1.2: Safety Information

Safety Information

Work in the chemistry laboratory may involve the use of highly flammable solvents, some corrosive and toxic chemicals, and apparatus which, if handled improperly, can cause minor to severe injuries. Before you start an experiment you need to know about all possible dangers of the chemicals and of the procedures involved. Read the specific safety advisories listed for each experiment and review the Standard Operating Procedures and MSDS's.

Relevant information on hazards of various compounds can also be obtained from the library resources for chemistry at the website https://safetyservices.ucdavis.edu/units/ehs/research/safety-data-sheets. For off-campus access, click on VPN first.

Material Safety Data Sheets (SDS or MSDS) provide information on how chemical substances can be safely handled, stored, and used. They indicate health, material, and physical hazards, exposure limits, and precautions. MSDS are produced by every supplier of a substance (if there are many suppliers for a substance there will be many MSDS as well. Select one with a recent issue date). Two good sites are:

MSDS via Chemical Safety.com (https://chemicalsafety.com/sds-search/)

Sigma-Aldrich, MSDS (http://www.sigmaaldrich.com/safety-center.html)

Record all hazard information in your lab notebook before you show up for the laboratory session. The TA's will check that you have done this before you are given the OK to begin the experiment.

Solvents

1. Many accidents that happen in chemical laboratories are caused by burning organic solvents. To avoid similar accidents in the class, you need to keep organic solvents away from any potential ignition sources, such as hot plates, stirrers, electrical equipment and connections, motors, heaters, etc. Before turning on a hot plate or other spark source, always confirm that no flammable materials are nearby. Never heat even small amounts of a flammable solvent with or near a hot plate or other spark source unless a condenser is attached to the vessel in which the solvent is contained. Never pour a solvent in the vicinity of a hot plate or other spark source.
2. If a solvent is spilled, have all workers at the bench turn off their stir plates, hot plates, or other hot or electrical devices. If the spill is very small (for example, a few drops), while wearing protective gloves and avoiding the vapors, soak up the solvent with a paper towel. If possible, wring the solvent from the towel into a beaker in the hood, and transfer it to the appropriate "Waste Solvent" bottle in the hood. **In case of larger spills, or spills of mercury, inform the TA at once.**
3. Flammable solvents with which you may have contact are ether, cyclohexane, benzene, toluene, xylene, alcohols, ethyl acetate, ammonia, acetone, dioxane, etc. If in doubt about a particular solvent, always assume that the solvent is hazardous.
4. Ethyl ether and petroleum ether (b.p. 30-60°) are especially dangerous. Always heat or distill them by heating with a water or steam bath, and collect the distillate in an ice-cooled flask. Carbon disulfide is extremely hazardous. It has been known to ignite even on hot steam pipes.
5. Avoid inhaling organic solvent vapors. Benzene and chlorinated solvents are especially toxic and some of these are carcinogenic. These solvents should only be handled in a fume hood.
6. Whenever acetone is used for cleaning or drying glassware, use it sparingly and away from flames or spark sources such as stir plates, hot plates, or other electrical equipment. Collect used acetone into the organic liquid waste container. Do not put it down the drain!
7. Waste solvents (and other waste chemicals) are to be collected in appropriate containers for environmentally safe disposal. Separate containers are provided for **(1) solid wastes, (2) waste flammable solvents, and (3) waste chlorinated organic solvents. (e .g. $CHCl_3$).**
8. **Advice on gloves from Sigma Aldrich:** Chemically resistant laboratory gloves come in a variety of materials such as natural rubber or latex, butyl rubber, polychloroprene, nitrile, polyethylene, PVC etc. in differing glove thickness and glove style. Each material protects well against certain chemicals but poorly against others. The choice of material and its thickness depends on its resistance to 4 permeation taking into account the factors listed above. Commonly, manufacturers′ literature and performance tables have to be consulted to find this information.

Some Rules for Glove Use:

Select gloves which are resistant to the chemicals you may be exposed to. Consult the relevant Material Safety Data Sheet (MSDS) that may recommend a particular glove material.

Select gloves of the correct size and fitting; gloves that are too small are uncomfortable and may tear whereas overlarge gloves may interfere with dexterity. In some cases, such as use of HF, it may be advisable to select gloves that can be removed very rapidly in an emergency.

Before use, check gloves for physical damage such as tears or pin- holes and for previous chemical damage: this is especially important when dealing with dangerous materials such as HF.

When working, it may be advisable to wash the external surface of the gloves frequently with water.

Some gloves, especially lightweight disposables, may be flammable: keep hands well away from naked flames or other high temperature heat sources. When removing gloves, do so in a way that avoids the contaminated exterior contacting the skin.

- Wash hands after removing gloves.
- Dispose of contaminated gloves properly.
- Do not attempt to re-use disposable gloves.
- Never wear possibly contaminated gloves outside of the laboratory or to handle telephones, computer keyboards, etc.

