

NATIONAL UNIVERSITY OF SINGAPORE
DEPARTMENT OF CHEMISTRY
GENERAL LABORATORY SAFETY INFORMATION AND
INSTRUCTIONS FOR THE UNDERGRADUATE TEACHING LABORATORIES

GENERAL

1. The Chemical Laboratory is a place for serious work where constant attention is required to avoid accidents such as fire, cuts, chemical burns, explosion, chemical poisoning and environmental pollutions, etc. As a general rule, accidents arise from carelessness or ignorance. These notes are designed to indicate some of the more important sources of accidents in a Chemical Laboratory, and how such accidents may be avoided. For obvious reasons, unauthorised experiments and working in the laboratory outside of class hours, without permission, are strictly forbidden.
2. A full version of the Department of Chemistry safety policy can be found at :

<http://www.chemistry.nus.edu.sg/PSSO/>
3. The safety information provided also includes advice on action to be taken in the event of an accident involving a chemical. The related risk assessment forms of experiments are available in the above-mentioned website. You must read these forms and related safety data listing carefully before you start any practical work.
4. Whilst this information is written with specific reference to Undergraduate Teaching laboratories, much of it can be carried forward to later laboratory work including UROPS and final year research projects.
5. If you have any queries or concerns about health and safety in the Teaching Laboratories you should direct these initially to the lecturer-in-charge of the laboratory session, or to the Departmental Safety Committee (chmbox2@nus.edu.sg)

EMERGENCY TELEPHONE NUMBERS

CAMPUS SECURITY	6874-1616
	6516-2365
Department Safety Office	6516-1672
Nearest Hospital (NUH)	6772-5000
Fire/Ambulance	995
Police	999

FIRE ALARMS

The alarms sound if a sensor detects flame, heat or smoke or if the break-glass alarm button is activated.

If you are in a practical class when the alarms sound, the fire warden or lecturer-in-charge will inform you if there is a need to evacuate. Spend a few seconds only in turning off heating equipment or making your experiment safe before leaving the building by the route that has been described to you.

Do not use the lifts. Assemble at the designated area at Carpark 7 for a roll-call. Do not attempt to enter the building until you have been told it is safe to do so.

FIRST AID

Every teaching lab is equipped with First Aid Boxes. In the event of an accident, you must inform the lecturer-in-charge or lab officer for assistance.

LABORATORY SAFETY

Whilst working in the laboratory, it is your responsibility

- To take reasonable care for your own health and safety and for that of others in the laboratory.
- To co-operate in matters of health and safety.
- Not to interfere with, or damage, any equipment provided for the purpose of protecting health and safety.

(MATERIALS) SAFETY DATA SHEETS

Every chemical or pure substance comes with its (materials) safety data sheet (MSDS or SDS), which contains accurate and adequate information on the properties and hazards of the substance. The MSDS or SDS format is in conformance with Singapore Standard SS 586:2008 (2014) - specification for hazard communication for hazardous chemicals and dangerous goods - Part 3: preparation of safety data sheets. A MSDS or SDS should contain 16 sections: identification, hazards identification, composition/Information on ingredients, first-aid measures, firefighting measures, accidental release measures, handling and storage, exposure controls/personal protection, physical and chemical properties, stability and reactivity, toxicological information, ecological information, disposal considerations, transport information, regulatory information, other information. Before you commence any practical work, you must familiarise yourself with the chemical hazards present in the experiment. Each set of experiment has the safety data listing of the chemicals you will be encountering and their associated hazards. The chemical hazards are represented by various hazard symbols using Globally Harmonized System (GHS) classification scheme. All those information are briefly described in the full version of the safety manual. In a typical MSDS, you can also find that a pure substance or chemical has a Chemical Abstracts Service (CAS) registry number or CAS number, which is a unique numerical identifier by CAS.

EMERGENCY EQUIPMENT

You will be shown the location of fire extinguishers, fire blankets, eye wash stations and safety showers and how to use them at the first laboratory session.

