SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE AND M.H. MEHTA SCIENCE COLLEGE, PALGHAR

Standard Operating Procedure

Department of Chemistry

Prepared by

Department of Chemistry

General Guidelines

Index

Departmental Laboratories

Sr. No.	Laboratory Name / Number	Floor	Area in Sq. Ft.
1	Physical Chemistry Laboratory	Ground	460
2	Undergraduate Lab-1	Ground	1050
3	Undergraduate Lab-2	Ground	1050
4	Instrumentation Lab 1	1st	1050
5	Postgraduate and Research Lab	1st	1050
6	Postgraduate Lab-1	2nd	700
7	Postgraduate Lab-1	2nd	700
8	Analytical Chemistry Lab	2nd	460
9	Physical Chemistry Lab	2nd	460

List of Instruments in Laboratories

Sr. No.	Name of the Instrument	Number
1	PH Meter	09
2	Conductometer	11
3	Potentiometer	07
4	Colorimeter	03
5	Visible spectrophotometer	03
6	UV-visible spectrophotometer	02
7	Flame photometer	01
8	Conductometer with TDS	01
9	Kal fisher instrument (Autotitrater)	01
10	Dissolution tester	01
11	Melting point apparatus	02
12	Voltameter	01
13	UV chamber	01
14	Digital balance	08
15	HPLC	01
16	Distillation unit	02
17	Incinerator	02
18	Gas sensing unit	01
19	Heating mental	15
20	Oven	05
21	Vacuum system	01

Sr. No.	Name of the Instrument	Number
22	Ion exchanger	01
23	Digital balance	08
24	Sonicator	01
25	Muffle furnace	01
26	Shaker	01
27	Thermostat	01
28	Magnetic stirrer	02
29	Oil bath	01
30	Vacuum oven	01
31	Autoclave	01
32	Deep freezer	01
33	Microwave	01
34	Shaker	01

General Instructions

These instructions are help full for students, faculty members and laboratory staff while performing practical in the department of chemistry laboratory. Below instructions are additional for smooth conduct of practical. Students performing the chemistry practical are required to follow further instructions strictly:

1. Wear apron before entering the lab.
2. Students should cover eyes with goggle and also use shoes to protect feet and legs.
3. Students should be properly dressed so that whole body part must be covered.
4. Follow the instruction of the teacher's during the practical.
5. Do not perform any other practical or reactions without permission of teacher.
6. Always go through the MSDS (Material Safety Data Sheet) of chemicals prior to performing practical.
7. Do not touch or smell any chemicals in the laboratory even though they may seem to be common in practice.
8. Be aware of all the emergency procedures.
9. Always wash the hands before and after completion of practical.
10. In case of any miss-handling of chemicals or any accident/incident inform the teacher immediately.
11. Students should strictly follow the policies of the college.

Basic Safety Guidelines
General instructions

1. Read and Understand Procedures: Before starting any experiment, carefully read and understand the entire procedure. If you have any doubts, seek clarification from your instructor.
2. No Pipetting by Mouth: Never use your mouth to pipette chemicals. Even seemingly harmless substances might be dangerous. Use a pipette bulb or automated pipette instead.
3. Know Your Chemicals: Read Material Safety Data Sheets (MSDS) for every chemical you use. Understand safe handling, storage, and disposal recommendations.
4. Appropriate Attire: Wear a lab coat or apron to protect your clothing.
5. Avoid wearing contact lenses.
6. Tie back long hair to prevent accidents.
7. Wear safety goggles to shield your eyes.
8. Learn Safety Equipment Locations: Know where the fire blanket, fire extinguishers, eyewash, and shower are located.
9. Ask for equipment demonstrations if needed.
10. No Tasting or Sniffing Chemicals: If you can smell a chemical, you're exposing yourself to a dose that could harm you.
11. Follow safety guidelines for using chemicals inside a fume hood.

General instructions for Handling Glassware

1. Always handle glassware with care. Avoid sudden movements or rough handling, which can cause breakage
2. Carry glassware by the base, not the rim or neck. This provides better support and reduces the risk of dropping.
3. Use clamps and holders to secure glassware when necessary. This is especially important when working with hot or heavy glassware.
4. When heating glassware, use a Bunsen burner or heating mantle with a heat-resistant mat. Never heat glassware directly on a bare surface.
5. Allow hot glassware to cool completely before cleaning or handling. Thermal shock can cause breakage.

6. Wear gloves and safety glasses when cleaning glassware.
7. Use appropriate cleaning solutions as instructed by your teacher.
8. Rinse glassware thoroughly with clean water after cleaning.
9. Allow glassware to dry completely before storing it.

General instructions for Chemical Safety

1. Follow the instructions for handling and disposing of chemicals carefully. Different chemicals have specific safety protocols.
2. Never mix chemicals unless specifically instructed to do so. Unforeseen reactions can occur, leading to hazardous situations.
3. Use designated tools for handling chemicals. Never use beakers, test tubes, or other lab equipment for personal purposes.
4. Label all containers clearly with the name of the substance and any relevant hazard information.
5. Never return unused chemicals to their original container. Dispose of them following proper procedures as instructed by your teacher.

General Instructions for Electrical Safety

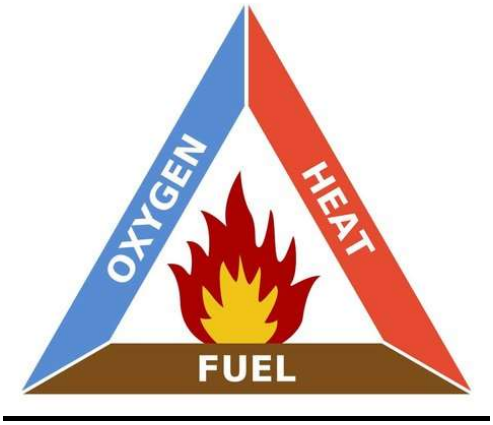
1. Always dry your hands and the equipment before operating it.
2. Never use electrical equipment near water or chemicals. Contact with water or chemicals can cause electrical shock or short circuits.
3. Unplug equipment by pulling the plug from the outlet, not the cord.
4. Never use extension cords in the lab for permanent use.
5. Report any malfunctioning electrical equipment to your instructor immediately.
6. Follow specific instructions for using high voltage or high current equipment.

