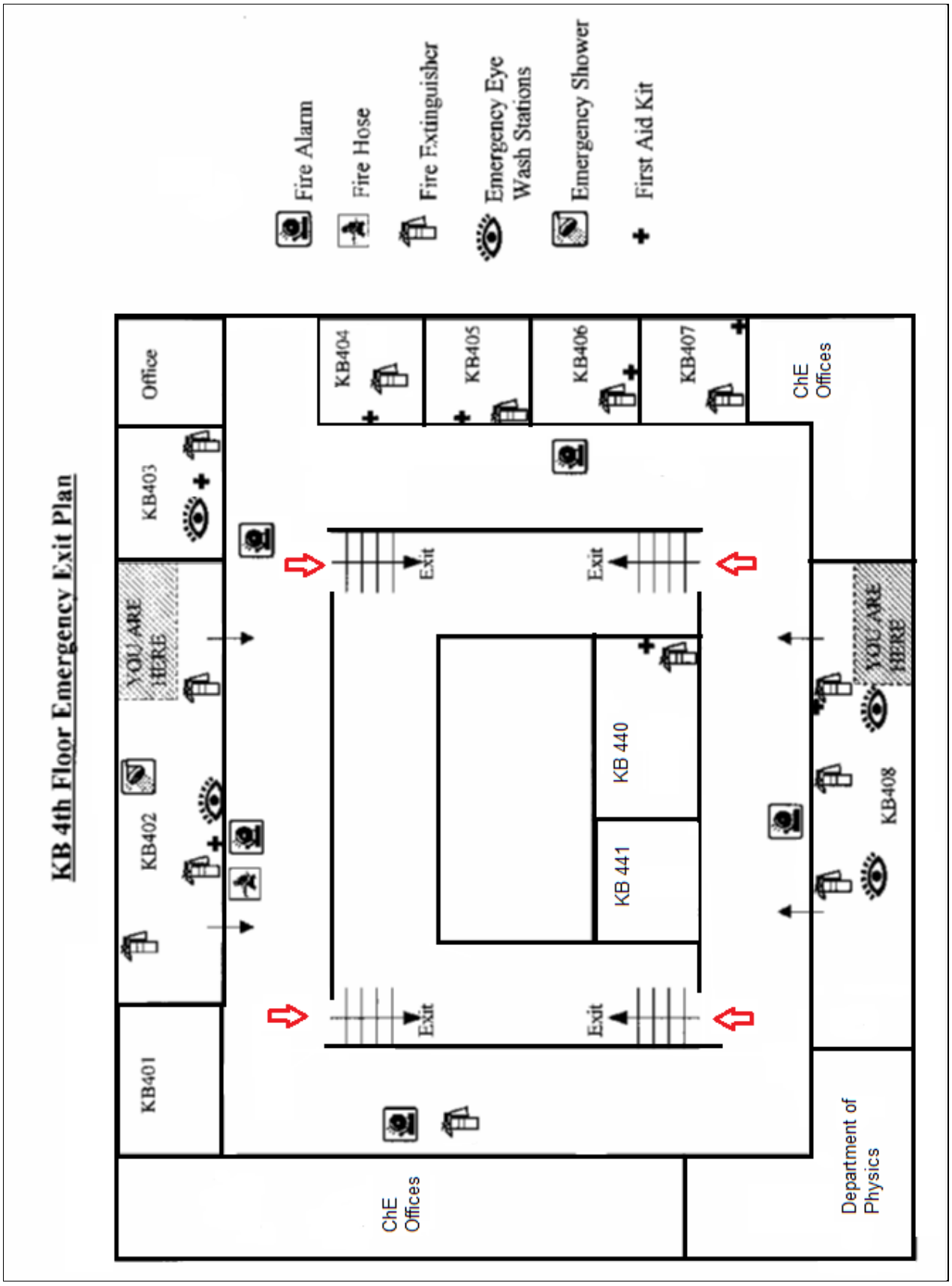
LABORATORY SAFETY

2.1. Actions in Response to Accidents

- ALL accidents MUST be IMMEDIATELY reported to your graduate assistant and the Laboratory Supervisor.
- In an emergency situation, move the person to safety and/or deal with the cause of the accident.
- Students should know the emergency exit plan for ChE Laboratories, provided on the following page.

