

Rules and Guidelines on Chemical Safety

1. General rules for chemical laboratories

- a. Only authorized personnel can enter chemical laboratories using their own Staff, Student, or Temporary Card, following guidelines stated on [this website](#).
- b. All laboratory members must familiarize themselves with the locations of emergency equipment/facilities including 1) first-aid boxes, 2) spill kit, 3) fire extinguishers, 4) fire blankets, 5) emergency showers and eye-wash stations, 6) emergency and fire alarms, and 7) [emergency escape routes](#).
- c. Usage of spill kit, fire extinguishers and fire blankets **must be reported** to the technician-in-charge (TIC) or the supervisor-in-charge (SIC) of the laboratory so that the equipment can be replenished immediately.
- d. Smoking, eating and drinking in chemical laboratories are **strictly forbidden**. Do not wear cosmetics, and never store food or drink in laboratory refrigerators.
- e. Tie back or restrain long hair. **Long pants** and **closed-toe shoes** should be worn for protection while working in the laboratory. High heel shoes should never be worn in chemical laboratories.
- f. To avoid contamination, do not wear lab coat and/or gloves outside chemical laboratories.
- g. Disposable gloves are for **single use** only. All used gloves should be disposed of properly. Do not touch door handles, door/light switches, lift buttons, or your personal belongings (e.g., mobile phone) when wearing gloves.
- h. Keep the workplace clean and tidy. All used apparatus and equipment must be cleaned at the earliest possible moment after use. Spillages must be cleaned up immediately, while fume cupboards and benches should be cleaned regularly.
- i. Fume cupboards are not for storage. Do not store excessive equipment or chemical bottles inside fume cupboards. **The TIC may relocate equipment, chemicals, or samples inside fume cupboards that are not in use.**
- j. When using a fume cupboard, keep the sash opening below the maximum working sash height. Pull down the sash when the fume cupboard is not in use. **Do not place power extension units inside fume cupboards.**
- k. Always keep clear the exits, passageways, and access to emergency equipment (i.e., those in Section 1b). Do not leave reagent/solvent bottles on the floor or along aisles.
- l. **Avoid working alone.** If necessary, build a buddy system for your lab mate to check with you from time to time.
- m. Broken glass or unwanted glassware should be discarded into **designated bins for glass and sharps**.
- n. Needles must be discarded into durable plastic sharp boxes instead of cardboard boxes/regular rubbish bin. **Do not recap needles.** Chemical residues on syringes or syringe needles should be removed in a safe manner before disposal.
- o. If you need advice or assistance, please contact your supervisor, Dr. Scott Chan (Engineering Manager, mechanwk@hku.hk), Dr. James Bok (Chemical Safety Coordinator, lbok@hku.hk) or the Safety Office (safety@hku.hk).

2. Chemical purchases

- a. Chemical purchases shall be approved and made by designated person(s) appointed by the supervisor of the research group. Ideally, such person shall be a senior member in the group (e.g., postdoctoral fellow) and also experienced in chemical work. A general practice is to pay attention to bulk order requests from other users in the group (e.g., chemical size exceeding 1 kg or 1 L). He/she shall take note of the points listed in this section before placing orders of chemicals.
- b. Purchase, storage and use of explosives, biohazardous materials and radioactive substances are **strictly forbidden** (see Section 8.1).
- c. A list of dangerous goods that must not be purchased is available on the [Moodle page on safety](#) (Chemical Safety section). It includes gases which are both toxic and oxidizing (e.g., chlorine, nitric oxide). HKU does not hold a license for storing/using these items under the [Dangerous Goods Ordinance, Chapter 295](#) (see Section 8) due to facility limitations.
- d. The following hydrofluoric acid-related reagents should not be purchased as there is plenty of them in the department (*w.e.f. 27 Feb 2026*).
 - i. Hydrofluoric acid (all concentrations, CAS no.: 7664-39-3)
 - ii. Ammonium fluoride (CAS no.: 12125-01-8)
 - iii. Bifluoride (hydrogenfluoride) salts (e.g., ammonium bifluoride, sodium bifluoride, potassium bifluoride, etc.)
 - iv. Solutions containing any of the above species (e.g. buffered oxide etchant (BOE), which contains a mixture of hydrofluoric acid and ammonium fluoride)

Please contact Dr. James Bok (slbok@hku.hk) if you need some.