Safe Handling of Some Other Chemicals

1. Most compounds are toxic, at least to some extent. Avoid breathing their fumes. If they are spilled on the skin or clothing, wash them off with soap and water as soon as possible. Solvents can carry toxic solutes through the skin, so be especially careful when handling solutions of toxic compounds in organic solvents.
2. Certain especially corrosive reagents which give off noxious fumes (e.g. bromine, acetyl chloride, acetic anhydride, phosphorous trichloride, fuming nitric and sulfuric acids, aluminum chloride, chlorosulfonic acid, benzene-sulfonyl chloride, etc.) should be handled in the hoods. Avoid spilling these substances on yourself or on the desk 5 top. They cause painful burns. Bromine is especially bad; if it is accidentally spilled on the skin, wash off the area immediately with water and alcohol and cover it with glycerol.
3. Sodium cyanide and potassium cyanide are very poisonous; a few milligrams are sufficient to cause death. They may even be absorbed through cuts in the skin. Do not allow cyanides to come into contact with acids since the very deadly gas, hydrogen cyanide, is formed. Therefore, use these compounds in a fume hood. Rubber gloves should be worn when handling these compounds, and extreme care should be taken to avoid spilling them on the desk top. Solutions of cyanide in DMSO or other organic solvents are easily absorbed through the skin.
4. Sodium and potassium metals react explosively with water. They are rapidly corroded by the atmosphere and should be stored under kerosene or oil. These metals must not be allowed to come into contact with the skin. They should be handled with dry filter paper or tweezers. Unused pieces of sodium may be returned to the bottle. Avoid all contact between chlorinated solvents and sodium or potassium. Organic solvents containing bits of sodium or potassium metal should never be added to waste bottles. Contact a TA for help.
5. Concentrated acids and alkalies are corrosive to the desk tops, clothing and skin. If any is spilled, dilute it with a large volume of water. If the spill is larger than a few drops, contact a TA. Neutralize acids with solid sodium bicarbonate. Neutralize bases with 3% acetic acid. Sulfuric acid is especially troublesome since drops adhering to the tops of bottles tend to absorb moisture and run down the outsides of the bottles.
6. Mercury and its salts are very toxic. If any is spilled, inform the teaching assistant at once.
7. Never use nitric acid for cleaning laboratory glassware. It may form explosive compounds with organic materials.
8. Explicit directions will be given for the collection or disposal of waste chemicals from all experiments.

Safety Considerations when Handling Apparatus

1. Do not use your hand as a backstop when boring corks. Use another cork or a rubber stopper. Cork borers are very sharp.
2. When inserting tubing or thermometers into bored stoppers, it is wise to take some simple precautions. Very serious cuts have resulted from carelessness. The tubing and stopper should be held by a towel so that if the tubing breaks, the towel and not the hand will receive the impact of the jagged edge. If the tubing does not enter the hole in the stopper easily, the hole may be made larger with a file (if a cork), or lubrication 6 with water, alcohol, or glycerol may help. Hold the tubing close to the stopper. When removing the tubing from the stopper, follow the same technique.
3. After bending a piece of hot glass, be sure to let it cool sufficiently before touching it.

4. Do not support apparatus on books, boxes, pencils, etc. Use large strong wooden blocks or rings. Assemblies with a high center of gravity (as when a reagent is added through the top of a condenser) should be set up and handled with much care.
5. Never begin heating a solution for refluxing or distillation without first adding several boiling stones or chips or ensuring that the solution is being rapidly stirred; otherwise severe bumping may occur and the solution may shoot out the top of the condenser. If you have forgotten the boiling stones and already begun the heating, cool the solution to well below its boiling point before adding the boiling stones.
6. **Completely closed systems must never be warmed, thawed or heated. Pressure buildup may cause explosions.**
7. Distillations must never be carried out to dryness. Small amounts of peroxide or side product residues may explode at the high temperatures which would occur in the distilling flask.
8. Do not use glass stirring rods for breaking up solids. They are liable to break. Use a metal spatula instead.
9. When carrying out extractions using a separatory funnel, always make sure it will hold the stopper and stopcock securely. Otherwise they may pop out and release the possibly corrosive or flammable contents of the funnel over yourself and others. Also, when releasing pressure from a separatory funnel, never point the outlet toward yourself or others in the laboratory.
10. Oil baths and melting point baths can cause severe burns if spilled. Make sure they are well supported.
11. Never evacuate ordinary Erlenmeyer flasks which are larger than 50 ml. They may implode.
12. Dewar flasks, because they are evacuated, implode easily when tipped over or dropped. Make sure the ones you use are wrapped on the outside with friction tape so they will not shower glass around the laboratory if broken

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