2.1.1. Emergency Telephone Numbers

Medline Emergency Health	444 12 12
Ambulance	112
Fire	110
Boğaziçi University	
Mustafa Haluk Ayaş Disaster and Emergency Management Branch Manager	6724
Gökhan Börekçi Disaster and Emergency Coordinator	7348
Infirmary	4440
Chemical Engineering Department	
Sinem Uğuz Safety Director/Laboratory Supervisor	6893
Bilgi Dedeoğlu Technician	6929


KB 4th Floor Emergency Exit Plan
Fire Alarm
Fire Hose
Fire Extinguisher
Emergency Eye Wash Stations
Emergency Shower
First Aid Kit
Office
KB403
KB402
YOU ARE HERE
KB401
KB404
KB405
KB406
KB407
ChE Offices
Exit
Exit
Exit
Exit
KB 440
KB 441
KB408
YOU ARE HERE
ChE Offices
Department of Physics

2.1.2. Emergency Response to Common Laboratory Accidents

In the event of an emergency, the guidelines listed below should be followed. Furthermore, in all instances the advice and/or orders given by trained emergency-responding personnel (e.g. physicians, nurses, paramedics, firefighters, and police officers) must also be followed. Additionally, all accidents, no matter how minor, must be promptly reported to a supervisor and to the Laboratory Manager.

Contact to Chemicals with Eyes

Hold eyelids open and flush eyes immediately with clean water using eye wash fountain. Continue rinsing for at least 15 minutes. Always seek medical attention. Remove contact lenses immediately.

Ingestion of Chemicals (Poisoning)

Give large volumes of water to drink. Do not induce vomiting unless specifically instructed to do by trained medical personnel. If the cause of poisoning is known, refer to the specific Material Safety Data Sheet (MSDS). Promptly seek medical attention.

Contact of Chemicals with the Skin

Flush areas exposed to the chemical with a large amount of clean water for at least 5 minutes. Use safety shower if necessary. Remove contaminated clothing and jewelry. If clothing or jewelry adheres to a chemically-burned area of the skin's surface, do not pull it away. Seek medical attention for chemical burns or if symptoms persist.

Inhalation of Chemical Vapors or Smoke

Relocate the person to an area of fresh, uncontaminated air. Loosen her cloth at the waist and neck. Keep her lying down and warm. (Hot coffee or tea may be given, but no other stimulants.) Call for emergency medical help. Artificial respiration may be necessary.

Burns

In the case of *minor burns*, put ice water over the affected area to relieve pain and do not put anything on the burn. For *major burns*, seek immediate medical attention. Apart from actual injury, worse dangers may follow by infection of the burnt skin surfaces and by shock. General shock treatment is to apply warmth to the patient by blankets and hot-water bottles and to keep the head low by raising the foot of the stretcher or bed. Stimulants should not be given without the approval of one of the first aid officers in general accident cases, and but hot tea or coffee, well sweetened, is

invaluable in burn cases and can be given freely.

Electrical Shock

Turn off the current at a master switch before attempting to rescue a person in contact with a live circuit. If this is not possible, use rubber gloves to protect your hands. Before touching the person, stand on a dry mat or take off your coat and stand on that. Call for immediate medical help! In the meantime, if the patient can drink, give him stimulants (hot tea or coffee) to drink. Artificial respiration may be necessary.

Cuts and Dermatitis

Wash *small cuts* with antibacterial soap and water and cover with Band-Aid. In the case of *serious cuts*, stop bleeding by applying direct pressure with a clean towel and obtain proper medical attention. Do not work in the laboratory with open cuts! To avoid dermatitis, i.e., inflammation of the skin, seek first aid people in the case of cuts or irritation due to contact with chemicals. Soap and hot water are the best materials that promote personal cleanliness in order to avoid dermatitis. While oils, gasoline, benzene, acetone and other organic solvents will easily remove certain strains from the hands, they promote excessive dryness of the skin that can result in dermatitis infections. Avoid dipping bare hands in any chemical solution, however weak the solution may be. Use stirring rods and wear protective equipment such as gloves. Similarly do not handle powders or other solids with bare hands, but use some form of scoop.

2.1.3. Response to Laboratory Fire

In case of a fire,

STUDENTS should do the following:

- Move away from danger and call for help.
- Sound the fire alarm and call the fire department.
- Know all the fire escape routes.
- Do not attempt to extinguish the fire unless there is no other choice.

SUPERVISORS should do the following:

- Get all the people OUT first!
- Know all the fire escape routes.
- Close the door of the lab or room, but do not lock it.
- Call the fire department immediately.

If your clothing should catch on fire, follow the instructions listed below:

- Use an emergency safety shower if it is nearby.
- Otherwise, use a fire blanket or the method of "STOP, DROP and ROLL".

  STOP moving around,

  DROP to the ground and hold your hands across your chest,

  ROLL on the ground in a coat or blanket to smother the flames.
- Cool burned areas with clean water.
- Promptly seek medical attention.