- e. Some chemicals require a license to be purchased. Users shall check if the chemical purchase is **in compliance with laws of Hong Kong**. Users can search at the “enter keyword(s)” field at <https://www.elegislation.gov.hk> if the chemical is regulated by any of the ordinances listed below:

- i. [Import and Export Ordinance, Chapter 60](#)
- ii. [Pesticides Ordinance, Chapter 133](#)
- iii. [Dangerous Drugs Ordinance, Chapter 134](#)
- iv. [Antibiotics Ordinance, Chapter 137](#)
- v. [Pharmacy and Poisons Ordinance, Chapter 138](#)
- vi. [Control of Chemicals Ordinance, Chapter 145](#) (see Section 9)
- vii. [Ozone Layer Protection Ordinance, Chapter 403](#)
- viii. [Chemical Weapons \(Convention\) Ordinance, Chapter 578](#)
- ix. [Hazardous Chemicals Control Ordinance, Chapter 595](#)
- x. [Mercury Control Ordinance, Chapter 640](#) (see Section 10)

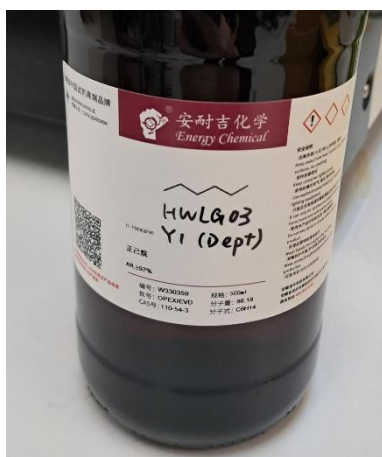
Please contact Dr. James Bok (slbok@hku.hk) if you have genuine need of them.

- f. The amount of chemicals purchased should be kept minimum as needed. Instead of buying in bulk at once, chemicals should be purchased in small quantities and repurchased only when they are used up. This helps reduce the amount of chemicals accumulated in the lab.

- g. Chemicals should be purchased through suppliers which are experienced in chemical trading, as they will be more familiar with the import/export regulations.
- h. Users must not hand-carry any chemical from overseas/across the border.
- i. Users must not buy chemicals or bring chemicals into the lab without approval from the supervisor or the designated chemical purchase approver(s) in the research group.
- j. **Reimbursement for chemical purchases is not accepted**, unless special approval is made by the supervisor **before** placing the order. The user shall bear the risk of law infringement if not ordering chemicals from trusted suppliers.
- k. When a new bottle of chemical arrives in the lab, its storage location **must** be recorded on a **chemical list** (Section 7) as soon as possible.
- l. To facilitate the chemical purchase approval process, users can use the **Chemical Purchase Form**. A template of the form and the guide are available on the [Moodle page on safety](#) (Chemical Safety section).

3. Chemical storage

- a. Chemical bottles should be sealed with parafilm and stored in proper places as recorded on a **chemical list** (Section 7). All chemicals must be stored in labs with access control.
- b. Chemicals should be stored below eye level. Heavier items should be stored on lower shelves. Chemical bottles should be stored upright and not stacked on top of each other.
- c. On each chemical bottle, clearly write down on label 1) **which room**, and 2) **which cabinet/shelf/fridge** that it is stored in. Replace old and fading labels before they become difficult to read. For chemicals stored in shared labs, also indicate **which research group** that they belong to.
- d. Each chemical cabinet/shelf/fridge should have a location label as well. An example of a bottle of chemical owned by the department stored in HWLG03 cabinet Y1 is shown below. The location labels on the bottle and the cabinet need to match the record shown on the chemical list.