In case of a person's clothing catching fire, throw him/her to the floor, and roll him/her to smother the flames quickly. If a fire blanket or a laboratory coat is very handy, it may be used. If near a shower, roll him under and then turn on the water but never let him/her stand up even if you have to be forceful; this procedure prevents injury to the respiratory passages and eyes by the flame which would naturally rise and envelope the head. Never use an extinguisher of any type on a person. The soda-acid extinguisher may damage the eyes whilst the carbon dioxide type may cause severe frostbite.

In case of a large chemical spill on your body or clothes, stand under the safety shower and flood the contaminated area with water. Remove contaminated clothing to prevent further reaction with the skin.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE aims to protect a worker from being exposed to chemicals via the main routes of entry into a person's body, through the nose (inhalation), mouth (ingestion) and eyes or skin (absorption). In teaching laboratories, PPE includes a lab coat, glove and safety glasses or goggles. The use of PPE does not eliminate or reduce the hazard, the user is likely to be exposed to laboratory hazards and PPE is your last line of defence. SAFETY GLASSES MUST BE WORN AT ALL TIMES. Even if you normally wear glasses, safety glasses must be worn over them.

Wear PROTECTIVE clothing (e.g. lab coat) in the laboratory that will provide the maximum body coverage. When carrying out experimental work, you MUST wear a fastened lab coat. Shorts, mini-skirts, halter-/skimpy tops or open-toed sandals are NOT allowed in the laboratory. Lab-coats must be clean. If your lab coat is found to be dirty and/or contaminated with chemicals, you should ask our lab officers to borrow a spare one temporarily. You can then put your lab coat into a sealed plastic bag and send it for specialized cleaning service, if requested. Please do not dump the contaminated lab coat as regular waste to the trash bin because such lab coat is a kind of chemical waste.

In some circumstances, it may be desirable to wear gloves to minimize contacts with hazardous chemicals. Bear in mind that gloves are not resistant to all chemicals and may give a false sense of security. Gloves must be strictly confined to the handling of the chemicals and must be discarded immediately after. They should never be worn out of the lab or on computer terminals, equipment, door knobs, etc. The way to remove the glove is based on the concept "dirty to dirty - clean to clean". The contaminated surfaces only touch other contaminated surfaces. Your bare hand which is clean, will only touches the clean areas inside the other glove. First you need to grasp the outside of one first, then hold the glove with your gloved hand, insert your fingers to the clean area inside the glove, finally turn the glove inside out over the first glove. Finally dump the used glove to the ordinary bins and wash your hands thoroughly.

FUME HOODS

The fume-hood is probably the most important part of protective equipment in the laboratory. Those in the Department of Chemistry are built-in ducted fume-hoods that vent to the outside through outlets on the roof. Fume hoods are designed to protect against hazards from toxic or obnoxious material by dragging a flow of air away from the user and so preventing potentially harmful vapors being inhaled or otherwise ingested. However, the effectiveness of a fume-hood is much reduced if it is open too wide so keep the front sash down as far as is comfortable or possible whilst working and closed when not actively working. Do not put your head into the fume-hood whilst working.

GLASSWARE

Glassware is the most widely used equipment in Chemistry Teaching Laboratory and is also the most common source of injury such as cuts.

- **Glassware.** Before use, check that all glassware is free from cracks, flaws or scratches that may cause it to fail in use.
- **Broken Glasses.** Keep damaged glassware for repair if it has a ground glass joint; otherwise dispose of it in the "Broken Glass" bin. Do not use the ordinary waste bin. Use a broom and dustpan to clear up broken glass. Be especially careful when clearing broken glass from a sink where water can make sharp edges difficult to see. Use tongs to pick out pieces. Dispose of glass "sharps" e.g. pipettes in the proper containers and not in the ordinary waste bins.
- **Assembly.** When fitting two pieces of glassware together, use a small amount of grease if necessary. When fitting tubing to glassware, lubricate the glass with water or glycerol and soften the ends of the plastic tubing by brief immersion in hot water. Do not use excessive force. Do not exert force in a direction that will make the glass snap. Think about where the sharp edge of the glass might go if it does break and arrange your grip accordingly. Wrap the glass in a towel or thick layers of paper tissue. Reduce the leverage on pipettes by holding them near the end when fitting fillers. When removing tubing, use a sharp knife to cut off tubing that does not yield to gentle pressure.
- **Hot glassware.** Take care with hot glass (which looks the same as cool glass). Place hot glass where no one can accidentally come in contact with it before it has cooled.
- **Joints and Stoppers.** Disassemble ground glass connections immediately after use (for vacuum work they should be lubricated before assembly). Do not stopper hot flasks or containers. If a stopper seizes, do not reheat the container to remove it.
- **Vacuum or Pressure use.** Glassware subjected to either pressure or vacuum should be inspected carefully for flaws before use.