Using Fire Extinguishers (Supervisors)

Students should not fight the fire!

1. An extinguisher may be used **by trained personnel** only if all the following apply.
   - The building is being evacuated. (fire alarm pulled)
   - Fire department is called.
   - Fire is small and not spreading.
   - Exit is clear; there is no danger in fighting the fire with your back to the exit.
   - You can stay low and avoid smoke.
   - The proper extinguisher is at hand.
   - You know how to use an extinguisher.

2. Use `buddy system` to have someone back you up when using an extinguisher.
   If there is any doubt about personal safety, leave immediately!
3. Pull the pin on the extinguisher.
4. Stand several feet from fire, depress the handle and sweep back and forth towards the fire.
   Do not walk on an area that you have `extinguished` in case fire reignites.
5. Direct the extinguisher at the base of the flames until the fire is completely out.
6. Recharge any discharged extinguisher immediately. Inform the laboratory supervisor if the pin of any extinguisher has been pulled out.

NEVER ENTER A ROOM!

- That is smoke filled.
- Containing a fire without a back-up person.
- If the top half of the door is warm to touch.

If you any doubts about your ability to extinguish the fire, leave the scene, to slow down the spread of the fire and the resulting smoke, close but do not lock doors as you leave. Before opening any door during your exit, feel the door's surface with the back of your hand to be sure that the fire hasn't spread to the room you wish to enter. If smoke is a problem, you should stay as low to the floor as possible.

Types of Fire Extinguishers:

1. Class A: ordinary materials like burning paper, cardboard, plastics, etc.

2. Class B: flammable or combustible liquids (gasoline, kerosene, organic solvents)

3. Class C: energized electrical equipment (Appliances, switches, panel boxes, hot plates, stirrers, etc) Water is a dangerous extinguisher due to the risk of electrical shock.

4. Class D: combustible metals
   (Magnesium, titanium, potassium, sodium, organometallic reagents)
   Materials that burn at high temperatures and react violently with water and chemicals.

Common Extinguishers:

- Water extinguishers are suitable for class A. But they are very dangerous and not suitable for class B, C, D.

- Dry chemical extinguishers are suitable for class A, B, C, fires. They leave a blanket of non-flammable material which prevents reignition.
    - Type BC: sodium or potassium bicarbonate
    - Type ABC: ammonium phosphate

- CO_2 extinguishers are suitable for class B, C fires. They are good choice for electrical fires and leave no harmful residue.

- Metal/sand extinguishers are suitable for class D fires.

2.1.4. Response to Chemical Spills

In the event of a chemical spill, student safety is the primary concern. Notify persons in the immediate area of the spill, evacuating all students from the area. If the spilled material is flammable, turn off ignition heat sources. Avoid breathing vapors of the spilled materials. Leave on or establish exhaust ventilation if it is safe to do so.

Wear appropriate personnel protection equipment during the actual clean-up procedure. If the spill poses an immediate health or safety hazard which cannot be controlled, evacuate the laboratory and call the department safety office. As a general guideline, acid spills can be neutralized and absorbed with sodium bicarbonate and sodium phosphate mono-basic can be used to neutralize and absorb spills of bases. Activated charcoal, vermiculite, or “Kitty Litter” can be used to absorb spilled solvents. After being absorbed, the chemical and absorbent material should be placed into double plastic bags, and the bags should be sealed, labeled, and placed within functioning fume hood. The supervisor should be notified so that she will arrange, in consultation with the campus Department Safety Office, for the proper disposal of the chemical waste.

General Hazardous Waste Disposal Procedures

Follow the advice given in the appropriate MSDS for chemical-specific waste storage procedures. (See MSDS hang by the experiment). In general, solid non-hazardous chemical wastes can be bagged, labeled “non-hazardous”, and disposed of with the regular trash. Extreme caution, however, must be exercised to ensure that the disposed chemical is, in fact, non-hazardous. If there is any question as to the hazardous nature of a particular chemical, it should be treated as if it were hazardous, and, therefore, it must not be disposed of with regular trash. Liquid non-hazardous

chemical wastes can be poured down the sink, but extreme care must be exercised before disposal to ensure that the chemical is, in fact, non-hazardous. Additionally, dilute the disposed chemical by running tap water down the sink for at least five minutes.

Hazardous chemical wastes should be segregated, labeled, and safely stored for disposal. The supervisor should be notified of the accumulation of chemical wastes. She will arrange for the department safety office to coordinate disposal of the waste chemicals. No neutralization procedure for contained chemical waste should be undertaken without permission.