Lab location	Chemical name	CAS No.	Size (mass / vol)	Qty	Brand	Location code	Location ref.	Remarks	Ownership
HWLG03	N-Hexane	110-54-3	500ml	3	Energy Chemical	Y1			DEPT

- e. Stock-taking shall be performed at least once per year to make sure that the chemical list accurately reflects the current chemical storage.
- f. Chemical storage should be kept as **low** as possible. Limit the amount of volatile or flammable materials to the minimum required.
- g. Students or staff should clearly label samples prepared by themselves. If the samples are to be kept in the department after his/her studentship or contract ends, the sample container(s) **must** be labelled with 1) component(s) inside, 2) his/her name, and 3) the research group that he/she belongs to.
- h. All laboratory members including the SIC must inform the TIC if new or additional chemicals are brought into the laboratory.
- i. Before opening or buying new bottles of chemicals, use the ones that have been opened first.
- j. Store volatile, flammable (e.g., solvents), and pungent (e.g., thiols) chemicals inside ventilated cupboards.
- k. Provide a means to contain spills (e.g., trays/double containment), especially for the storage of carcinogens and highly toxic chemicals.
- l. Separate incompatible chemicals by physical barriers. For example, the following classes of chemicals are mutually incompatible: acids, bases, oxidizers, pyrophoric, flammables, toxic, and water reactive.
- m. Use only **spark-proof refrigerators** for storing flammable/pyrophoric chemicals at low temperature.
- n. The integrity of chemical bottles should be examined regularly. **If damaged caps or bottles are found, replace them as soon as possible.**
- o. Chemicals, particularly those known to decompose with time, should be marked with the date of receipt or the opening time. Observe their shelf-life limits and dispose of them properly beyond the expiry date, or when their quality turns bad.
- p. Please refer to Section 8 for information about storage of dangerous goods.

4. Handling chemicals

- a. Use the safest chemical at minimal quantity for your experiments.
- b. Read the **material safety data sheet (MSDS)** before handling chemicals. MSDS provides detailed information about the physical, chemical, and physiological properties, as well as handling procedures of the chemical.
- c. If you are not sure about how to handle a certain chemical or reaction, **do not proceed**. Consult a senior member in the laboratory, or those in Section 1o.
- d. Personal protective equipment (PPE, including safety goggles, gloves, lab coat, face shields, etc.) **must be worn** in places where chemicals are handled. Even if you have not started handling chemicals yourself, wearing PPE protects you from potential accidents when others around you are dealing with chemicals.

- e. Isolate hazardous operations, **especially those on a large scale**, in separate fume cupboards or even rooms. Notify personnel in the laboratory before conducting such operations and limit the number of people involved.
- f. Conduct all operations involving hazardous materials (e.g., gas, vapour, fine powder, and airborne particulates) in a fume cupboard or other control equipment (e.g., gloveboxes).
- g. **Heaters must be kept away from wash bottles.** Heat flammable solvents only using electrically heated water/oil baths or heating mantles inside fume cupboards, and **switch off the heaters after use.**
- h. Avoid heating chemicals in a closed system due to the risk of explosion. If such operation is required, assess the risk before doing so. For example, one should know about the boiling point of the liquid and determine if gas will be generated. If necessary, use proper containers that can withstand pressure (e.g., seal tubes), add blast shields, and add a label warning others that a pressurized container is present in the fume cupboard.
- i. Be cautious when opening bottles which may be under pressure (e.g., solvents).
- j. Fine-powdered chemicals (e.g., silica gel, **nano-powders** with submicron particle size) should be handled inside fume cupboards (include weighing). A mask or respirator should be worn. Clean up any dust (on spatula/weighing paper/spillages) with wet tissue (if the chemical is compatible with water). Discard the contaminated tissue by enclosing it in a glove, followed by tying a knot on the glove. Please refer to the [Interim Guidelines on the Safe Use of Engineered Nanomaterials](#) for more information.
- k. Bottles which contain corrosive fumes (e.g., concentrated hydrochloric acid, ammonium hydroxide) must be opened inside fume cupboards. If necessary, cover the bottle with a towel/tissue paper to divert any chemical spray.
- l. Always use appropriate pipetting devices. **Do not pipette by mouth.**
- m. Provide a means in advance for confining spillages shall they occur. For example, perform filtration on a spill tray, and **transport chemical bottles in suitable secondary containers.**
- n. Transport chemical bottles with durable baskets, or trays on a trolley. If they are too heavy to carry (e.g., bottles of solvent), transport them using appropriate trolleys. Make sure that they do not topple during transportation, and do not over-stack them. For example, put the bottles inside a suitable carton box.
- o. Please refer to Section 8 for information about handling dangerous goods.