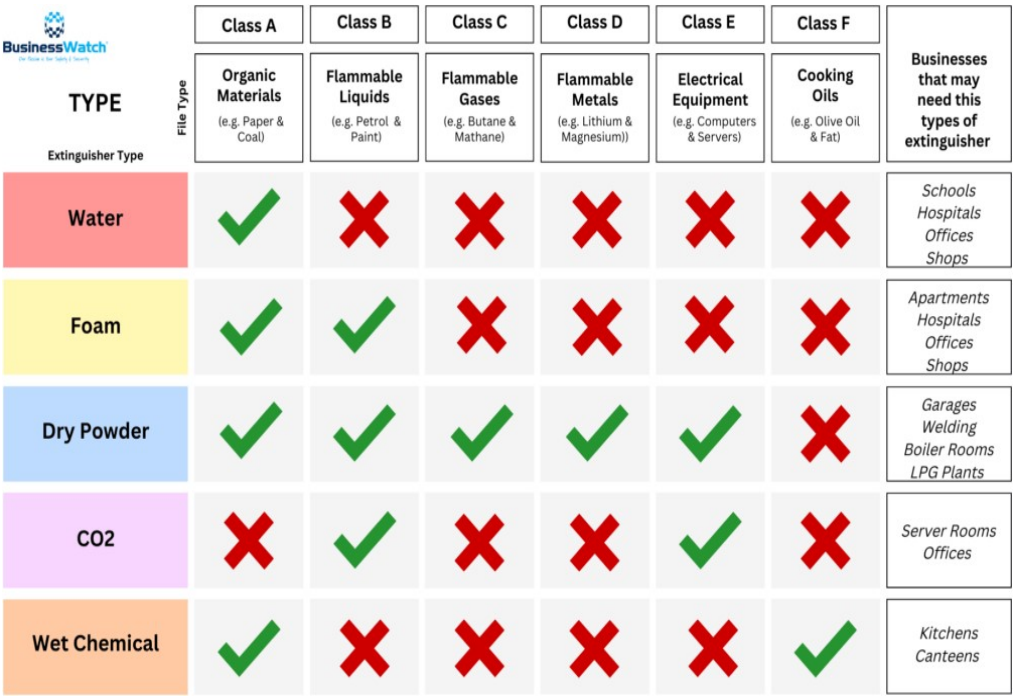
General Instructions Heating Safety

1. Let hotplates and microscopes cool down before touching them. Test to see if they are cool enough by bringing the back of your hand close to them.
2. Use tongs to handle hot objects.
3. The only type of glassware that may safely be heated is either Kimax or Pyrex.
4. Always point the top ends of test tubes that are being heated away from people.
5. Only glassware that is thoroughly dry should be heated.
6. 6. Never leave a hotplate unattended.

General Instructions for Fire Safety

1. Fire safety is critically important in a chemistry lab due to the presence of flammable materials and potential ignition sources. Here are some key measures to prevent and respond to fires:
2. Prevention:
3. Minimize the amount of flammable liquids present in your workspace. Only use what is necessary for the experiment.
4. Keep flammable liquids in designated, approved safety cans away from heat sources.
5. Never store flammable liquids in open containers or near Bunsen burners or hot plates.
6. Maintain a clean and organized workspace free of clutter and flammable materials.
7. Inspect electrical cords and plugs for damage regularly. Report any issues to your instructor.
8. Never leave unattended heating sources such as Bunsen burners or hot plates.
9. Know the location of the fire extinguisher closest to your workspace and be familiar with its operation.
10. Never block fire exits or access to safety equipment.




BusinessWatch
TYPE
File Type
Extinguisher Type
Class A
Organic Materials
(e.g. Paper & Coal)
Class B
Flammable Liquids
(e.g. Petrol & Paint)
Class C
Flammable Gases
(e.g. Butane & Mathane)
Class D
Flammable Metals
(e.g. Lithium & Magnesium))
Class E
Electrical Equipment
(e.g. Computers & Servers)
Class F
Cooking Oils
(e.g. Olive Oil & Fat)
Businesses that may need this types of extinguisher
Water
Schools Hospitals Offices Shops
Foam
Apartments Hospitals Offices Shops
Dry Powder
Garages Welding Boiler Rooms LPG Plants
CO2
Server Rooms Offices
Wet Chemical
Kitchens Canteens

Safety Guidelines for Students

- **Laboratory Entry**

1. Lab Attire: Ensure you are wearing appropriate lab attire, including a lab coat, closed-toe shoes, and safety goggles.
2. Access Control: Submit your id card at the entrance.
3. Safety Briefing: If it's your first time or if there are any changes, attend a safety briefing.
4. Personal Protective Equipment (PPE): Put on necessary PPE (gloves, masks, etc.) based on the lab's requirements.
5. Check Equipment: Inspect equipment you plan to use for any damage or malfunction.
6. Wash Hands: Wash your hands thoroughly before starting work.

- **Laboratory Exit**

1. Clean Up: Clean your work area, return equipment, and dispose of waste properly.
2. Remove PPE: Remove gloves, goggles, and other PPE.
3. Wash Hands: Wash your hands thoroughly.
4. Sign Out: Collect your id card.
5. Secure the Lab: Ensure all equipment is turned off, and the lab is secure.

- **Additional laboratory safety tips to keep in mind**

- **Chemical Handling:**

1. Label Everything: Clearly label all chemical containers with their contents and hazards.
2. Read Labels: Always read labels before using any chemical.
3. Ventilation: Work in a well-ventilated area when handling volatile substances.
4. Avoid Mixing: Never mix chemicals unless instructed to do so.

- **Fire Safety:**

1. Know Fire Exits: Familiarize yourself with fire exits and evacuation routes.
2. Fire Extinguishers: Know the location of fire extinguishers and how to use them.
3. No Open Flames: Avoid open flames near flammable materials.

- **Electrical Safety**:

1. Inspect Cords: Check electrical cords for damage before use.
2. Unplug Safely: When unplugging equipment, grasp the plug—not the cord.
3. Grounding: Ensure electrical equipment is properly grounded.

- **Emergency Preparedness**

1. Know Emergency Numbers: Keep emergency numbers (fire, medical, etc.) handy.
2. First Aid Kit: Locate the first aid kit and know its contents.
3. Emergency Showers and Eye Wash Stations: Know their locations.

- **During Lab Work:**

1. Stay Alert: Be aware of your surroundings and potential hazards.
2. Follow Procedures: Adhere to specific procedures for experiments or tasks.
3. Emergency Procedures: Know the location of emergency exits, fire alarms, and safety equipment.
4. No Food or Drink: Avoid eating or drinking in the lab.
5. Label Chemicals: Clearly label all chemicals and reagents.
6. Dispose Properly: Dispose of waste materials according to guidelines.

Safety Guidelines for Teachers

- **Laboratory Entry**

1. Teachers should always carry their identification, which should be worn at all times inside the laboratory premises.
2. Review daily activities and ensure readiness.
3. Look for spills, leaks, damaged equipment or any other potential dangers.
4. Verify that all non-essential equipment is turned off.
5. Inspect frequently used equipment for any damage or malfunction.
6. Teachers should be allotted lockers for safekeeping of personal items like mobile phones, lunch boxes, helmets, and handbags.

- **Laboratory Exit**

1. Ensure all students have completed their experiments or safely stopped ongoing procedures.
2. Verify all equipment is turned off: this includes Bunsen burners, hot plates, and any other electronic equipment used.
3. Close fume hood sashes if they were used during the session.
4. Guide students to dispose of waste chemicals and materials following proper protocols.
5. Ensure proper segregation and disposal based on waste types and relevant regulations.
6. Document any spills, accidents, or equipment malfunctions in the lab logbook.

Safety Guidelines for Laboratory Staff

- **Laboratory Entry**

1. Obtain permission: Always seek permission from a designated laboratory supervisor or teacher before entering the lab.
2. Wear proper attire: Non-teaching staff should wear closed-toe shoes and clothing that covers the arms and legs. Avoid wearing loose-fitting clothing or jewelry that could get caught on equipment.
3. Be aware of ongoing activities: Inform about any ongoing experiments or potential hazards in the lab before entering.
4. Personal Belongings: Non-teaching staff should keep personal items such as mobile phones, lunch boxes, helmets, and handbags in lockers.