Disposal of Hazardous Waste at Boğaziçi University

A. It is the responsibility of each person working with chemicals on the BU campus to be aware of the proper means of disposing of the residues of those chemicals.
B. The person generating a hazardous waste is responsible for proper labeling, segregation of the waste material and calling the department safety office regarding pick-up.
C. BU safety office shall be responsible for the collection and disposal of all hazardous wastes generated on the BU Campus.
D. The BU Hazardous waste disposal committee shall provide appropriate containers and labels for hazardous waste disposal to those departments requesting same.
E. Each container of waste submitted for disposal must be labeled with the following information.
    1. Complete and accurate description of the contents of the container using full chemical names and, if known, the proportion of each chemical contributing to the whole.
    2. Name and/or department of the person generating the waste.
    3. Date the material was discarded.
    4. Commercial mixtures, trade-marked products, etc., shall be accompanied by an MSDS if the chemical constituents are not readily identifiable from the name of the product or from the information provided on the product's packaging label.

F. In order to avoid the expense of chemical identification procedures, every reasonable effort shall be made within each department to identify unlabeled or poorly labeled containers before they are submitted as wastes to the Safety Office.

2.2. Safe Handling of General Laboratory Operations

Following are some comments of safety on points of danger which may be commonly encountered in chemical engineering laboratories.

Glass tubing or rod: When breaking off into shorter lengths the glass should be wrapped in a cloth. When inserting it into corks, bungs, or rubber tubing, the end of the glass tubing should first be fire-smoothed to remove sharp edges, lubricated with glycerin or preferably silicone grease. If the latter is used it is possible, months later, to withdraw the tubing easily without any sticking to the bung. The slight force necessary is applied in a longitudinal direction whilst being gently oscillated. Hold the tubing within a few inches of the point of insertion. Hold the cork or bung with the thumb and forefinger against a firm surface. Never hold it against the palm of the hand. Tubing should protrude slightly from stoppers as the holes may otherwise tend to get closed up by action of solvents on the cork or bung.

Electrical Equipment: There is a risk of electric shock in handling any electrical wiring, connections or equipment. Most pieces of apparatus, such as ovens, furnaces, motors and hot plates are made as shockproof as possible but should nevertheless be handled with care. Such apparatus should not be touched with damp hands or when standing on a damp surface. The majority of hazards arise from slipshod assemblies, makeshift connections and high voltages. Connections between apparatus and the grounded power plugs should be made by sufficiently strong and thick cables meeting the specifications of the manufacturers. In the case of ovens, furnaces or other apparatus working at high temperatures, any connections should be made with asbestos covered wire. The use of cotton covered flexible wire should be avoided. Porcelain or bakelite connectors should be used to make all loose or temporary connections. Do not use old or threadbare wire in any assembly and if any insulation shows signs of thinning or cracking, the wire must be replaced. Keep any wiring off the bench tops and away from metal fixtures. Avoid using open knife type switches. Switch off any apparatus before attempting to move, adjust or inspect it. If a liquid is spilled on to an electric motor, stop running it and dry off thoroughly before starting up again. If you have any uncertainties about electrical apparatus consult the senior officer in your laboratory.

Boring corks: Cork borers should be kept sharp and the cork lightly rolled before it is bored. The end of the cork away from the cutter should be pressed against a piece of smooth wood or vulcanized fiber held on the edge of the bench. The borer should be lubricated with glycerin and the cutting done in one direction only, not alternately clockwise and counter-clockwise.

Glass apparatus: Examine all apparatus for defects before any experiments. You are not expected to use cracked, badly chipped or otherwise dangerous glassware. According to how badly it is damaged it should be send to the glassblower for repair or thrown away. Do not put broken glassware back in a cupboard and keep it out of sinks and receptacles provided for general rubbish

or waste paper; special receptacles are provided for glassware damaged beyond repair. Do not place dirty apparatus in the sink, it may be in the way in an emergency.

Gas: Gas taps should be kept closed when the burners are not lit. The rubber tubing which carries gas should be kept in good condition and should not be exposed to the heat of flames or other heating equipment. If a small flame has to be left on, turn off the air so that the yellow flame is invisible in sunlight and can be a source of accident or fire. Make sure that you know where the main gas cock for your laboratory is situated. This should be in an easily accessible place, and either place or either clearly labeled or distinctively colored.

Bottles and other containers: All containers should be labeled in a sufficiently permanent way. Danger often occurs because a bottle has not been labeled at all or because an old label, giving wrong information has been left on. Never leave strong acids or alkalis on the draining boards where they may be readily overturned. Reagent bottles should always be returned to the shelves and stoppered immediately after use. Dispose carefully and separately of contents of bottles which cannot be positively identified.