5. Handling chemical waste

- a. All chemical waste pails and containers must be stored in labs with access control.
- b. Laboratory members must be responsible for properly disposing of chemical waste created by themselves as early as possible.
- c. Students or staff must properly dispose of unwanted chemical samples prepared by themselves before their studentship or contract ends.
- d. Never pour organic waste, chemicals with high aquatic toxicity, or aqueous waste containing heavy metals into the sink.

- e. **Reactive and/or toxic chemicals** must be properly quenched (i.e., made non-reactive and/or toxic) before being discarded.
- f. Dispose of chemical waste into proper pails according to the waste type, such as aqueous alkali waste, aqueous acid waste, halogenated organic waste, and non-halogenated organic waste.
- g. Make sure that the waste you pour into the pail is **compatible** with the content inside. You may refer to the Hazardous Waste Compatibility Chart printed on Appendix VI of the guidelines on [Chemical Waste](#) from Safety Office. If you are not sure or cannot find a suitable waste pail, inform the TIC. Consult the Safety Office if necessary.
- h. **Label the waste type on waste bottles clearly** and empty the bottles into proper waste pails as soon as possible. Do not store excessive amount of chemical waste inside fume cupboards.
- i. Each chemical waste pail should have a **log sheet** which records the contents that have been introduced into the pail, and the corresponding volume/concentration/weight.
- j. Inform the TIC if you find chemicals, samples or waste that are poorly labeled or unknown. Do not dispose of them on your own. Consult the Safety Office if necessary.
- k. Waste pails **must be capped properly** after filling and before transporting.
- l. **Do not fill up chemical waste pails more than 80% full.** Otherwise, they will be damaged due to pressure build-up, and result in leakage.
- m. Surplus or expired chemicals should be segregated, individually packaged and labelled for storage, prior to collection. Please fill in the Labpack Form (Appendix VIII of the guidelines on [Chemical Waste](#)) and send it to Safety Office for further processing.
- n. For more information, please refer to the guidelines on [Chemical Waste](#).

6. Response to accidents and emergency

6.1 General

- a. In case of life-threatening scenarios, dial **999** directly. For other emergencies, immediately call the HKU security control centre (Tel: **3917 2882**).
- b. The **fire alarm** is to be activated for emergency situations requiring the evacuation of the building, including fires, toxic gas release, or chemical accidents that cannot be confined in a room. Activation of the alarm will **automatically** inform the fire station to dispatch the fire brigade.
- c. When the fire alarm is heard and/or seen (flashing lights) **continuously**, evacuate immediately following the steps below:
 - i. Switch off flammable gas taps/valves.
 - ii. Pull down the sash of fume cupboards.
 - iii. Leave the building and go to the assembly point according to the [fire evacuation plan](#). **Do not go back to your office to collect your belongings, and do not use elevators.**
 - iv. Keep away from the building until permission to re-enter the building is given by the fire brigade or HKU security.
- d. The **emergency alarm** (available in some laboratories) is to be activated in the event of a chemical spillage, traumatic injury, splash in eyes, and other accidents. The emergency alarm is a local siren which alerts people on the same floor to warn them against entering the room

where the alarm is activated. Its activation does not yet signal a full building evacuation, and it does not automatically notify the fire station.

- e. In case of accidents, inform the technician-in-charge (TIC) or the staff-in-charge (SIC) of the laboratory, or the Engineering Manager (Dr. Scott Chan, Tel: **3917 8983**) as soon as possible. Phone numbers are available on the safety placard at the entrance of each laboratory.
- f. All accidents and incidents of dangerous occurrences (e.g., fires, chemical spills, injuries) must be reported to the Engineering Manager (Dr. Scott Chan, mechanwk@hku.hk) **as early as possible** for filling relevant report forms.
- g. Near-misses and repeated violation of safety regulations should be reported to TIC or SIC of the laboratory as soon as possible.