SAFETY PRACTICES

- Bear in mind that harmful chemicals may enter your body via inhalation, ingestion, absorption through skin or eyes, and injection. To prevent or minimize potential chemical exposure via all these entry routes while handling chemicals, use appropriate PPE and work inside the well-ventilated fume hood in your lab session.
- Eating and drinking in the laboratory is strictly prohibited. This includes chewing gum.
- Keep long hair tied back and ensure that long or large necklaces are safely tucked away.
- Mobile phones, personal stereos, etc., must be switched off when entering the laboratory. Anything that interferes with your ability to hear what is going on in the laboratory is a potential hazard and should not be used.
- In every lab session, your personal belongings are best kept in lockers outside the laboratory or the designated cabinets under the fume hood, and not left elsewhere they can be contaminated or cause obstruction.
- After reading any warnings and recommendations, use all chemicals carefully and minimally and for volatile chemicals, work in a fume hood. Dispose of solvents properly. Immediately return any chemicals you have used to the shelves for other students to use.
- Keep your work area such as the open lab bench, tables, top-pan or analytical balances, fume hood and instrument rooms, tidy and clean up any spills, including water, on the floor.
- Wash your hands thoroughly when you leave.
- Sign in and sign out on the laboratory attendance sheet.
- Assume you are the only safe worker in the laboratory. Work cautiously and defensively!

OTHER SAFETY ISSUES

- Flammable volatile liquids such as alcohol, ether, etc., must be distilled on a steam bath, never over or near an open flame.
- Chemical burns and poisons absorbed through the skin: A considerable number of organic substances are vesicant which cause painful chemical burns if allowed to come into contact with the skin. If any of these substances is spilt on the skin, wash it off with a liberal amount of alcohol, followed by tap water. Contaminated clothing should be removed.
- Mercury vapour is a cause of chronic poisoning. Mercury should never be left in open vessels and if spilt should be cleaned up immediately. Droplets of mercury can be collected from the bench or from the floor by means of a spill collector.
- Particular care should be exercised in disposing of waste or spilt chemicals and reactions residues. This should be done on the advice of the lab officer or lecturer-in-charge. Rubbish, waste filter paper must not be thrown into the sink but placed in the rubbish bins provided.
- If you dispose of chemical waste solution or liquid, do it in a proper and a considerate way. In our teaching laboratories, there are two types of chemicals waste carboys, namely chlorinated (halogenated) and non-chlorinated (non-halogenated) types. Bear in mind that you never pour any halogenated and/or non-halogenated organic solvent to the sink. Be considerate to our environment and next generations.

SUMMARY

1. Wear safety glasses, full body cover clothing, covered shoes and a fastened lab-coat at all times. Wear gloves if appropriate. Keep long hair tied back.
2. Do not eat or drink or take food into the laboratory.
3. Do not use a personal stereo or any other equipment involving headphones.
4. After reading any warnings and recommendations, handle chemicals carefully inside a well-ventilated fume hood whenever possible.
5. Beware of glass especially if it is broken and then dispose of it safely.
6. Keep your work area tidy and clean up any spills including water on the floor.
7. If the emergency alarms sound, stay calm, make your work safe and leave the building as directed. Report any accidents you have to the lecturer-in-charge or lab officers.
8. Dispose of solvents properly.
9. Wash your hands carefully when you leave.
10. Sign in and sign out on the laboratory attendance sheet.