Gas cylinders:

1. All cylinders must be marked as to content.
2. Keep valve protection cap on, when pressure regulator is not attached.
3. Secure cylinders with straps, chains etc. to prevent them from falling.
4. Do not store full and empty cylinders together.
5. Group cylinders by type of gas & place different groups away from each other. (~7 meters)
6. Protect cylinders from acids, alkalis, water, and oil. Do not store cylinders near sources of heat, ignition, electrical circuits, and direct sunlight. Temperature should not be above 45 ^{o}C.
7. Ground all cylinders and equipment used with compressed flammable gases.
8. Avoid low temperatures. Many steels crack at low temperatures.
9. Do not store corrosive gases more than 3 months.
10. Use the proper regulator for the specific gas.
11. Do not empty a cylinder completely.
12. Avoid rolling or dragging cylinders. Hand-trucks must be used.
13. Never drop a cylinder or allow them to strike each other.

14. Use soapy water (or leak detector) to detect gas leaks.
15. Do not force a regulator to fit the cylinder.
16. Never attempt to repair cylinders, valves and safety devices.
17. Make sure all valves are closed while connecting a regulator to a cylinder.
18. All valves must be closed and pressure should read zero before disconnecting.
19. Store cylinders in well-ventilated areas with basic weather protection and free from contamination.

Hoods (Fume cupboards): Any work which may involve harmful gases should be carried out in a fume cupboard and not on the open bench. Make sure the ventilation is in order before commencing any operation. Many young people come from school with the idea that the main use of fume cupboards is for work where unpleasant odors such as hydrogen sulfite are evolved. It is important that they should be informed early that fume cupboards are used to contain toxic vapors or fumes and that odor is a secondary consideration.

Flasks under pressures greater or lesser than atmospheric: Any flask which is kept under pressure or vacuum will be subject to considerable strain so that Erlenmeyer or other thin-walled, flat-bottomed flasks should not be used. The normal type of suction flask is made of heavy glass to resist this pressure but it is likely to collapse if damaged in any way and therefore suction flasks should be regularly examined to ensure that they are sound. Being of thick glass, they are more liable than thin-walled flasks to crack if hot liquids are poured into them. Never cork tightly a vessel containing hot volatile liquids. If it is necessary to exclude moisture a breather tube should be used or dust can be kept out by substituting a glass wool plug for the cork.

Vacuum desiccators: Considerable damage can be caused by the collapse of large desiccators. They should be exhausted behind safety screens. Do not use a large desiccator if a small one will do. Any desiccator that is seriously scratched should be discarded. Sudden changes of temperature should be avoided and the desiccator should be placed on a rubber mat, or an even surface, to avoid any irregular pressure on the base.

Vacuum distillations: Be sure that vacuum has been released from all parts of the apparatus before disconnecting. Sudden changes of pressure may cause breakage of the glass or spattering of the contents of flasks. Substances distilled at high temperatures must be allowed to cool before air is admitted to the system as most organic substances oxidize at elevated temperatures. For the same reason the conventional air leak is not free from objection and it is better to use a leak to which

nitrogen or carbon dioxide is fed, with a mercury blow off in the connecting line. Do not heat the flask directly but use an air bath to surround it. This gives more even heating and affords some an air bath to surround it. This gives more even heating and affords some protection if breakage should occur. Remember that systems under vacuum are potential sources of explosion if any parts of the apparatus are hit or knocked hard enough to crack the glass. Be sure that rubber stoppers used do not project too far into the necks of flasks or condensers. With softening due to heat they may easily be sucked completely into the flask with disastrous effects.

Supports: If you are using the large flasks be quite sure that they are well supported by the right sizes of clamp, ring-stand or tripod to hold them securely into position. Never support thin glassware such as beakers, clamps attached to the edge or rim. If you have to carry large beakers or flasks make sure that the outsides are free from slippery material and use both hands for carrying, supporting the vessel from underneath, particularly if it contains heavy chemicals.

Transfer and storage of inflammable liquids: Transfer of large quantities, more than a liter, of inflammable liquids from one vessel to another should not be done in rooms where there are flames or electric heaters. Solvent residue receivers should be of proper design; drums or barrels should not be used in the laboratory. Do not place bottles of volatile inflammable solvents in direct sunlight.

Spillage and residues: Mop up at once water or chemicals spilled on the floor. If a corrosive liquid or strong acid is spilled, directions for cleaning up should be obtained from the senior chemist in your laboratory. Residues left on the ringstands or rubber tubing may cause irritation or burns on the hands of the next person to use this equipment. Never leave apparatus containing corrosive materials, particularly sulfuric acid, oleum, alkalis, nitric acid and phenols, at the sinks to be washed. Always rinse vessels out before leaving them.

