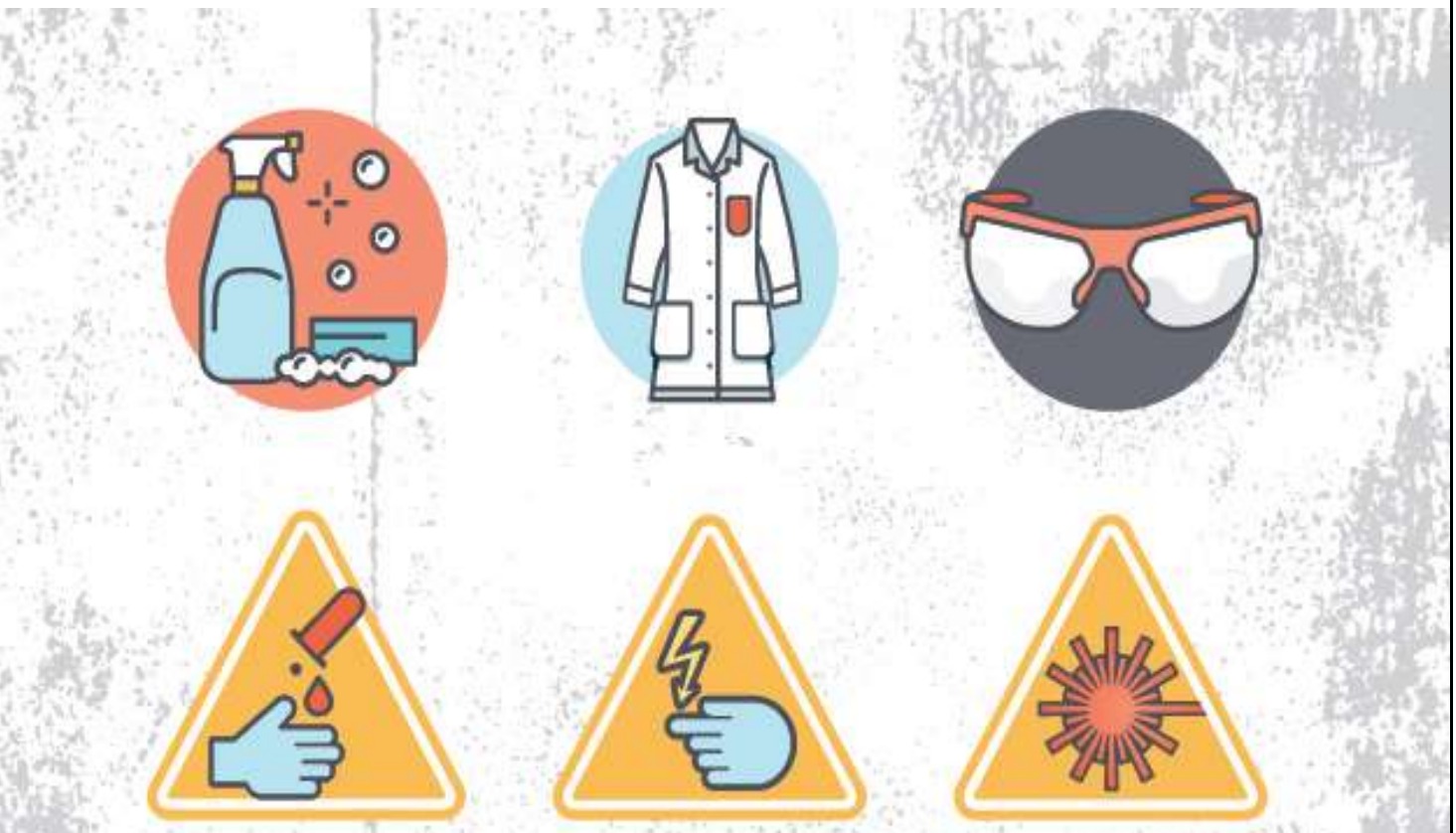
LABORATORY INSTRUCTIONAL GUIDE FOR LAB USERS

[A Must Read Before Using the Laboratory]