- **Laboratory Exit**

1. Ensure any equipment used is returned to its proper location and the work area is clean and organized.
2. Perform a final check to ensure all equipment is off and the lab is in a safe and orderly state.
3. At the end of the day, laboratory security should ensure that sensitive items such as test samples, laboratory records, and other confidential information are not taken out of the laboratory premises.
4. Remove your lab coat and other personal protective equipment (PPE).
5. Wash your hands thoroughly with soap and water.
6. Leave the lab through designated exits.

Storage of Chemicals

General Instructions

1. Store chemicals inside a closeable cabinet or on a sturdy shelf.
2. Shelf should have a front-edge lip to prevent accidents and chemical spills (recommended ¾- inch high).
3. Shelving should be secured to wall or floor.
4. Ensure that all storage areas have doors with locks.
5. Keep chemical storage areas off limits to all students.
6. Ventilate storage areas adequately.
7. Organize chemicals first by COMPATIBILITY—not alphabetic succession. Store alphabetically within compatible groups.
8. Store acids in a dedicated acid cabinet.
9. Nitric acid should be stored alone unless cabinet provides a separate compartment for nitric acid storage.
10. Store highly toxic chemicals in a dedicated, lockable poison cabinet that hasbeen labeled with a highly visible sign.

Chemical Segregation

1. Store volatile and odoriferous chemicals in a ventilated cabinet.
2. Store flammables in an approved flammable liquid storage cabinet.
3. Store water sensitive chemicals in a water-tight cabinet in a cool and dry location segregated from all other chemicals in the laboratory.

Storage Don’ts

1. Do not place heavy materials, liquid chemicals, and large containers on high shelves.
2. Do not store chemicals on tops of cabinets.
3. Do not store chemicals on the floor, even temporarily.
4. Do not store items on bench tops, in laboratory chemical hoods or under sinks. Storage Don’ts
5. Do not store chemicals on shelves above eye level.
6. Do not store chemicals with food and drink.
7. Do not store chemicals in personal staff refrigerators, even temporarily.

8. Do not expose stored chemicals to direct heat or sunlight, or highly variable temperatures.

Proper Use of Chemical Storage Containers

1. Never use food containers for chemical storage.
2. Make sure all containers are properly closed.
3. After each use, carefully wipe down the outside of the container with a papertowel before returning it to the storage area.
4. Properly dispose of the paper towel after use.

SOPs for Personal Hygiene in the Lab Students

Chemistry laboratories are environments where students engage in various experiments and procedures involving potentially hazardous chemicals. Personal hygiene practices are crucial to minimize the risk of accidents, and contamination, and ensure the overall safety of everyone in the lab.

1. Hand washing is a primary safeguard against inadvertent exposure to toxic chemicals.
2. Always wash your hands before leaving the laboratory.
3. Wash your hands with soap before leaving the laboratory, and before eating, or drinking.
4. This will prevent the spread of hazardous reagents and cut off a potential exposure route.
5. Do not apply cosmetics while in the lab. Applying anything to your face, especially around your mouth or eyes, poses a significant risk of exposure.
6. Long pants and shoes completely covering the top of the foot should be worn at all times when working in the lab.
7. Lab coats will protect your clothes and your skin from splashes, spills, or other exposures to chemical agents, and flames in some cases.
8. Never smell or taste chemicals.
9. Do not pipette by mouth.
10. Always keep your work area tidy and clean.
11. Always tie hair back that is longer in length.
12. Make sure that dangling jewellery is secure or avoid wearing it in the first place.
13. Never wear sandals or other open-toed shoes in the lab. Footwear should always cover the foot completely.
14. When using lab equipment and chemicals, be sure to keep your hands away from your mouth eyes, and face.
15. Do not use a personal handkerchief for lab experiments.

16. Use books and journals only in clean areas to prevent contamination.
17. Clear up waste, deal with washing up, and put things away as you finish with them.
18. Cover any cuts, infected wounds, or boils you may have with clean, suitable materials.
19. Do not spit in the laboratory as this can spread germs.
20. Lab coats should be washed regularly and separately from other garments to avoid cross-contamination.
21. Do not wear laboratory aprons outside laboratory areas such as canteens, or common areas.

Teachers

Teachers play a pivotal role in ensuring the safety and well-being of students in the chemistry laboratory. Practicing good personal hygiene is essential to minimize the risk of accidents, and contamination, and promote a culture of safety within the laboratory environment.

1. Keeping personal items separate from lab work.
2. Be familiar with the location and proper use of emergency equipment such as fire extinguishers, safety showers, eyewash stations, and first aid kits.
3. In the event of an accident or exposure to hazardous chemicals, guide students on appropriate action and notify relevant authorities as necessary
4. Stay updated on the latest safety protocols, procedures, and best practices in laboratory safety through professional development opportunities and training sessions.
5. Wash hands thoroughly with soap and water before and after conducting experiments or handling chemicals. Encourage students to follow proper hand hygiene practices and lead by example.

SOPs for Laboratory Entry and Exits Students

- **Entering the Laboratory**:

1. Lab Attire: Ensure you are wearing appropriate lab attire, including a lab coat, closed-toe shoes, and safety goggles.
2. Access Control: Submit your id card at the entrance.
3. Safety Briefing: If it's your first time or if there are any changes, attend a safety briefing.
4. Personal Protective Equipment (PPE): Put on necessary PPE (gloves, masks, etc.) based on the lab's requirements.
5. Check Equipment: Inspect equipment you plan to use for any damage or malfunction.
6. Wash Hands: Wash your hands thoroughly before starting work.

- **Exiting the Laboratory:**

1. Clean Up: Clean your work area, return equipment, and dispose of waste properly.
2. Remove PPE: Remove gloves, goggles, and other PPE.
3. Wash Hands: Wash your hands thoroughly.
4. Sign Out: Collect your id card.
5. Secure the Lab: Ensure all equipment is turned off, and the lab is secure.

- **Additional laboratory safety tips to keep in mind**
- **Chemical Handling:**

1. Label Everything: Clearly label all chemical containers with their contents and hazards.
2. Read Labels: Always read labels before using any chemical.
3. Ventilation: Work in a well-ventilated area when handling volatile substances.
4. Avoid Mixing: Never mix chemicals unless instructed to do so.

- **Fire Safety:**

1. Know Fire Exits: Familiarize yourself with fire exits and evacuation routes.
2. Fire Extinguishers: Know the location of fire extinguishers and how to use them.
3. No Open Flames: Avoid open flames near flammable materials.

- **Electrical Safety**:

1. Inspect Cords: Check electrical cords for damage before use.
2. Unplug Safely: When unplugging equipment, grasp the plug—not the cord.
3. Grounding: Ensure electrical equipment is properly grounded.

- **Emergency Preparedness**

1. Know Emergency Numbers: Keep emergency numbers (fire, medical, etc.) handy.
2. First Aid Kit: Locate the first aid kit and know its contents.
3. Emergency Showers and Eye Wash Stations: Know their locations.

- **During Lab Work:**

1. Stay Alert: Be aware of your surroundings and potential hazards.
2. Follow Procedures: Adhere to specific procedures for experiments or tasks.
3. Emergency Procedures: Know the location of emergency exits, fire alarms, and safety equipment.
4. No Food or Drink: Avoid eating or drinking in the lab.
5. Label Chemicals: Clearly label all chemicals and reagents.
6. Dispose Properly: Dispose of waste materials according to guidelines.

