

SOP for the Safety measures to be followed in the lab

1. Students must be alert and attentive at all times in the lab. Follow all written and verbal instructions. Never hesitate to ask your doubts.
2. Report all accidents, injuries or breakage to the teacher in- charge or lab attendant immediately. Also, report any equipment that you suspect is malfunctioning.
3. Avoid wearing overly-bulky or loose-fitting clothing, or dangling jewellery that may become entangled in your experimental apparatus. Pin or tie back long hair.
4. Use goggles:
 - a. when heating anything.
 - b. when instructed to do so.
5. No cell phone or ear phone usage in the active portion of the laboratories, or during experimental operations.
6. Do not eat, drink or smoke in the laboratory.
7. Try to be fully aware of what is going on elsewhere or around you in the same laboratory.
8. Know the location of all exits for the laboratory and the building.
9. Know the location of the alarm and fire extinguishers and how to operate them.
10. Know the location of safety showers and where eye-washes and safety aid boxes are kept.
11. Know the location of the nearest telephone that can be used during an emergency.
12. Never work alone in the laboratory. If you must work alone, make someone aware of your location and arrange him/her to call or check on you periodically.
13. Perform only those experiments which have been assigned to you by your teacher/guide. Do not perform unauthorized experiments. Get the permission of teacher in charge before you try something original.
14. Do not use cracked or broken glassware, check glassware before using it.
15. Wear protective clothing (coat) in the laboratory. Do not use these coats out of the laboratory because this clothing may have become contaminated.
16. Be careful when working with apparatus that may be hot. If you must pick it up, use tongs, a wet paper towel, or other appropriate holder.
17. If a thermometer breaks, inform the teacher/lab attendant immediately. Do not touch either the broken glass or the mercury with your bare skin.
18. Know the potential hazards of the materials and equipment with which you work with.
19. Protect your eyes from all types of fumes and chemicals. Wear safety glasses or goggles at all times. Minimize all chemical exposures. Never leave containers of chemicals open.

20. Handle all chemicals with care and read labels before attempting to get them.
21. Do not touch any of the chemicals with your hand. Use a spatula to get solid chemicals.
Use gloves whenever necessary.
22. While heating a test tube, ensure that its mouth points away from yourself or anyone else.
23. Never look directly into the mouth of a flask containing a reaction mixture.
24. Avoid inhalations of gases or fumes. Gases like H_2S are highly poisonous. If the odour of any gas is to be noted as a part of the experiment, gently waft (fan) a little of it towards your nose with your hand, keeping your face at a safe distance; do not stick your nose in the container to inhale.
25. Do not ever taste any chemical. Remember that many chemicals are poisonous. Never consume and/or store food or beverages or apply cosmetics in areas where hazardous chemicals are used or stored.
26. Handle the reagent bottles with extreme caution. Reagents like conc. H_2SO_4 , are extremely dangerous chemicals and can cause serious burns and injuries to any part of your body with which they come into contact.
27. Do not add water to conc. H_2SO_4 . For diluting H_2SO_4 add the acid slowly to water with stirring.
28. Carry out all experiments involving toxic solvents and reagents in a fume cupboard provided with an exhaust system.
29. Report all accidents and injuries, however small, immediately to the Teacher-in charge so that first aid can be applied immediately. [A description of the first aids that should be given for burns, cuts, inhalation of gas, eye-accidents and poisoning is given in the next section.]
30. Turn off burners or electrical equipment when not in use.
31. Clean your work area and equipment before you leave the laboratory.
32. After your work is over, store away your apparatus carefully either in a cupboard or in the storeroom.
33. Wash exposed areas of the skin prior to leaving the laboratory.