Content:

- Laboratory Safety Rules
- Laboratory Accidents and First Aid treatments
- Requisition form for Intending lab user



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BOOK OBJECTIVES

1. To help the laboratory user appreciate and understand the culture and conduct of a laboratory workshop
2. The manual is a handy consult on safety hints and indications that may arise while using basic laboratory facilities
3. The manual exposes the lab user once and again to first aid measures in cases of incidents or accidents
4. The manual highlights signs and symbols in the lab which must be understood and adhered for safety in the laboratory environment
5. The manual will enhance accountability and responsibility of all lab users thereby eliminating carelessness of glass wares, consumables and personal items
6. The forms in the guide are to be collected only if they are correctly filled. This compels undergraduates to do a digest study into their project in view thereby enhancing their understanding and relieving the back-and-forth call on their supervisors

This little book is a compendium of lessons I leant the hard way when I served in a chemical department. I desire that all laboratory users can gain the lessons, while avoiding the accident. Cheers

INTRODUCTION

Having a strong set of overall laboratory safety rules is essential to avoiding disasters in the lab. *David P. Oluwatosin r*ecently scoured the safety policies of several world class laboratories and institutions to determine some of the most common lab safety rules out there, to help you whether you're developing or updating a set of policies for your own use or lab. Of course, safety rules are only effective when they are enforced, which is why strong lab management is so important to a safe laboratory as well. Knowing the proper laboratory safety signs and symbols is as well important.

Here are the safety rules that most commonly came up in my look at several laboratories policies:

WORK RULES:

- The hypothetical question **"*What would happen if…?*"** should always be posed before an experiment or procedure is attempted. Do not conduct the procedure unless you can answer all "*What if*" questions.
- Never underestimate the risk and hazards involved in working in laboratories.
- Plan ahead. Review thoroughly all proposed laboratory procedures to determine the potential health and safety hazards before you begin work.
- Assume that substances of unknown toxicity are hazardous.
- Assume that a mixture will be more toxic than its most toxic component.
- Be alert to unsafe conditions and ensure that they are corrected as soon as they are detected.
- Be prepared against accidents or unexpected events.
- Before beginning an experiment, know what specific action to take in the event of an accidental release of a hazardous substance or an injury.
- Always know the location of safety equipment in your work area, and the emergency safety procedures and contact number of your supervisor.
- If a test result is different than the predicted, a review of how the new result impacts safety practices must be made.

GENERAL RULES:

- Make sure that all containers are properly labeled.
- **A fume hood or other containment device (glove box, etc.) must be used if exposure limits are likely to be exceeded, or if uncertainty exists**.
- Because odor thresholds can be greater than the exposure limits, odors should not be used as the primary method of vapor detection.
- If strong odors are noticed, the laboratory worker should evacuate the laboratory of all user immediately.
- Avoid inhalation of chemicals; do not "sniff-test" chemicals.

- If you need to smell a vapor then do not put your nose directly above a flask, beaker, or other vessel that contains chemicals.
- Holding the vessel at least one foot away, use you hand to gently and very cautiously fan the vapors towards your nose.

PPE and Personal Attire.

- Wear appropriate Personal Protective Equipment and Personal Attire at all times, this should include Chemical splash goggles.

Food, Beverages and Cosmetics:

- Never eat, drink, chew gum, or apply cosmetics in laboratories or chemical storage areas.
- Food, beverage, or other consumables are not allowed in laboratories or chemical storage areas. Food, and drink absorb chemical vapors, particulates, and gases from the air.
- Hold reagent bottles and other vessels containing liquids so that any drips will be opposite the label, and hold them so any previous drips on that same side do not get on your hand. Clean off any drips or spills.
- Avoid accidental self-injection of chemicals (be careful with sharp objects!).
- Never taste chemicals.
- Never use mouth suction to pipette chemicals; use pipette sucker or other mechanical devices.
- Only use glassware or utensils for their intended purposes (e.g., do not use a beaker as a drinking glass).
- Handle and store laboratory glassware with care to avoid damage.
- Inspect glassware often; do not use damaged glassware.
- Use extra precautions when handling containers that *are under negative or positive pressure*; shield or wrap them to contain chemicals and fragments should an explosion/implosion occur.
- Avoid practical jokes or other behavior that might confuse, startle, or distract another worker. **Any "horseplay" or behavior that is harassing, disruptive, aggressive, or in any way presents a hazard to those working in the laboratory is forbidden. Any person or groups of persons engaging in such behavior is required to leave the laboratory.**
- Vent equipment that may discharge harmful vapors or mists (vacuum pumps, distillation columns) into fume hoods or snorkel hoods.
- Do not allow the release of toxic substances into cold rooms since these rooms recirculate the air.
- Immediately clean up all spills and properly dispose of the spilled chemical.
- Hazardous Waste. Deposit chemical wastes through appropriately channel. If you are not sure, please ask the lab attendants.

Water to Acids or Bases.

- Dilute concentrated acids and bases by slowly pouring the acid or base into the water while stirring.
- Combining acid and water frequently generates heat and may cause splashing.
- Adding the acid to the water reduces the amount of heat generated at the point of mixing and provides more water to disperse the heat.

- **Benchtop Safety Shields.**

- Note that the use of a closed fume hood sash may suffice, but realize that there may be situations when a safety shield (or a section of the horizontal fume hood sash) might need to be used inside a fume hood. The shield must be placed between the apparatus and the worker. These shields (in addition to chemical splash-resistant goggles) must be used when:
- A higher-than-normal splash hazard exists (e.g., heating concentrated corrosives).
- The contents are under a sufficiently strong positive or negative pressure that, should the vessel break, debris from an unprotected container could be projected about the lab.

Fundamental Steps to Follow Before Working with Hazardous Substances:

- **Hazard Identification**.

- Consult the label and other sources for information to evaluate the hazardous properties of a chemical, including routes of exposure and exposure limits.
- Determine if a less hazardous (or nonhazardous) chemical can be substituted.

- **Characteristics of the Chemical**. Laboratory workers must know the following:

- Physical properties of the chemical (e.g., aerosol, liquid, low vapor pressure that can lead to fast evaporation and increase exposure)
- Type(s) of hazard (corrosive, flammable, toxic, etc.)
- Chemical incompatibilities (e.g., mixing of certain chemicals can cause fires, release of toxic fumes, etc.)
- Route(s) of exposure (inhalation, absorption through skin, ingestion, injection)
- The amount of exposure that is considered to be safe.
- The lethal dose of any toxic chemical
- How the chemical acts on the body (acute or chronic; carcinogen; mutagen; teratogen).
- Symptoms and target organs of over-exposure.

- Identify the **Circumstances of Use**.

- Calculate the amounts to be used or the possibility of generating new or unknown substances.
- Plan the positioning of equipment before beginning any new operation.
- Review thoroughly all proposed laboratory procedures to determine the potential health and safety hazards before you begin work.

- Are any chemicals known to cause defects, intense sensitivity, etc.?
- What is your comfort level using that chemical?

Standard Operating Procedures

For any chemical that is defined as hazardous, the **SOP**s for working with that type of hazard must be followed in addition to the safety rules outlined in this chapter.

Follow all safeguards for using the chemicals including:

- When and how to use control measures (fume hoods, etc.).
- Appropriate personal protective clothing and equipment.
- How and where to properly place the chemical when in use.
- How and where to properly store the chemical when not in use.
- The proper methods of handling & moving chemicals.
- The proper procedures for handling chemical wastes.
- Inspect laboratory equipment before use. Do not use if the item is even suspected to be defective.

Prior Approval.

- Obtain approval for using chemicals considered particularly hazardous *before* using them.