Teachers

- **Laboratory Entry**

1. Teachers should always carry their identification, which should be worn at all times inside the laboratory premises.
2. Review daily activities and ensure readiness.
3. Look for spills, leaks, damaged equipment or any other potential dangers.
4. Verify that all non-essential equipment is turned off.
5. Inspect frequently used equipment for any damage or malfunction.
6. Teachers should be allotted lockers for safekeeping of personal items like mobile phones, lunch boxes, helmets, and handbags.

- **Laboratory Exit**

1. Ensure all students have completed their experiments or safely stopped ongoing procedures.
2. Verify all equipment is turned off: this includes Bunsen burners, hot plates, and any

other electronic equipment used.

3. Close fume hood sashes if they were used during the session.
4. Guide students to dispose of waste chemicals and materials following proper protocols.
5. Ensure proper segregation and disposal based on waste types and relevant regulations.
6. Document any spills, accidents, or equipment malfunctions in the lab logbook.

Laboratory Staff

Entry Procedures

1. Obtain permission: Always seek permission from a designated laboratory supervisor or teacher before entering the lab.
2. Wear proper attire: Non-teaching staff should wear closed-toe shoes and clothing that covers the arms and legs. Avoid wearing loose-fitting clothing or jewelry that could get caught on equipment.
3. Be aware of ongoing activities: Inform about any ongoing experiments or potential hazards in the lab before entering.
4. Personal Belongings: Non-teaching staff should keep personal items such as mobile phones, lunch boxes, helmets, and handbags in lockers.

Exit Procedures

1. Ensure any equipment used is returned to its proper location and the work area is clean and organized.
2. Perform a final check to ensure all equipment is off and the lab is in a safe and orderly state.
3. At the end of the day, laboratory security should ensure that sensitive items such as test samples, laboratory records, and other confidential information are not taken out of the laboratory premises.
4. Remove your lab coat and other personal protective equipment (PPE).
5. Wash your hands thoroughly with soap and water.
6. Leave the lab through designated exits.

SOPs for Chemical Disposal

LABORATORY STAFF

This SOP is very help full for chemical disposal which is important to disposal of chemicals, solvents and reagents as Well as prepared products during practicals safely without any type of hazard to environment and human beings. All students and teaching and non-teaching staff have to follow this SOP.

Disposal of Organic Solvents

1. Contaminated organic solvents such as acetone, alcohol, MEK should never be poured into the sink.
2. These solvents should be put into metal safety cans.
3. If you plan to use a large quantity of organic solvents, you should buy a safety can for your lab.
4. However, these are for use only by people using the specific areas which they serve.
5. Every time you add a compound to the safety cans, you must do the following.
6. List the compound name and quantity each time. Estimate quantity in millimeters.
7. For mixtures, estimate the component quantities, eg. 750 ml of 50:50 methanol- butanol would be written 375 methanol/375 mg. t- butanol/375 ml.
8. Use the back of the tag if more entries are made than there is space provided.

DO NOT PUT ACIDS IN SOLVENT WASTE CANS. THIS INCLUDES ELECTROPOLISHING ELECTROLYTES AND ETCHANTS.

Non-Organic Waste

1. Place in 'Primary' container (or original glass container).
2. Label this with the amount and identity of the contents. 2. Place all primary containers in á secondary (cardboard box) filled with packing material.
3. Label this box with the contents of primary containers, your room number and the building number.
4. This procedure is to be followed for all inorganic waste including acids and toxic substances.
5. Always label all waste material.

6. Never mix two chemicals that are to be disposed they might form explosive otherwise harmful mixtures.

Type	Procedure for Disposal
Liquid Chemicals	To be drained carefully with continuous flow of water into sink.
Solid Chemicals	Each solid chemicals are to be collected in polybag separately & tie it's mouth. Hand over all such bags to ETP for further disposal.
Cyanide and Cyanide and Toxic/Poisonous chemicals	All such type of waste generate contamination waste at Q.C. Lab to be treated ensure Other it free from cyanide
Hazardous and chemicals (As per packed in bag and then it is to SOP)	All such type of waste to be handed over to ETP for further action

Disposal Procedures:

1. Sorted by compatibility
2. In approved containers
3. Tighten caps
4. Ensure contents are properly identified
5. Move to a Satellite Accumulation Area
6. Call HWC to Pick up Number
7. Complete Forms or ensure labeling information
8. Varies from Location to Location
9. Drop off at Marshalling facility or arrange for pick up
10. Waste Disposal Company will lab pack

SOPs for Gas Cylinder and Compressed Gas

This SOP is very helpful for the safe handling of compressed gas and gas cylinders, all students and teaching and non-teaching staff must follow this compressed gas and gas cylinder SOP.

Students

1. Follow all safety instructions provided by instructors.
2. All the students should use safety goggles.
3. It is compulsory to wear lab coat or apron, and/or gas mask required for personal protection depending on the gas and use.
4. Gloves should be worn to protect hands from potential hazards.
5. See the Safety Data Sheet (SDS) for chemical-specific hazard information.
6. If safe, turn the gas valve off. For cylinders that continue to leak, immediately take necessary action and information to the Lab supervisor.
7. Do not handle gas cylinder in the absence of Lab supervisor.
8. Never attempt to repair or modify gas cylinders or associated equipment's.
9. In case of fire, evacuate the area and alert emergency services.
10. Do not use electronic devices or switches.

Teacher

1. Provide training to students on the safe handling of gas cylinders and compressed gases.
2. Supervise students during practical activities involving gas cylinders.
3. Ensure that students adhere to safety protocols.
4. Maintain an inventory of gas cylinders and conduct regular inspections.
5. Handle cylinders with care to prevent damage to valves or fittings.
6. Use a suitable gas detector to check for leaks before and during use.
7. If a leak is detected, evacuate the area immediately.
8. Keep gas cylinders away from heat sources and open flames.
9. In case of fire, evacuate the area and alert emergency services.

10. Maintain records of training sessions, inspections, and any incidents involving gas cylinders.
11. Supervise students during practical activities involving gas cylinders.
12. Enforce safety protocols and ensure compliance with all relevant regulations.
13. Maintain an inventory of gas cylinders and conduct regular inspections.
14. Respond promptly to any safety concerns or incidents involving gas cylinders.

Laboratory Staff

1. Follow all safety instructions provided by supervisors or designated personnel.
2. Non-teaching staff members should wear appropriate PPE, including safety goggles or glasses and gloves, when handling gas cylinders.
3. Use personal protective equipment (PPE) as required for handling gas cylinders.
4. Report any safety concerns, incidents, or damage related to gas cylinders immediately to the appropriate authority.
5. Assist in maintaining a safe environment by following proper handling procedures and participating in safety training.
6. Conduct regular inspections of gas cylinder storage areas and equipment.
7. Gas cylinders should be stored in well-ventilated, dry, and secure areas designated for this purpose.
8. Cylinders should be stored upright and secured with chains, straps, or stands to prevent tipping.
9. Separate incompatible gases and ensure proper signage is in place.
10. Use cylinder carts or trolleys to transport gas cylinders safely.
11. Ensure cylinders are securely fastened in an upright position during transportation to prevent tipping or damage.