Standard Operating Procedure

Instruments

1. Magnetic Stirrer with Hot plate

- Ensure that the instrument is clean and free from any dust particle.
- Connect the main supply of the instrument.
- Switch 'on' the instrument.
- If required adjust the required temperature by temperature 'knob'.
- Keep the beaker (Having Sample) on the plate and wait for heating.
- Deep the magnetic stirrer in a beaker and start the stirring by the knob.
- Stirring speed should be control by 'knob' to slow, middle and high.
- Switch 'off' the instrument after completion of work

2. Colorimeter

- Insert plug in the socket.
- Switch on the instrument at least 15 minutes before use.
- Ensure to keep water blank before switching on the instrument.
- Set the required wavelength.
- Select %T using the knob and adjust to 100%.
- Switch the knob to O.D which should be zero.
- Clean the cuvettes after use.
- Make an entry in the log book.

3. Centrifuge

- Turn ON the electrical power to the centrifuge.
- Load the centrifuge tubes into the rotor.
- Close the lid of the centrifuge.
- Select the required time by adjusting the timer knob.
- Select appropriate speed with the speed controller.
- Wait next to the centrifuge until it has reached the desired speed and has not stopped due to it being imbalanced.
- Wait until the centrifuge run has being completed.

- Unscrew the rotor lid and remove the samples.
- Switch off the instrument after use.

4. UV Inspection Cabinet

- Ensure the area is clean.
- Switch on the main power supply.
- Switch on “VISIBLE LIGHT” marked switch.
- Open the door.
- Keep the TLC plate in the chamber.
- Switch off “VISIBLE LIGHT”.
- Close the door.
- Switch on the required UV Light (i.e. Shortwave (254 nm), long wave (360 nm)).
- Visualize the sample from outside the chamber through glass provided to visualize the sample inside the chamber.
- After visualizing the sample note down the observation, switch off the UV light and remove the plate from the chamber.
- Take care that any part of the body should not come in direct contact with UV light.

5. Ultrasonicator

- Ensure that the area and instrument are clean.
- Fill the purified water in both on the optimum level.
- Switch “ON” the main power supply and press “POWER” button to “ON”.
- Slowly keep the lower tray into the bath.
- Select the SONIC by MODE button and control the strength of sonic.
- Select “TIME” by “MODE” button and set the operating time by “UP/DOWN” button.
Select “TEMP” by “MODE” button and set the temperature by “UP/DOWN” button.
- After feeding all parameter, push the “START/STOP” button to start cleaning.
- When the items are removed from the sonicator, press “START/STOP” button and “POWER” button.

6. Hot air oven

- Ensure that the instrument and its surroundings are clean.

- Load the material to be sterilized or dehydrogenated or dried, on the trays provided within the oven, close the door and tighten it with the clamps provided.
- Connect the plug to the power source and switch on the power.
- Switch on the mains of oven.
- LED lamp for the power indicator will glow.
- Switch on the fan of the oven.
- Press and hold the red button given in the temperature control box which will display the pre-set temperature.
- Set required temperature (250o C for depyrogenation and 100 oC for drying) using COURSE and FINE temperature adjustment knobs.
- Rotate the arrow mark of energy regulator knob from OFF position to LOW, MEDIUM or HIGH position according to the temperature requirement and urgency, to reach the required temperature. 10) Heater will start, the LED for heating will start glowing and the temperature rises steadily to the set temperature.
- Note the time at which the set temperature is reached
- 12)Consider the Hold time from the reach of set temperature for depyrogenation cycle.
- 13) After completion of sterilization and depyrogenation or drying, switch off the MAINS and the power source.

7. Vacuum oven

- Switch on the vacuum oven
- Adjust the required temperature by adjusting temperature knob.
- Start boosting heater
- After attending required temperature keep the dish and lid separately inside the oven. Close tightly the oven door.
- Adjust the required vacuum as specified in the monograph / standard test procedure with the help of vacuum pump connected to the vacuum line of the oven.
- Allow holding the specified temperature & vacuum till constant weight.
- After completion of specified time of the test release the vacuum slowly and switch off the vacuum oven.
- Allow coming down the temperature below 40°C.