6.2 Fire

- a. Prioritize lives and your own safety in case of a fire.
- b. If you see a person on fire, smother the flames with a fire blanket or get the person to a safety shower, whichever is easier and faster.
- c. Tackle fire with appropriate fire extinguishing tools depending on the fire type. You may refer to [this pamphlet](#) or the table below:

Type of extinguisher suitable for extinguishing fire involving				
Type of fire Type of extinguisher	Paper, Textiles, Wood, Plastic	Flammable liquids, Solvent, Oil, Grease	Electrical appliances, Motors, Electrical switches	Size of a typical fire extinguisher
Carbon Dioxide Gas	–	✓	✓	4.5 kg
Water	✓	–	–	9 litre
Dry Powder	✓	✓	✓	5 kg
Clean Agent	✓	✓	✓	1 to 18 kg
Foam	✓	✓	–	9 litre

- d. If your attempt in extinguishing the fire is not successful, activate the **fire alarm** nearby and follow the evacuation procedures (Section 6.1c). Inform immediately the security control centre (Tel: 3917 2882). The fire would have engulfed the room before you get another extinguisher.
- e. If you witness the fire, report to the firefighters or security to inform them the location of the fire, and provide other necessary information (e.g., the type of fire, and the kinds of dangerous goods present in the room).

6.3 Chemical spillage

- a. The individual(s) who caused the spill is responsible for prompt and proper clean-up. Notify everyone in the laboratory immediately when chemical spill occurs and inform the TIC and the SIC of the laboratory.
- b. If the spill occurs inside the fume cupboard, turn off all electrical equipment inside and pull down the sash. Press the **emergency purge button** on the fume cupboard to activate maximum evacuation of air out of it.
- c. If the spill occurs on the open ground (less than 4 L), handle it with the **spill kit** if it is safe to do so. The area should be ventilated by pressing the **emergency purge button** on nearby fume cupboards. Please refer to Section 12 of [Chemical Safety in Laboratories](#) for more instructions on using the spill kit.
- d. If you cannot confine the spill using the spill kit (more than 4 L) or it is not safe to handle, leave the room immediately, then close the door of the laboratory. Activate the **emergency alarm**, followed by calling the Engineering Manager (Dr. Scott Chan, Tel: 3917 8983) or the security control centre (Tel: 3917 2882). If the emergency alarm is not available, alert others nearby, if it is safe to do so, not to enter the room where chemical spillage has occurred.
- e. If the spill cannot be confined in one room, activate the **fire alarm** nearby and follow the evacuation procedures (Section 6.1c). Inform immediately the security control centre (Tel: 3917 2882).

6.4 Skin/eye contact with chemicals

- a. Attend to any people who may be contaminated. Contaminated clothing must be removed immediately.
- b. For skin contact, excessive chemicals on the skin should be wiped off first. The affected skin should be rinsed with water for at least 5 minutes, followed by soap. Consult a physician afterwards at the UHS clinic at HKU, or in a hospital.
- c. For hydrofluoric acid (HF) burns, apply calcium gluconate gel on the affected skin after rinsing it with water for 5 minutes.
- d. For eye contact, flush the affected person's eyes at the eye-wash station for at least 5 minutes.
- e. After preliminary treatment for severe skin contact (e.g., over a large area), as well as HF burns and chemical caught in the eye, inform **immediately** the security control centre (Tel: 3917 2882) or dial 999 to bring the patient to Queen Mary Hospital (the hospital closest to HKU). Inform medical personnel the chemical involved.
- f. Inform the TIC or the SIC of the laboratory, as well as the Engineering Manager (Dr. Scott Chan, Tel: 3917 8983).

7. Chemical list

A chemical list must be kept for recording chemical storage, if any, for each research group. It should be updated whenever there are new chemicals or chemicals being used up. The list shall be shared within the research group such that the group members can access it (e.g., through a sharable link).

An example of a chemical list shown in Figure 1, which can also be found on the [Moodle page on safety](#) (Chemical Safety section). The following information must be included for each entry: **1)** lab location (of which the chemical is stored at) **2)** chemical name, **3)** CAS number, **4)** size (amount of chemical, in terms of mass or volume), **5)** quantity (number of bottles), **6)** brand, and **7)** location code (for identifying which cabinet/shelf/fridge the chemical is stored at).

Chemical List for each supervisor									
Supervisor	Prof. Example								
Optional information			Compulsory information						
SIC	Contact person	TIC	Lab location	Chemical name	CAS No.	Size (mass / vol)	Qty	Brand	Location code
Prof. Example	Dr. Tony Tong	Ms. Mary Ma	HW999	Acetic acid	64-19-7	500 mL	1	Sigma Aldrich	C1
Prof. Example	Mr. Henry He	Ms. Mary Ma	YP999	Methanol	67-56-1	2.5 L	1	RCI Labscan	C1

Figure 1 Screenshot of an example of a chemical list.