Avoid/Minimize Exposure to Hazardous Substances:

- Do Not Exceed the Exposure Limits: PEL (Permissible Exposure Limit) and BEI (Biological Exposure Indices). Substances can be hazardous simply by being exposed to the atmosphere because the harmful vapors can then come in contact with or be absorbed into a person's body.
- Implement Control Measures. Control Measures are actions aimed to eliminate a hazard. Continually implement the Hierarchy of Controls to select the best control to mitigate the risk of an accident, incident, injury, or near-miss in the laboratory.

Laboratory Accidents

These are Laboratory accidents – Incidences and disasters that occurs in the Laboratory (occupational hazards)

Laboratory Accidents Explained:

Accidents in the laboratory may be caused by Acids or Alkalis through splashes on the skin, splashes in the eyes and swallowing. Toxic substances which are chemicals can cause death or serious health challenges if swallowed, inhaled or if they come in contact with the skin (e.g. Potassium cyanide, Sodium Azide and formaldehyde solution).

Heat can cause accidents by exposure to open flames. Hot liquids, Inflammable liquids and explosives if not properly handled and stored can cause accidents. Broken glass can cause cuts,

bleeding and infection. More so, contamination by infected material and electric shock can are common causes of laboratory accidents.

How Accidents Can Occur in the Laboratory

- **Infection through Percutaneous: Injury**
  Accidents can arise through Percutaneous Injury – Injury though the skin needle sticks, cut, puncture etc.
- **Infection through broken skin**
  When the human body is not intact due to wound or bruises, Microorganisms can enter the body through such wounds or bruises, intact skin provides a good barrier.
- **Infection through Mouth**
  Microorganisms may be ingested during mouth pipetting, either by direct aspiration or from the mouth end of the pipettes which have been touched by contaminated fingers. Food may become contaminated from benches or fingers contaminated with infected material or food stored in refrigerator with contaminated material.
- **Infection through the respiratory tract**
  Many common laboratory procedures with micro-organisms releases aerosols. i.e. infected airborne droplets, into the atmosphere consisting of bacteria or viruses.

Management of Laboratory Accidents

- **Percutaneous Injury**
  If exposed to blood borne pathogens (e.g. needle stick), Wash with soap and water and report to your supervisor immediately.

- **Emergency Treatment in Case of Electrocution**
  When someone is electrocuted, immediately turn off the mains, remove the plug or wrench the cable free. **DO NOT TOUCH THE PERSON FLESH WITH YOUR HANDS** until the contact has been broken. **Important:** On no account should you try to free an electrocuted person from the electrical contact without using some form of insulative material, such as a dry ***thick*** cloth, folded laboratory coat, etc. If insulation is not used, the person rescuing will also be electrocuted.
- **Emergency Treatment of Heat and Chemical Burns**

Heat burn

If clothing is alight, smoother flames using a fire blanket or roll on the floor. Remove the person from the danger area. Immediately plunge the burnt area into cold water or apply a pad socked in cold water (or any other non-inflammable liquid to the affected part for 10 minutes. Cover the wound with dry dressing, remove any constricting articles such as rings, bracelets before the affected area starts to swell and become blistered, provide frequent small cold drinks.

Chemical Burn

Wash immediately in running water for several minutes, remove any contaminated clothing. Neutralize with a suitable chemical as follows: If an acid burn, neutralize with Sodium bicarbonate powder. If an alkali burn, neutralize with boric acid powder then seek medical attention.

Chemical Injury to the eye

Wash the affected eye as quickly as possible under running tap water. Neutralize with suitable chemical as follows: if an acid injury, neutralize with 5% Sodium bicarbonate solution. If an Alkali injury, neutralize with 5% acetic acid or vinegar diluted. Immediately seek medical attention.

- **Emergency Treatment for Poisoning**

Swallowing of an Acid or an Alkali

Immediately rinse the mouth well with water, neutralize with a suitable chemical as follows: if Acid has been swallowed, neutralize by drinking Magnesium hydroxide suspension or milk. If an Alkali has been swallowed, neutralize by drinking lemon juice or 1% Acetic Acid, drink 3 or 4 cups of water then seek medical attention.