SOPs for Hazardous Chemicals

Students

This SOP is very help full for Hazardous chemicals which is important to disposal of Hazardous chemicals, solvents and reagents as Well as prepared products during practical's safely without any type of hazard to environment and human beings. All students and teaching and non-teaching staff have to follow this SOP.

1. Wear protective goggles whenever heating or pouring hazardous chemicals.
2. Never mix chemicals together unless you are told to do so.
3. Never taste any chemicals.
4. If you need to smell the odour of a chemical, waft the fumes toward your nose with one hand. Do not put your nose over the container and inhale the fumes.
5. Follow the instructions of your teacher when disposing of all chemicals.
6. Wash your hands after handling hazardous chemicals.
7. Dispose of all chemicals as instructed by teacher. To avoid contamination do not return chemicals to their original containers
8. Be careful when working with chemicals such as acids or bases. Always pour them over the sink rather than over your work area
9. When diluting an acid always add small amounts of Acid to Water.
10. Rinse acids or bases off of skin immediately. Notify teacher immediately of spills.
11. Never taste any chemicals Before undertaking any work become familiar with the hazards of the chemicals involved.
12. Keep yourself away from container, while pouring out of siphoning the chemicals.
13. Use Suction bulb or vacuum during pipetting of solution.
14. Keep inflammable solvents and substances away from naked flame or electric spark.

Teacher

1. List all hazardous chemicals used in your facility, including their properties and hazards.
2. Evaluate the risks associated with each chemical, considering factors like toxicity, flammability, reactivity, and potential for exposure.

3. Define safety measures to minimize risks, such as proper storage, handling, and disposal procedures. Include guidelines for personal protective equipment (PPE) usage.
4. Outline procedures for responding to chemical spills, leaks, or exposure incidents. Include evacuation routes, emergency contacts, and spill cleanup protocols.
5. Provide comprehensive training to all personnel who handle hazardous chemicals. Ensure they understand the SOP and are competent in safe chemical handling practices.
6. Maintain detailed records of chemical inventories, safety data sheets (SDS), training sessions, and incident reports.
7. Regularly review and update the SOP to reflect changes in chemicals used, regulations, or best practices.

Laboratory Staff

1. Wear appropriate PPE, including gloves, lab coats, safety goggles, and closed-toe shoes, when handling hazardous chemicals.
2. Handle hazardous chemicals with care, following established procedures and using approved containers and equipment.
3. Be familiar with emergency response procedures, including the location of emergency exits, eyewash stations, and safety showers.
4. Report any incidents, accidents, or near misses involving hazardous chemicals to the appropriate supervisor or safety officer.

SOPs for Fume Hoods

In accordance with this document, laboratories should use appropriate administrative controlsand personal protective equipment when using fume hoods. Fume hoods (also called Lab Hoods) are local ventilation devices used to limit yourexposure to hazardous fumes, vapors or dusts when handling chemicals.

Preparing Fume Hood for Work

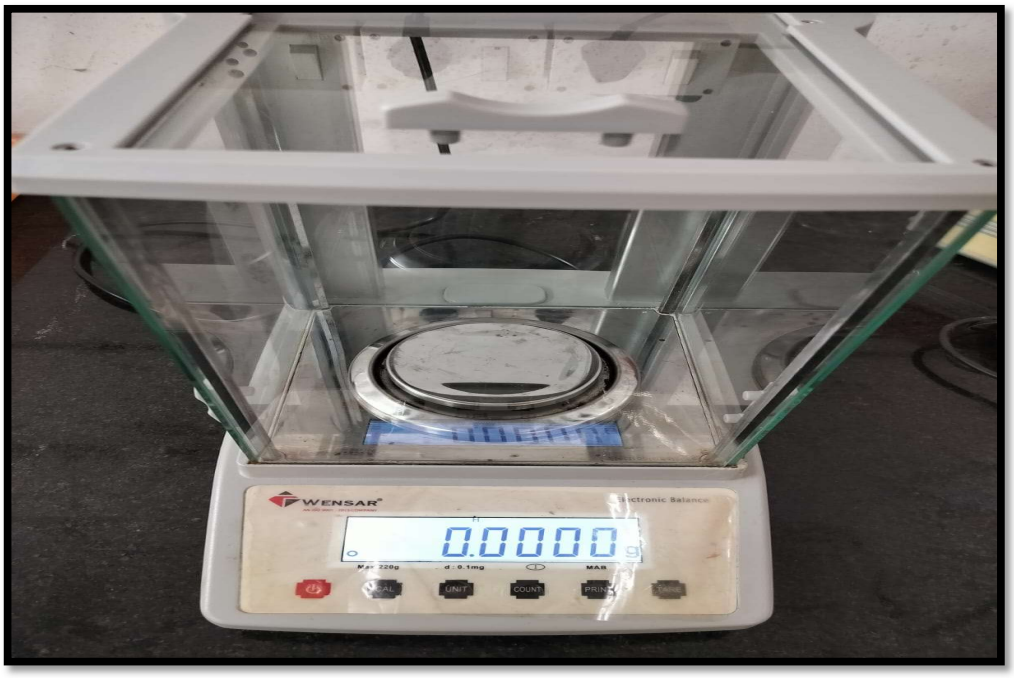
1. Check for a date on the certification sticker that is within the last year.
2. Check alarms and monitors to indicate proper operation.
3. Observe noise and air movement to indicate proper operation.
4. Close all windows and doors in the laboratory.
5. Set manual controller, if the fume hood has one, to “maximum” for the 100 feet perminute (fpm) position.
6. Set sash height indicated by the sticker and arrow; when possible, set the sash at thelowest position.

Safety Precautions (Teachers and Students)

1. All operators must receive training on the safe operation of the fume hood prior to using the equipment.
2. Use the required PPE, including lab coat, gloves, and eye/face protection.
3. Substitute toxic chemicals with less hazardous materials whenever possible.
4. Ensure work area is unobstructed. If materials must be stored in the hood (e.g., in-usewaste containers) place items adjacent to a side wall.
5. To ensure proper function, the baffles at the lower rear of the hood and the airflow through the front opening must not be obstructed.
6. Do not store chemicals in fume hood unless storage is the sole use of the hood. Always work at least 6” (15 cm) in from the front lip of the hood.
7. Keep sashes as low as possible when working in the hood.
8. Do not extend your head inside of the hood while experiments are being performed.
9. Perchloric acid at concentrations >70% must not be used in standard fume hoods.
10. Heated or concentrated perchloric acid must be handled in specially designed hoodswith wash down features to prevent formation of explosive perchlorates.