Standard Operating Procedure

Nanomaterials

Section 1 – Laboratory Information

Building/Room(s) covered by this SOP:	Chemistry lab
Department:	Chemistry
Laboratory Experiment	Synthesis of nanomaterials

Section 2 – Scope

This standard operating procedure (SOP) is intended to provide guidance on how to safely store, handle, use, and dispose of nanomaterials in chemistry laboratory. Nanomaterials are defined as the materials having at least one external dimension, or an internal structure of 100 nm or less. They show properties different from bulk samples of the same material. The synthesized nanomaterials can be of different sizes and shapes and their physical appearance can be powder, colloid/suspension, or supported over a solid matrix. In any case small amount of dry samples (less than 50 milligrams) will be handled.

Section 3 – Potential Hazards

The primary routes of exposure for nanomaterials are inhalation, skin contact, and ingestion. Nanomaterials prepared or used in laboratory experiments will likely be in one of three forms: a powder, in colloid/suspension, or in a solid matrix. The physical form of the nanoparticle will greatly influence the exposure potential. The inhalation exposure risk increases from nanomaterials in a solid matrix to nanomaterials in suspension to aerosolized nanomaterials.

Some common tasks that present some potential for exposure include:

- Working with nanomaterials without gloves

- Working with nanomaterials in suspension/colloid during pouring or mixing where stirring is involved
- Handling nanoparticle powders
- Washing glasswares used to synthesize/store nanomaterials
- Cleaning up spills or waste materials
- Mixing/powdering nanomaterials

Section 4 – Exposure Controls

The factors that will influence the exposure risk include the physical form of material, the quantity of material used or generated, and the frequency and duration of exposure. Every effort should be made to avoid releasing nanomaterials into the air.

Engineering Controls

If aerosols may be produced, nanomaterials (and any suspensions of nanomaterials) must be handled in a chemical fume hood. Aerosols may be produced during any open handling of dry powder, and during open or pressurized manipulations of suspensions.

Administrative Controls:

Some administrative controls that should be considered include:

- Providing known information to staff and students on the hazardous properties of the nanomaterial precursors or products
- Education of staff and students on the safe handling of nanomaterials

Hygiene Measures: Avoid contact with skin, eyes, and clothing. Wash hands before breaks and immediately after handling the nanomaterials.

Hand Protection: Wearing nitrile gloves is recommended for low volume measurements. Use proper glove removal technique to avoid skin contact.

Eye Protection: Properly fitting safety glasses or chemical splash goggles are required.

Skin and Body Protection: Laboratory coats must be worn and be appropriately sized for the individual and buttoned to their full length. Laboratory coat sleeves must be of sufficient length to prevent skin exposure while wearing gloves.

Respiratory Protection: Nanomaterials should be in conjunction with proper engineering controls, such as a chemical fume hood. However, if nanomaterials must be used outside of a chemical fume hood, respiratory protection may be required.

Section 5 – Special Handling and Storage Requirements

- Avoid contact with skin, eyes, and inhalation.
- Avoid handling nanomaterials in the open air
- Store dispersible nanomaterials, whether suspended in liquids or in a powder form in closed containers whenever possible. Store in a cool, dry, and well-ventilated area.
- Clean up the work area at the end of each work with wet wiping methods. Cleanup should be conducted in a manner that prevents staff and students coming in contact with nanomaterials.

Section 6 – Spill and Accident Procedures

All spills involving nanomaterials should be treated like a hazardous material spill and cleaned up immediately. Immediately evacuate area and ensure others are aware of the spill.

Section 7 – Waste Disposal Procedures

Since the toxicology and environmental fate of nanomaterials is still largely unknown, all nanoparticle waste (solid material and liquids) should be conservatively managed as hazardous waste. This also includes any debris (i.e. vials, plastic, cloths) that has become heavily contaminated with nanomaterials. All nanoparticle waste must be placed in an appropriate container and labelled.