Swallowing of Infected material

Immediately seek medical treatment, provide follow-up tests. **Note:** Mouth pipetting is main cause of accidental swallowing of chemicals or infected materials in the laboratory.

Safety Comes First: Common Laboratory Signs

Laboratories are full of signs. Some of them are:

- Flammable: **It Ignites**

  This is probably one of those self-explanatory signs – chemicals labeled with this are flammable and you should store them accordingly.

  Some examples of flammable chemicals regularly used are ethanol and isopropanol for plasmid preparation.

- Oxidizing agents**: I give Oxygen**

  Oxidizing agents provide oxygen to flammable substances to burn when used in lab. You should always store them separately from flammable substances!

- Corrosive agents: **I wear it away**

  They are strong chemicals that can corrode into your skin or any other substances.

  Strong acid (sulfuric acid etc.) and strong alkali (sodium hydroxide etc.) solutions are both corrosive

- Toxic: **I poison**

  These are highly harmful substances and, in extreme cases, can even cause death if you swallow, inhale or absorb them through you. Examples include HCl and the pH indicator methyl orange.


- Irritant: **It bothers**

  These substances can irritate your eyes and skin causing itchiness, soreness, redness and blistering. For example: calcium chloride.

- Health hazard: **It's a risk**

  These chemicals can cause you serious health damage including problems with your respiratory system, carcinogenicity etc. For example, ethidium bromide, Phenol and Chloroform.

- Environmental hazards: **Nature matters**

  These chemicals are potentially hazardous to the environment – if not properly disposed of, they can contaminate soil and water. For example, bromoform and phenol.

- Explosives and compressed gas: **I can blast**

  Explosives are not generally seen in general unit labs, compressed gas on the other hand is a fairly common sight e.g. CO_2 cylinders in tissue culture. Gas cylinders and aerosol cans are compressed gases that should be treated

- Bio-hazards: **Organism problem**

  This sign may be found on doors or trash cans of the lab, so that you are aware that you are entering an area in which biological material, such as cell lines, bacterial or human samples, are used, and also indicates where to discard waste associated with your organisms.

- Laser and ionizing radiation: **I am harmful**

  These signs generally appear only in areas that you should get an intensive safety introduction on *before* beginning work.

  Lasers can harm your eyes causing severe injury; you should be well protected before entering labs that utilize lasers.

- High voltage: **I can electrify**

- Hot and cold warning: **Temperature shock**

  Extreme temperatures are also a potential lab hazard that should not be ignored. Some hot plates can reach temperatures of 400°C, so when you are using them be careful so you don't give yourself a nasty burn. You should also be careful of very cold temperatures as they can give shock

Make sure you know what type of chemicals or hazards you will be working with and protect yourself accordingly – **precaution is better than cure!**

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Intending lab users are required to print the form below, fill appropriately and duplicate to lab supervisor(s).

REQUSITION FOR THE USE OF CHEMISTRY LAB FACILITIES

Request #: _____ (Official) Date: _____

Proposed Lab: _____ Locker No: _____

Researcher's Name (Capital Letters):																	
Supervisor's Name (Capital Letters):																	

☐ CHEMISTRY ☐ NON - CHEMISTRY

Institution:	
Department:	
Residential Address:	
Email:	
Phone:	

Nature of Work (Please provide details):

Proposed start date: _____ Proposed end date: _____

What facilities are required for the work (please provide details):

Are the required materials for the job available with you? _____

Do you need any materials from us? (please provide details):

Will your institution/dept reimburse the cost of consumables? (please attach the letter) _____