Instrument Handling Procedures

Weighing Balance

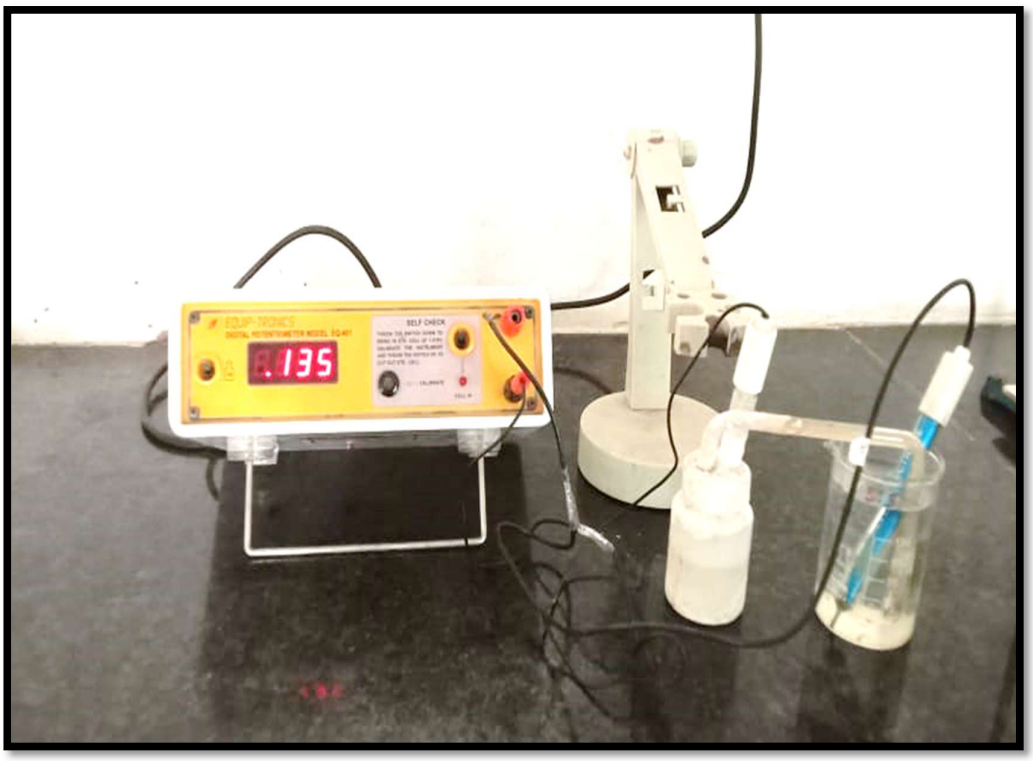


Requirements: Analytical balance digital, transfer utensils (spatula)

Procedure:

1. Make sure that the balance is kept clean.
2. Ensure that the calibration status is valid.
3. Connect the power cable to the mains and switch ON.
4. Automatically self-checking starts from „che-3" and ends with off.
5. Press ON/OFF key, all the display will glow.
6. Press TARE KEY, 0.000 mark appears on the display.
7. Once the stability is attained, the balance is ready for weighing.
8. Place the material to be weighed on the pan and note down the reading.
9. After completion of weighing press, ON/OFF key. STAND by light glows.
10. Clean the balance immediately after weighing.

Potentiometer



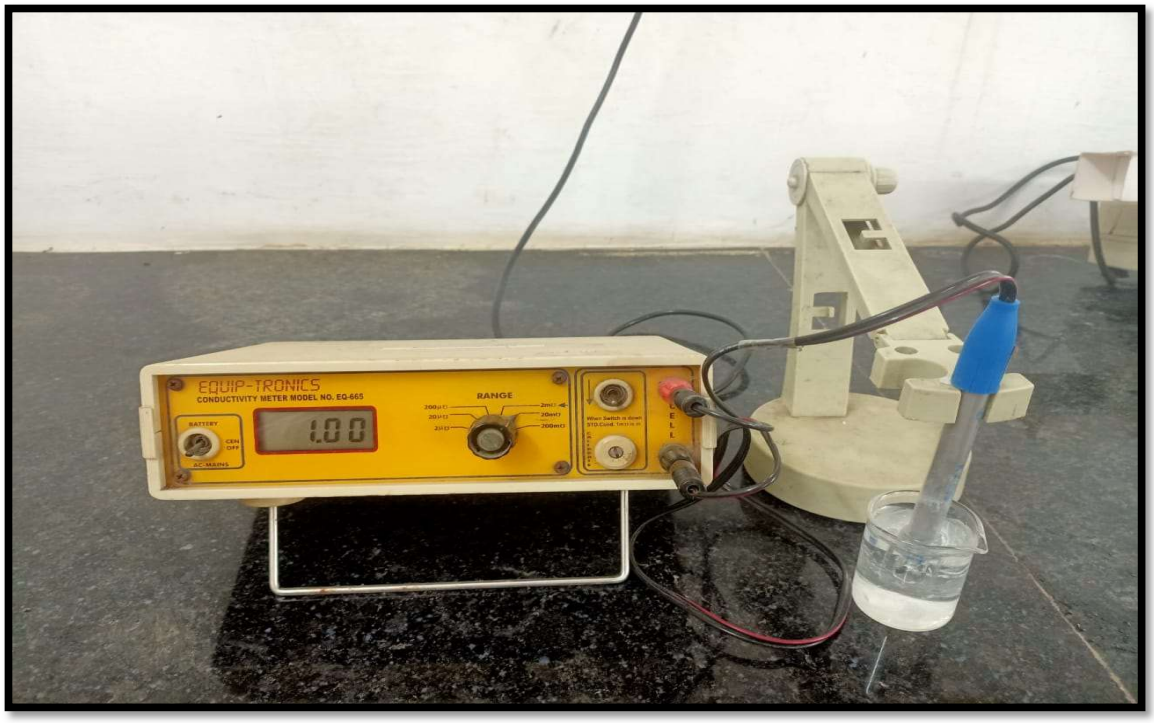
Standardization: To Standardized the potentiometer,

1. Switch the instruments on about 10-15 minutes before starting the experiments.
2. Using the specially supplied connector cables, connect negative and positive input terminals with the corresponding negative and positive Standard cell terminals of a good Weston standard cell.
3. Observe the digital display. It should read 1.018volts, indicating that the instruments is already standardized, if not slowly standardise knob so that the display read 1.018 volt.

Measurement of Potential:

1. To measure the e.m.f of the cell, connect the negative and the positive terminals of the cell to the corresponding input terminal seen on the potentiometer panel.
2. Observe the digital display. The reading gives potential of the cell connected to the potentiometer.
3. The reading must always be positive. If it is negative, reverse the connections of the terminal of the cell.

Conductometer



Conductivity meter is used to measure conductance.

Standardization: To standardized the Conductometer,

1. Switch the instruments on about 10-15 minutes before starting the experiments.
2. Keep the Range switch on 2 (milli mho) position.
3. Keep the standard conductance switch at down position.
4. Observe the digital display. If the display shows 1.000, then it means the instruments is standardized, If not rotate the standardized shaft so that the display reads 1.000.

Accurate Method

1. Switch the instruments on about 10-15 minutes before starting the experiments.
1. 2.Keep the conductivity cell in distilled water for about 10-15 minutes, connect its
2. terminals seen on the conductivity meter.
3. Prepare exact 0.1 N KCl solution. Take it in 100cm3 beaker.
4. Remove the conductivity cell from distilled water. Wipe it clean softly with a filter
5. paper and immerse it into 0.1N KCl solution.
6. Wait for about one minute, check the standard conductance switch. It should be keep on up position.

7. Select the correct range by rotating the range selector knob so as to get maximum number of significant figures on the display.
8. Observe the display, It should read specific conductance of 0.1 N KCl at 250C is 0.01288 mhos
9. If it does, then the instrument is already standardized, else rotate the standardize till the correct specific conductance is obtained.