For **2)** chemical name, an **English** name of the chemical must be provided, which may be accompanied by a Chinese name or abbreviated name(s). Additional information such as purity, molecular weight, etc., can be written on the **Remarks** column (Figure 2, the optional information section). For **4)** size, it refers to the amount of chemical as stated in the package label of the chemical bottle. The actual amount of chemical remaining in the bottle can be recorded on the **Remarks** column.

For **7)** location code, it should be short enough for ease of identification and labelling. For example, two yellow cabinets in the same lab can be labelled as Y1 and Y2, respectively. A name can be also assigned to each shelf/drawer/box inside each cabinet to record the location of the chemical more precisely on the **Location ref.** column (Figure 2). Please **label on each chemical bottle** which shows the lab location and location code (see Section 3c).

The **Ownership** column (Figure 2) will be useful for shared labs (e.g., HWLG03-2) to record the owner (i.e., which research group) of each chemical. It is highly recommended to label the owner of each chemical bottle in shared labs. Besides, the **Solvent** column (Figure 2) may be used to identify flammable solvents used in large quantities for easier management.

In addition, some chemicals are classified as dangerous goods, and they have a unique UN number and belong to different dangerous goods classes (DG Class). If applicable, both UN number and DG

class are documented in material safety data sheets (MSDS). **UN number, DG Class and MSDS link** are strongly recommended to be included on the chemical list, as such information may be requested by the Safety Office for auditing purposes.

Location ref.	Remarks	Ownership	Date	Stock-taking	Stock-taking notes	Solvent? (Y if yes)

UN number	DG Class	MSDS link	Lot/Batch number	Expiry Date	Input "Y" if it will be disposed

Figure 2 Optional information to be included on the chemical list.

The chemical list template also contains columns (Figure 3) for inputting additional information for the Labpack form provided by the Safety Office for disposing surplus/expired chemicals (Appendix VIII of the [HKU Chemical Waste Policy](#)). As requested by the chemical waste collecting company, physical state of the chemical (S: solid, L: liquid, M: mixture/sludge), and the type of container/lid/cap (G: glass, P: plastic, M: metal) need to be provided. Moreover, it is highly recommended to provide the CAS number of the chemical in the Remarks field in the Labpack form.

Extra information for Labpack form (for disposing surplus/expired chemicals)						
Chemical formula	Physical state (S/L/M)	Container size (in mL)	Container type (G/P/M)	Lid/Cap Type (G/P/M)	Chemical amount (in g or mL)	Remarks

Figure 3 Extra information for the Labpack form.

8. Dangerous goods

8.1 General information

Dangerous goods are classified into Classes 1–9 as shown in Figure 4. You may refer to [this pamphlet](#) for more details. **Purchase, storage and use of Class 1 (explosives), Class 6.2 (biohazardous materials) and Class 7 (radioactive substances) are strictly forbidden in this department.** Biohazardous materials include all viable infectious (e.g., medical/clinical sample or waste), pathogenic (e.g., bacteria, viruses, parasites, fungi), or toxin-producing agents, prions, biologically derived toxins, or nucleic acid constructs that **have the potential to affect the health** of humans, animals, plants, or the environment (University of California, Davis, 2008; HKU Safety Office, 2014).

As prescribed in the [Dangerous Goods Ordinance, Chapter 295](#), the Fire Services Department of Hong Kong regulates the manufacture, conveyance, storage, and use of dangerous goods of Classes 2, 3, 4, 5, 6.1, 8 & 9. The quantity of chemicals in each laboratory should be kept as **LOW** as justifiable according to their usage. **Chemicals in excessive amounts, even not exceeding the legal exempt quantity, may be relocated to designated dangerous goods stores managed by the Safety Office.**



Figure 4 Classification of dangerous goods.

8.2 Class 2 dangerous goods (compressed/liquified gases)

According to the Safety Office, HKU currently does not hold a license for gases which are **toxic and oxidizing** (Class 2.3 gas with subsidiary hazard 5.1), and gases which are **toxic and oxidizing and corrosive** (Class 2.3 gas with subsidiary hazards 5.1 and 8), such as chlorine (UN 1017) and compressed nitric oxide (UN 1660). Purchase, storage and use of such gases **are forbidden**.