Solvent extractions: When making extractions and in shaking volatile solvents in separating funnels or other closed equipment, be sure to release the pressure frequently or the stopper may be blown out and the liquid thrown on the operator, or the entire funnel may explode.

Solvent vapors: Large quantities of solvent vapors such as toluene, benzene and carbon tetrachloride should not be breathed. Note this especially when using them for cleaning in a sink where hot water is running.

Benzene: Benzene is as inflammable as light petroleum and is much more toxic. If the vapor can be

smelled, it is being breathed in dangerous quantities. No concentration of vapor, however small, can be considered safe over long periods.

Carbon disulfide: Carbon disulfide is one of the most inflammable of common solvents. The flash point is -30°C. A steam pipe or electric bulb may ignite it. It is also poisonous.

Ethers: Diethyl ether is exceedingly inflammable and the vapor ignites very readily. Electric hot plates are a frequent source of ignition. Diethyl, isopropyl and higher ethers may form explosive peroxides on standing and a small amount should be tested before distilling any quantity. They are best kept in the dark or in a dark colored bottle, containing a spiral of bright copper wire, which has previously been reduced with methanol, in the liquid. Beware of ethers that have been standing for some months, particularly if in ordinary clear glass bottles with a fair volume of air over the liquid. Ether supplies should be frequently tested for peroxides.

Aluminum Chloride: Bottles should be opened with great caution particularly when they have been stored after partial use. The substance is liable both to cause stoppers to stick and to develop pressure by formation of hydrogen chloride which may burst the container. It has blinded workers by discharging explosively from bottles on opening. No quantity greater than ½ kg should be stored on open shelves. In any quantity it is best stored in vessels fitted with "breathers" filled with a drying agent but the "breathers" are liable to choke and should be inspected at frequent intervals.

Bromine: Bottles containing bromine fracture very readily because of the mobility and great density of the element. The vapor or the liquid can cause unpleasant burns, and is poisonous.

Mercury: Mercury poisoning is insidious and produces nervous tremors more frequently than is realized. Metallic mercury has a definite vapor pressure and is toxic if left when spilled or in open vessels. If spilled it should be picked at once by means of a fine capillary tube attached to a filter flask and vacuum pump. If it is necessary to leave a surface of mercury exposed in any vessel there should be a layer of water or other non-toxic liquid on top of the mercury.

Methyl silicate: Methyl silicate should be handled cautiously as its vapor can cause serious eye injury or even permanent blindness.

Sodium and phosphorus: Sodium, which should be stored under paraffin or naphtha, should not be kept near yellow phosphorus which is stored under water, since confusion might lead to very

serious consequences. Inconspicuous fragments of sodium, left when it has been employed either as a reactant or drying agent, constitute a grave danger to anyone cleaning the apparatus. The complete disposal of all traces of the metal should be carried out or arranged by the person who has used it. Sodium residues often become coated with a layer of hydroxide or carbonate and are all the more dangerous on this account. Residues should be destroyed with methylated spirit even when they look as if exhausted.

Sulfuric acid and corrosive liquids: Although everyone with laboratory experience is familiar with the properties of sulfuric acid, it remains one of the most common causes of accident. Fuming sulfuric acid demands particular care. When sulfuric acid is used as a drying agent, usually in a desiccator or bubbler, its presence is apt to be forgotten, and accidents result while cleaning apparatus or cleaning breakages. Acid splashes should always be washed off with water before attempting neutralization with sodium bicarbonate solution. Bottles of ammonia, nitric acid and the like should be opened carefully with a cloth wrapped round the neck and over the stopper before tapping the stopper loose. Special carriers should always be used to carry corrosive materials. Corrosive chemicals must not be handled in large fragile containers (such as 4 lt beakers) without provision of another receptacle to catch the contents in case of collapse. To avoid the consequences of breaking one bottle against another, strong acids must not be stored on the same shelves as strong alkalis.

Rubber tubing and bungs: Certain organic chemicals particularly tar products and oils have a deleterious effect on natural rubber equipment. Tubing and bungs should therefore be kept out of contact with such chemicals, but where this is impracticable use should be made of the oil-resisting polymers.