Measurement of conductance:

1. Switch the instrument on about 10-15 minutes before starting the experiment.
2. Keep the conductivity cell dipped in distilled water for about 10-15 minutes. Connect its terminals to the cell terminals seen on the conductivity meter.
3. Confirm that the instrument has been properly standardised.
4. Take the sample solution whose conductance is to be measured, in a 100 mL beaker.
5. Remove the conductivity cell from distilled water. Wipe it clean gently with a filter paper and dip it into the sample solution.
6. Wait for a minute. Check that the standard conductance switch is kept at up position.
7. Rotate slowly the range selector knob till the display shows maximum number of significant figures.
8. Note down the reading shown in the display with an exponent of (-3), e.g., if the display reads (3.142), note it as (3.142 x 10-3) mhos. This is the conductance of the sample solution.

pH meter

1. Depending on the pH meter used and the electrode used procedure can look slightly different, but in most cases pH measurements procedure will be at least very similar.
2. First of all - remember, that the electrode should not be dry, so immersed in proper solution**.** Thus, between pH measurements it should be put into a beaker with distilled water or - much better - KCl solution (0.1M to 1M). Don't worry that you will destroy the electrode moving it between solutions. It can easily survive minute in the air, but don't let it dry.
3. Second, equally important thing is **-** the electrode is very fragile. Bubble at the end is made of very thin and delicate glass - the thinner glass improves the sensitivity. Thus, you should treat your electrode with care.
4. Ensure that pH meter is on. If you want high precision of measurements, it is better to let the pH meter to warm up for some time (like 15 minutes) to ensure it will not drift later.
5. Before the use of pH measurement, you must calibrate pH electrode by using pH buffer solution of pH 4.0, pH 7.0, pH 9.20.
6. After calibration you are ready to measure pH. Rinse electrode and submerge it in the tested solution. Read the result and write it down in your lab notebook. Rinse the electrode and move it to the storage beaker.

Turbidometer

Calibration and Standardization

Calibration is checked against primary standard formazin suspensions each use, to ensure linearity between ranges and to verify the actual turbidity of Gelex secondary standards used for routine standardization.

Procedure

Sample Preparation and Analysis

1. The instrument should be turned on and allowed to warm up for at least 30 minutes before use. Samples and standards should be at ambient temperature.
2. Slowly invert formazin standard cells 2 – 3 times and then let the sample sit undisturbed for 5 minutes before measurement. Do not shake the standard cells as it can take hours for bubbles to dissipate.
3. Select appropriate sample range and standardize using the primary formazin standard.
4. Check range against appropriate Gelex standard; should be within 10% of noted turbidity.
5. Gently invert samples to mix. Fill sample tube with 25mL of sample, introducing as little air as possible when pouring sample into cell. Make sure the outside of the sample tube, specifically the bottom and sides, is free from water and fingerprints.
6. Repeat the previous step for the first 10 samples, noting cell position in rack on data sheet, and allow them to sit undisturbed for 5 minutes.
7. Insert the first sample cell into the sample compartment and cover with the light shield.
8. Read the turbidity of the sample from the scale corresponding to the range switch selection.
9. The reading obtained is turbidity in Nephelometric Turbidity Units (NTU).
10. See table below for recording readings in different ranges. Sample turbidity should fall mid-range.

Spectrophotometer/ Colorimeter

Zero adjustment:

1. Switch the instruments on about 10-15 minutes before starting the experiments.
2. Insert the required filter from the nonfilter end into the filter port.
3. Fill the sample carrier (cuvette) with the blank solution. Wipe it clean for outside. Place the port into the sample port. Push off-on switch to on position.
4. Put the % transmittance- Optical density (%T-O.D) switch on % Transmittance position.
5. Rotate the zero-adjustment knob so that the digital display shows zero.
6. Remove the cuvette containing blank from the sample port and again place it back taking care that the printed mark on the cuvette comes to the same position.
7. Check the reading on digital display. It should once again show zero, then repeat the step no.3 and 4 until display read zero.

100% adjustment:

1. Push the off-on switch to off position.
2. Remove the filter from the filter port and re-insert it from the filter side. Or if no filter is kept inside, choose the required filter and insert it into the filter port from the filter side.
3. Fill the cuvette with the blank solution and wipe it clean from outside. Place this cuvette into the sample port. Push the off-on switch to on position.
4. Place the % transmittance- Optical density (%T-O.D) switch on % Transmittance position. Rotate the 100% Coarse knob slowly so that the display show about 97-98%. Rotate the 100% Coarse knob slowly, so that the display shows exact 100%.
5. Now rotate the 100% fine knob slowly so that the display shows exact 100%.

6. Remove the cuvette containing blank from the sample port and replace it back taking care to see that the printed mark on cuvette always comes to the same position.
7. Check the reading on the display. It should show 100%. If it does not show the100%, then repeat the step no 4, 5, 6 until the display reads 100%.

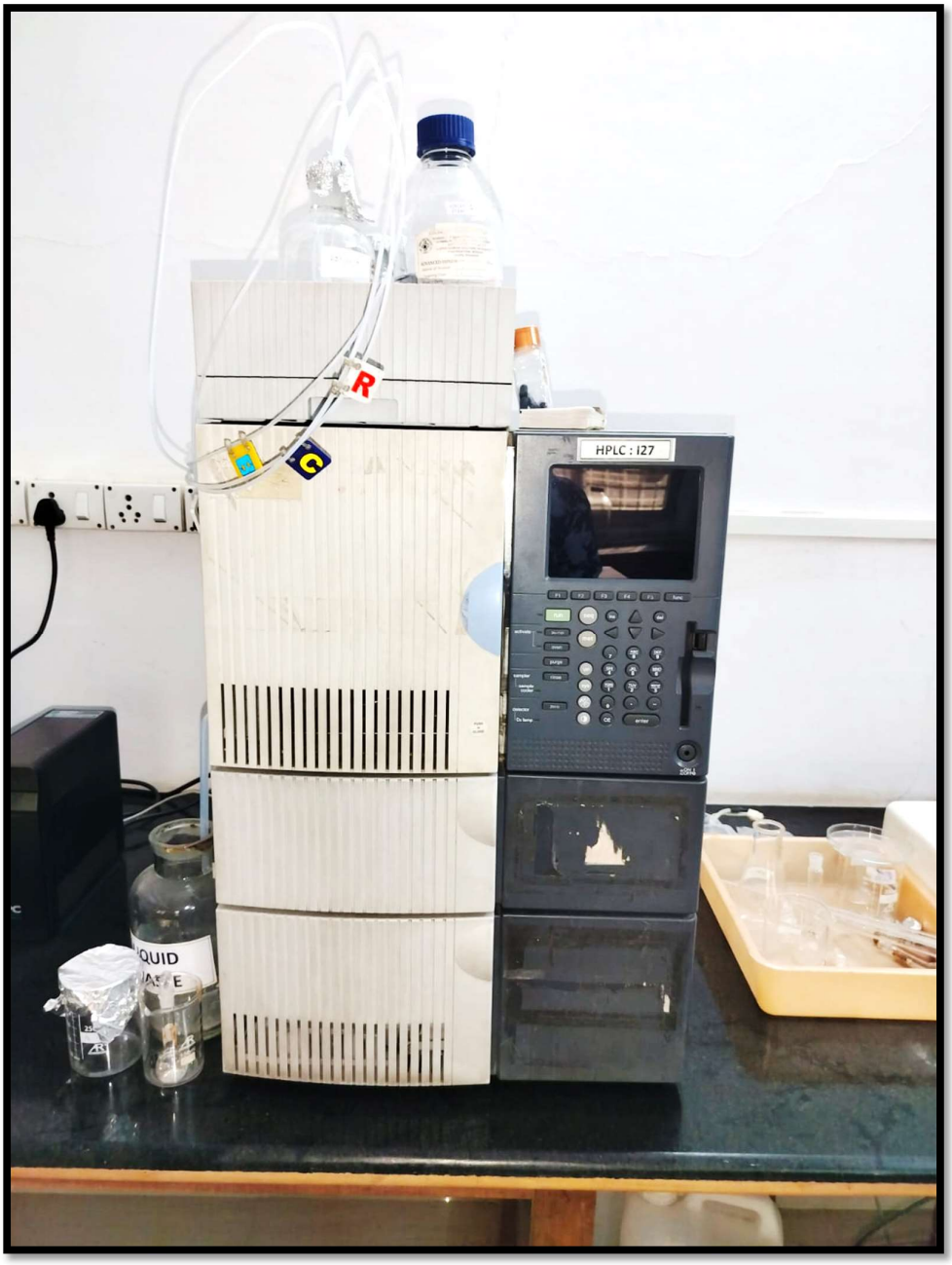
Measurement of the Absorbance:

1. Let the off-on switch be kept at on position. Check that filter kept inside the filter port is the required filter**.**
2. Rinse and fill the cuvette with the sample solution whose absorbance is to be determined. Wipe it clean from outside.
3. Check that the %T- O.D switch is kept on position and the printed mark on cuvette has been kept at the same position.
4. Read the display and note down reading. This is the absorbance of sample solution.

Some important precautions:

1. Wipe the cuvette clean before putting it inside the sample port.
2. Always check that the mark on the cuvette is kept at the same position with respect to the sample port.
3. Switch the instruments on about 10-15 minutes before
4. starting the experiments and do not switch of unless the experiment over or filter need to be changed.
5. After the filter or the sample solution is changed, wait for about 20-30 second before note down the reading from the display.

High Performance Liquid Chromatography (HPLC)



PURPOSE:

To provide procedure for operation, calibration and maintenance of SHIMADZU HPLC System.

PROCEDURE:

STARTING UP PROCEDURE:

1. Place the tubes A, B, C and D leading to the pump in suitable solvents or mobile phase.
2. Also auto sampler rinse port in R reservoir bottles.
3. Turn ON the LC-2010CHT main unit's power
4. After confirming that all the units is switched on, turn the PC power ON, Computer
5. Monitor displays the following screen.

PURGING MOBILE PHASE/SOLVENT

1. Place the tube leading to the purge/rinse degasser in 50:50 (methanol, water) or as per specified.
2. Disconnect Instrument First and Purge with Instrument Control Panel.

CREATING A PROGRAMME FILE

1. Click on file and select new followed by program file and click ok.
2. Continue the creating the program.
3. Set the temperature of the Auto-sampler as per specification and press NEXT.
4. Set the temperature of the Column Oven as per specification and press NEXT.
5. Set the flow and type of analysis either gradient/isocratic and press NEXT
6. Do not disturb the Sampler Options (Syringe Speed and Sample dependent
7. parameters), press NEXT
8. Select the UV and desired run time and press NEXT.
9. Select the wavelength.
10. Finally save the program file and print the program file

CREATING A SEQUENCE FILE:

1. Select File > New >Sequence (using wizard) and follow the displayed windows for creating the sequence or save as the sequence from sequence template to desire location with as per LCP.
2. Select the proper time base where the sequence will run
3. Enter the sample data like sample name, number of vials, injections per vial, position,
4. Injection volume, batch no. Column ID Condition Test.
5. Select the program & report file or copy program, method and report file.

6. The sequence is successfully created after pressing, "Finish". and print the sequence file.

PRECAUTIONS:

1. Do not over tight fitting of the injector, column, pump, or detector.…
2. Always flush the system with water followed by methanol and keep the line filters in methanol when system is not in use.
3. After use of buffers, flush the system with purified water to avoid formation of precipitation**.**
4. Use only HPLC grade solvents for analysis, dilution and preparations.
5. Ensure that, purge valve is open, at the time of purging; it can damage the column at high flow rate.
6. Ensure sufficient solvent in the reservoir bottles before starting system.
7. Always use purified water and/or mobile phases filtered through 0.45 µ or 0.2 µ membrane filter and degassed.
8. Ensure caps of the mobile phase bottles are closed properly to avoid the intake of the particulate matter and evaporation of the solvents.
9. Ensure that there is no precipitation around needle surface**.**
10. Flow rate should be increase
11. Avoid suction of air into the system, as it traps in flow cell and creates a problem in detection.
12. Empty the waste containers of the HPLC system frequently.
13. Do not allow the detector waste out let to dip in to the waste solvent of the system.
14. Give enough time to stabilize the system and warm up for the lamp ignited.
15. Always check the leaks at different PEEK nuts/ screws, at injector, at pump, at detector and at degasser.

Gas Chromatography (GC)

Procedure:

Preparation of the Instrument:

1. Turn on the gas chromatograph and allow it to warm up according to manufacturer's instructions.
2. Check that the carrier gas supply is adequate and at the appropriate pressure.
3. Ensure that the detector(s) and other components are functioning properly.
4. Set the appropriate column temperature and detector temperature based on the analysis requirements.

Calibration:

1. Perform instrument calibration using appropriate standards.
2. Inject calibration standards at known concentrations to generate a calibration curve.
3. Verify that the calibration curve meets acceptance criteria before proceeding with sample analysis.

Sample Preparation:

1. Prepare samples according to the specific analytical method.
2. Ensure that samples are properly labeled and documented.

Sample Analysis:

1. Load the prepared samples into the injector syringe or autosampler.
2. Inject the samples into the GC system using the appropriate injection method (e.g., split, splitless).
3. Run the samples through the GC system according to the established method parameters.
4. Monitor the chromatogram for peak resolution, peak shape, and baseline stability.
5. Record relevant data such as retention times, peak areas, and peak heights.

Data Analysis:

1. Process the chromatographic data using appropriate software.
2. Integrate peaks and calculate concentrations using the calibration curve.
3. Review the data for accuracy and consistency.

Maintenance and Shutdown:

1. After completing the analysis, perform routine maintenance tasks such as column conditioning and system purging.

2. Shut down the gas chromatograph following manufacturer's instructions.
3. Clean the injection port and detector according to the laboratory's cleaning protocol.

Safety Precautions:

1. Handle all chemicals and samples with care, following appropriate safety protocols.
2. Ensure proper ventilation in the laboratory when working with volatile compounds.
3. Wear appropriate personal protective equipment (PPE) such as lab coat, gloves, and safety glasses.
4. Documentation:
5. Record all relevant information including instrument settings, sample preparation details, and analytical results in a laboratory notebook or electronic record.
6. Sign and date the analysis records to verify completion and compliance with the SOP.

Precautions:

1. If the instrument fails in calibration or any problem observed in the instrument either during routine analysis or during the preventive maintenance, the concerned personnel investigate the reason for failure.
2. Display a status board as “INSTRUMENT OUT OF CALIBRATION” and inform the service engineer.