Some important safety measures and precautions for handling liquified gases (e.g., liquid nitrogen) and compressed gases are as follows:

- Liquified and compressed gases should be handled and stored in **well-ventilated areas**.
- Use only cryogenic containers for carrying liquified gases. For example, a dewar flask should be used to carry liquid nitrogen instead of a coffee thermos.
- Liquified gases must not be stored in a tightly sealed container due to high explosion risk.
- Wear **face shield, cryo-gloves** and **cryo-apron** when handling liquified gases. The gloves and apron should be certified to provide sufficient thermal insulation at cryogenic temperatures.

- e. Beware of **icing of the main valve** of the liquified gas tank during gas transfer, which the valve may become difficult to be operated.
- f. Beware of sudden gas venting from the safety valve of a liquified gas tank due to pressure buildup.
- g. Gas cylinders should be individually strapped at two-thirds of cylinder height to a firm support (e.g., wall mount, cylinder rack).
- h. Gas cylinders should be transported with a cylinder trolley, but not rolled or dragged. The regulator must not be attached to the cylinder during transportation.
- i. Check carefully of the type of screw of the gas fittings and regulators (e.g., right-handed/left-handed screw, metric/imperial/BSP/NPT/G type of threads, inch/mm diameters). Incompatible fittings might lead to gas leakage.
- j. Standard operating procedures (SOP) for replacing gas cylinders can be found on the [Moodle page on safety](#) (Chemical Safety section).
- k. For more information, please refer to [this document](#) (sections 9 and 10) from the Safety Office.

8.3 Class 3 dangerous goods (flammable liquids)

Special attention shall be paid to this class of dangerous goods, which include many organic solvents that are used in large amounts. The Safety Office has set the storage limit of Class 3 chemical in each laboratory to be **20 L of any one substance**, and **40 L in aggregate**. Some important safety precautions are as follows:

- a. Solvents must not be exposed to direct sunlight. Keep them away from open flames.
- b. Solvents bottles must be **stored inside designated fire-resistant and vented cupboards** after use, and they should be placed on suitable spill trays.
- c. They must not be placed inside fume cupboards for long-term storage, kept on the floor, or stored in the corridors.
- d. If flammable liquids need to be stored at low temperature, store them in **spark-proof refrigerators** only.
- e. Transfer of solvents should be performed in well-ventilated areas. If the solvents are toxic or carcinogenic (e.g., chloroform, benzene), transfer them inside a fume cupboard.
- f. Solvent drums (20 L) can be placed on a spill tray (>20 L in capacity) on the floor if there is insufficient space in vented cupboards for their storage. When transferring solvents from drums to bottles, use proper siphon pumps instead of pouring directly, and place the receiving bottle(s) on a spill tray.
- g. Ethereal solvents (e.g., diethyl ether, tetrahydrofuran (THF), 1,4-dioxane) can form explosive peroxides upon prolonged storage. Check the shelf-life of these solvents and be cautious when opening old bottles of them. Discard them beyond the expiry date. Moreover, avoid long-term storage of distilled ethereal solvents as stabilizers will be removed upon distillation.

8.4 Class 4, 5, 6.1, 8 & 9 dangerous goods

Obtain/store the smallest quantity of these chemicals that would be sufficient for your work and opt for less hazardous alternatives whenever possible. Before handling them, please make sure you have reviewed the **MSDS, safety precautions, standard operating procedures (SOPs), and proper method of disposal/handling spillages**.

8.4.1 *Class 4 (flammable solids, air and/or water-reactive chemicals)*

Some of them require handling with air-free techniques, especially those liable to spontaneous combustion (Class 4.2 dangerous goods) and generation of flammable gases upon reaction with water (Class 4.3 dangerous goods). Handle them in gloveboxes if necessary.

8.4.2 *Class 5 (oxidizing agents)*

They are incompatible with many organic compounds and acids. Therefore, they should be separated from other chemicals (e.g., by using a secondary container). Special attention shall be paid to perchloric acid and perchlorate salts as they are notoriously explosive. Operations involving heating of concentrated perchloric acid must be performed in special fume cupboards with water wash-down facilities. Besides, strongly acidic and oxidizing solutions such as **aqua regia** and **piranha solution** are extremely hazardous, and they must be handled within fume cupboards. Unspent solutions of them **must not be stored** and must be quenched properly.