Pipettes: In using a pipette for any material you should be careful that no liquid is drawn into the mouth. Make sure that the tip of the pipette is kept well under the surface of the liquid. Never pipette cyanide or other poisons. The use of a vacuum line for pipetting such poisons is sometimes recommended but there is always difficulty in cutting of the suction of the right point and it is far better to use a burette or an aspirator bulb. Pipetting of hot solutions and volatile liquids is also dangerous because of the tendency to expel liquid from the tip when pressure develops in the confined air space at the top of the pipette. Corrosive liquids should never be pipetted.

2.3. Safety as you leave

After you complete your work in the laboratory, you have to make sure that you leave behind a safe lab. The following are the few things you have to check before you leave:

- Is your equipment safely turned down?
- Are all heaters, all switches, and all water and fluid flows to your unit turned off?
- Have you turned off the cooling water after the equipment was really cool?
- Have you safely closed all vessels containing volatile chemicals that may have dangerous or hazardous vapors?
- If you are the last group leaving the lab? Is the steam generator turned off? What about the air compressor? Do you notice any water flow?

If you neglect any one of the above, you may be at least partially responsible for any possible hazard in the laboratory. Please do not leave all the checking to the Laboratory Assistants or to your friends. Remember, they may forget too!

2.4. Emergency Treatments for Poisoning

SUBSTANCE AND SYMPTOMS	FIRST AID TREATMENT
ACETYLENE	
Mental confusion, slow breathing, low pulse, vomiting.	Fresh air, warmth and quiet. Oxygen and artificial respiration.
ACIDS	
Acetic: Burns on lips and mouth and yellowing of skin, nausea and vomiting, pain in throat, feeble pulse, diarrhea and collapse.	Wash mouth out with water or 5 per cent sodium bicarbonate and give milk to drink. Keep the patient warm and quiet.
Hydrochloric: Pain in throat and stomach, nausea and vomiting, feeble pulse, diarrhea and collapse.	As for acetic acid.
Hydrogen Cyanide: Throat irritation, dizziness, headache, nausea, pallor, sudden unconsciousness.	Let patient inhale amyl nitrite for 20 seconds. Give milk or starch water and then an emetic. Give oxygen and artificial respiration if necessary. If HCN is inhaled give oxygen and artificial respiration only.
Hydrofluoric: Symptoms as for hydrochloric acid.	Give weak time water and then warm water. repeat three or four times. Keep patient warm and quiet and give a stimulant and artificial respiration if necessary. with burns on the skin, drench with water, remove contaminated clothes, apply compress of ice, alcohol or magnesium sulfate or if possible, dip affected part in such a solution until medical help is obtained.
Nitric: Symptoms as for acetic acid except that burns are white before becoming yellow.	As for acetic acid.
Phosphoric and Sulfuric: As for acetic acid.	As for acetic acid.
ALCOHOLS	
Symptoms vary for different people, some become sentimental, others quarrelsome and others fall asleep. Often there is nausea and vomiting.	Keep patient warm, give large quantities of warm water, followed by an emetic, and then give coffee.
ALDEHYDES	
	Give a tumbler of 0.2 per cent ammonia, followed by milk.
AMMONIUM HYDROXIDE	
Burns on lips, severe throat and stomach pains, diarrhea, pallor and collapse.	Give fruit juice or very dilute acid then milk. Keep patient warm and quiet.
ANILINE, ORTHO or PARA NITRO TOLUENE and ALL NITRO or AMINO COMPOUNDS	
Inhalation of fumes or contact of liquid with the skin may cause serious illness.	If any quantity is spilled on the clothes, a bath should be taken and the clothes changed. If taken by mouth, give quantities of soapy water to drink and apply artificial respiration and oxygen, if possible. If inhaled, remove