RULES

1. As a general principle, Lab (no and Name tag) _____ provides support to students of the department, various other departments of the university and other visiting universities as a matter of courtesy contribution to vision 2022.
2. The requester is responsible to report and reimburse damaged glass wares and equipment in line of use.
3. The user of the facility is responsible for cleanup of his/her work area after use and cannot leave the lab until he/she has been cleared by the lab technician on duty.
4. The user must follow all safety procedures listed or not listed in this manual but which are necessary to his/her safety during work in the laboratory.
5. Untrained, unskilled and novice user of a glassware, reagent or equipment cannot work in the lab unsupervised.
6. The _____ lab workshop is not meant to be used for student activities such as reading, internet-surfing, competitions and unsupervised projects even if they are part of coursework unless with permission from the Head of Department/Head Tech.
7. The use of some lab equipments may require charges; you will be communicated as to the fee. Kindly attach to this form a signed letter of agreement with fee stated and duplicate to lab technician on duty and supervisor.
8. **The facility can be used only if this form is filled and agreed upon.**
9. **User cannot be cleared from the lab until so indicated below**

DECLARATION

- **I have filled the form and read the rules of the workshop carefully. I hereby solemnly declare that I have understood the rules and should follow them during practice. I further declare that I shall strictly follow the safety procedures during my work.**

Researcher's Name: _____

Signature: _____

Email: _____

Phone: _____

Date: _____

Supervisor's Name: _____

Signature: _____

Email: _____

Phone: _____

Date: _____

Official Section

Accepted ☐ Rejected ☐

Head Tech: _____

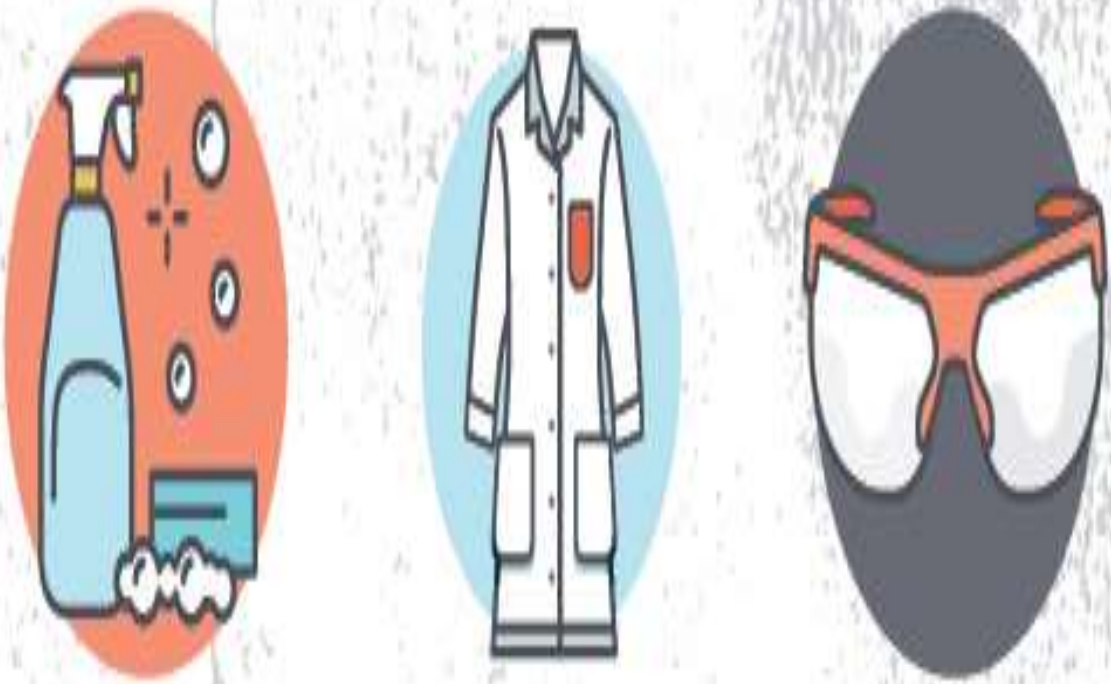
Lab (No and Name Tag): _____

Signature: _____

Date: _____

Clearance (Sign and Date): _____

Dept stamp and HOD'S Signature



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