8.4.3 *Class 6.1 (toxic chemicals)*

Examples of this class include cyanides and water-soluble barium salts. It is recommended to store them inside a toxic cabinet which can be locked and managed by a senior member in the laboratory. A logbook shall be kept for recording the amount of toxic chemicals used each time.

8.4.4 *Class 8 (corrosive chemicals)*

Acids and base should be **separately** stored. Acids should be stored inside **plastic** cupboards, or at least on a plastic spill tray. Acid-incompatible chemicals, such as bases, fluoride and cyanide salts, must not be stored inside acid cupboards. For chemicals that produce acidic fumes upon reaction with moisture (e.g., acyl chlorides, silyl chlorides, thionyl chloride), please contain the chemical bottles in a zip lock bag.

Concentrated acids, as well as volatile acids and bases, must be handled inside fume cupboards, including opening bottles of them. Concentrated acids (except hydrofluoric acid) should be transferred using glass pipettes instead of syringes connected to metal needles. For dilution of acid/base, always add concentrated acid/base to water, but not the other way around. Perform acid/base dilution or neutralization slowly under an ice-water bath, as these processes are exothermic (i.e., involving heat generation).

8.4.5 Hydrofluoric acid

To ensure safety, all bottles of hydrofluoric acid (HF) in the department must be stored in a locked cabinet in the departmental wet lab. Users must be trained and seek for approval from their supervisor before they can conduct experiments with HF. Everybody inside the laboratory must be notified when HF is being used, and it must be handled inside fume cupboards under supervision by another experienced laboratory member. For manipulations which can generate HF (e.g., mixing fluoride salts with acids), the user should also adhere to the protocols for handling HF.

When working with HF, mid-arm length **neoprene gloves**, neoprene apron, lab coat, face shield, and safety goggles should be worn. These PPEs are available at the departmental wet lab. **Never handle HF with glassware**, and double-check the container's compatibility with HF.

According to the Safety Office, spillages of HF can be handled using the absorbent pads supplied in spill kits available in laboratories. On the other hand, HF causes wounds on the skin which are difficult to heal, and **calcium gluconate gel** should be used for emergency handling of HF skin burns. For additional information about handling HF, you may refer to the [guidelines](#) provided by Caltech.

If you have further questions about dangerous goods, please consult those in Section 1o.

9. Control of Chemicals Ordinance (Chapter 145)

As prescribed in the ordinance, a license is required for importing, exporting, possessing and manufacturing certain chemicals which can be used for making dangerous drugs or psychotropic substances. The ordinance and the list of chemicals can be found [here](#). Please pay special attention to chemicals listed in **Schedule 1** and **Schedule 2** of the ordinance.

Do not purchase, store, or manufacture any of the controlled chemicals included in Schedule 1 or Schedule 2 on your own. Note that the salts of these substances are also under control. Offenders to the Control of Chemicals Ordinance are liable to a fine of \$1,000,000 and to imprisonment for 15 years. Please inform the TIC or the SIC if you find any **Schedule 1** or **Schedule 2** chemical in your laboratory. If you have further questions, please consult those in Section 1o.

10. Mercury Control Ordinance (Chapter 640)

The ordinance regulates the import, export, keeping and use of mercury, mercury mixtures and mercury compounds, which are classified into **Part I** and **Part II** Chemicals. **Part I** Chemicals include i) elemental mercury, and ii) mercury mixture having a mercury concentration of at least 95% by weight. **For importing Part I Chemicals** for laboratory-scale research or used as a reference standard, please make sure that the total quantity of mercury imported in the shipment **does not exceed 250 g**.

Part II Chemicals include i) elemental mercury, ii) mercury mixture having a mercury concentration of at least 95% by weight, and iii) mercury compounds. They can be only used for laboratory-scale research or as a reference standard. **Please make sure that the total amount of Part II Chemicals kept by each research group does not exceed 500 g.**

For more details and information, please refer to the following websites:

https://www.epd.gov.hk/epd/english/resources_pub/resources_subject/mco.html

<https://www.elegislation.gov.hk/hk/cap640>