	patient to fresh air and give absolute rest. DO NOT GIVE ALCOHOLS or OILS.
BARIUM SALTS	
Nausea and vomiting. Stomach cramp, diarrhea. Pallor and paralysis limbs.	Give Epsom salts and then an emetic. Keep patient warm and quiet.
BENZENE	
Headache and dizzinessy, ringing in ears, diarrhea and burning sensation in eyes, nose and mouth.	If taken orally, give an emetic and also Epsom salts. Give oxygen and artificial respiration if necessary. Hot coffee or tea as stimulant. If the casualty is caused by inhaling benzene vapor, transfer to fresh air, but prevent chilling and give absolute rest.
BROMINE	
Throat and stomach pain, weak pulse, vomiting, pallor, difficult breathing.	If taken orally, rinse mouth with 3 per cent sodium carbonate solution and magnesia in water. Then give milk and a suspension of 10 g of magnesia in 150 ml of water. If inhaled, treat as for phosgene.
CARBON TETRACHLORIDE	
Headache, dizziness, pallor, vomiting, weak pulse.	Mustard and water as emetic. Epsom repeat, then give a stimulant. Do not give oils of fats. Artificial respiration if necessary.
CARBON MONOXIDE, ETHYLENE, ACETYLENE, COAL GAS	
Headache, giddiness, nausea, weak pulse, throbbing of temples, difficult breathing sense of pressure and constriction of chest, loss of muscular power, unconsciousness.	Remove casualty to fresh air, prevent chilling and administer artificial respiration. If respiration is slow or irregular, give oxygen. The patient must not be walked about or given stimulants.
CAUSTIC SODA	
As for Ammonium Hydroxide.	As for Ammonium Hydroxide.
CHLORINE	
Throat and stomach pain, weak vomiting, pallor, difficult breathing.	Remove patient on pulse, stretcher to fresh air. Keep warm and quiet and give absolute rest. If taken orally (as chlorine water), treat as fro bromine. If breathing weak, administer oxygen.
CHLOROFORM	
Weak and slowing pulse, pallor dilated pupils.	Artificial respiration if necessary and give oxygen if available. Jeep warm and quiet.
COAL GAS	
See Carbon Monoxide.	See Carbon Monoxide.
COPPER SALTS	
Nausea and vomiting, diarrhea, signs of collapse and heart failure.	Give white of egg or milk abundantly. Large quantities of water, give potassium ferro cyanide (5-10 grains

	only) in water.
CYANIDES	
As for Hydrogen cyanide.	As for Hydrogen cyanide. (See acids).
ETHER	
As for chloroform.	As for chloroform.
FORMALDEHYDE	
Clammy skin and pallor, nausea and vomiting, burning in mouth and collapse.	Give salt volatile and pure charcoal, egg white and milk and then a stimulant. Keep patient warm and quiet.
HYDROGEN PEROXIDE	
Headache, nausea, vomiting greenish color of face, coma and failure of breathing. This is a serious and usually underrated poison, nearly a toxic as hydrogen cyanide. In strong concentrations, it paralyses the sense of smell so that, it can cause rapid unconsciousness. Effects of weak concentrations are cumulative.	Apply artificial respiration if necessary, for several hours. Give oxygen, if available.
ETHYLENE	
See Carbon Monoxide.	See Carbon Monoxide.
LEAD SALTS	
Headache, nausea and vomiting, blue Epsom line on gums, contricted throat, diarrhea and possibly paralysis.	Mustard emetic, then salts and repeat the emetic, white of egg or milk and a stimulant. Keep warm and quiet.
MERCURY SALTS	
Metallic taste in mouth, nausea and vomiting, thirst, diarrhea, shallow breathing and collapse.	Mustard emetic repeated several times with large quantities of water. Then milk and a stimulant. Keep warm and quiet.
NITROUS FUMES	
Choking, coughing, vomiting, weak pulse, pallor, cyanosis and collapse. Delayed action. A worker may not collapse till the day following exposure.	Complete rest and quietness is essential. Keep patient war. It may be necessary to administer oxygen while waiting for the doctor.
PHENOL	
White burns on mouth and throat, stomach pain, nausea and vomiting, pallor, shallow breathing then fainting.	Mustard or soapy water emetic. Large amounts of water to drink. Repeat emetic several times then give large glass of Epsom salts. Follow with syrup of lime to keep patient warm and quiet. DO NOT give oils.
PHOSPHORUS	
Nausea, vomiting, taste of garlic headache, pallor, diarrhea vomit luminous in dark, collapse.	Give 200 ml of a 0.2 per cent solution of copper sulfate in water, then an emetic of mustard and water twice. Keep patient quiet. Do not give oils, fats or milk.
RED PHOSPHOROUS	
	Mustard emetic repeated several times, then white of egg, keep warm and quiet.
POTASSIUM HYDROXIDE	

As for Ammonium Hydroxide.	As for Ammonium Hydroxide.
POTASSIUM PERMANGANATE	
Nausea and vomiting, cold clammy skin, collapse.	Mustard emetic twice then pure charcoal, egg white, milk and stimulant.
SILVER SALTS	
Nausea and vomiting (black color), throat and stomach pain, coma and collapse.	For silver cyanide, give a tablespoon of 3 per cent Hydrogen peroxide, then whisky of salt volatile as stimulant. For all other silver salts, give large amounts of salt water. Follow both with a mustard water emetic (twice) and then give egg white or milk, and keep patient warm and quiet.
SODIUM HYDROXIDE	
As for ammonium Hydroxide.	As for ammonium Hydroxide.
ZINC SALTS	
Metallic taste, stomach pain and vomiting (tigned with blood), pallor and collapse.	As for copper salts.