



NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: PHY133

COURSE TITLE: LABORATORY EXERCISE MANUAL

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LABORATORY EXERCISES MANUAL

COURSE GUIDE

Course Introduction

This block pertains to the practical component of the 'Good Laboratory Practices' course. It is worth two credits and therefore would require 60 hours of work. It consists of seventeen exercises related to the theory units of the previous four blocks. All the exercises have one or more activities and most of these are laboratory based. Some of the exercises do not require laboratory facilities. These may be carried out in the classroom.

The first seven exercises are based on Blocks 1 and 2 of this course and are related to the laboratory design, organisation and management. Exercises 1, 2 and 3 deal with the study of design of laboratory, preparation room and store. Exercises 4 to 7 deal with the activities such as duties of laboratory staff and procedures for purchase of laboratory related items, stock verification, maintenance of apparatus and maintenance stock register.

Exercises 8 to 13 are based on Block 3. The activities of these exercises include basic electrical maintenance work, supply of essential services in the laboratory, handling and storage of compressed gas cylinders, fire safety measures, handling of hazardous chemicals, sterilisation and safe disposal of biological materials. There are two demonstration activities in these exercises which include use of a fire extinguisher and, use of a fume cupboard.

Exercises 14, 15 and 16 are related to Block 4. In these exercises, the disposal of unserviceable items, obsolete items and of chemical wastes are discussed. Some first aid procedures are illustrated through a demonstration exercise. There is an activity on assembling first aid box. Exercise 17, the last exercise of this block, is an interactive group activity i.e. a group discussion. It concerns with the development/improvement of oral communication skills.

Objectives

After performing the exercises of this block, you should be able to:

- state the design features of a laboratory, its preparation room and its store,
- carry out the duties specified for laboratory staff,
- follow the procedures for stock verification, purchase of alcohol and other laboratory related items,
- follow proper procedures for electrical maintenance like wiring a plug and assemble a continuity testing device,
- prepare a list of different compressed gases on the basis of their colour code,
- locate the supply lines of water, gas and electricity of a laboratory, and draw schematic sketch of the same,
- identify and enlist different fire extinguishers and explain the use of carbon dioxide fire extinguisher,
- classify the chemical substances into different hazard types and use a fume cupboard for carrying out a chemical reaction,
- use safe disposal methods for the biological materials in the laboratory,
- follow the procedure described for the disposal of unserviceable and obsolete items,
- state the principles behind the disposal of chemical wastes,
- compile the contents of a first aid box,
- follow the first aid procedure in laboratory related emergency situations, and

- present your point of view in a group discussion on a topic or issue pertaining to a laboratory situation,

Details Regarding Time Required and Location of Performance

The seventeen exercises mentioned above are to be completed in 12 laboratory sessions. Two sessions of four hours each will be held each day. Further details for all the exercises are given in the table given at the end of this part. You will find details regarding the session number, time allotted, place of performance (work place or study centre), and any specific laboratory or classroom needed. **The column on work place (W) or study centre (S) is applicable only to Mode-1 students; Mode-2 students will be performing all the practicals only at the study centre.** The exercises with the entry 'any lab' under the last column can be performed in Botany or Chemistry or Physics or Zoology laboratory.

Guidelines for Doing Exercises

While doing practicals you must have all the blocks of this course with you for reference. In many of the exercises, you'll find references to the materials given in Blocks 1 to 4.

The 'Laboratory Exercises Manual' is prepared in a workbook format. This means that you will use the block itself for noting down observations and writing a report concerning each exercise. Space is provided wherever you are supposed to write your findings/results/reports. In case you feel that the space given in the block is not enough, you can use a separate note book for writing reports.

Specific instructions for Mode-1 students

- Three days of practicals (for sessions 1 to 6) have to be finished at the work place before proceeding to the study centre for doing rest of the practicals for four days,
- For the exercises to be performed at the work place, the terms "study centre and counsellor" mentioned in the block must be read as work place and Resource Person, respectively.
- Your copies of the programme guide and Block 5 i.e. "Laboratory . Exercises Manual" of this course must be made available to the Resource Person(s) at the work place for reference purposes,
- You must bring to the attention of the Resource Person(s) the session-wise list of experiments/exercises and their assessment criteria.
- Please note the choices given among Exercises 14, 15 and Activities 1, 3 and 5 of Exercise 16. If you choose to do Exercise 14 and Activity 3 of Exercise 16, you have to perform the same at individual level, although these are marked as group activities.
- Your Resource Person(s) will be providing you the necessary academic support for doing the exercises.
- For the practicals carried out at the work place, you must
 - *maintain complete record either in the block or in separate note book and*
 - *get the same scrutinised and assessed by the Resource Person(s).*
- While proceeding to the study centre you have to carry with you the following items:
 - The Blocks 1 to 5 and the record note book (if used), and
 - a copy of the mark list for the practicals performed at the work place; the mark list must be signed by the Resource Person(s) and countersigned by the Head of the Institution.

EXERCISE 1

STUDY OF DESIGN AND FEATURES OF A LABORATORY

1.1 INTRODUCTION

Recall Unit 1 of Laboratory Organisation and Management (LOM) course where you were introduced to the essential features of a good laboratory. Since no two labs are alike, it is important to know the design and organisation of the lab one is using. In this exercise you will visit a lab, observe its features carefully and critically, and make a report.

Objectives

After doing this exercise you should be able to:

- describe the design and features of the lab you have visited,
- critically examine any lab with regard to its essential features and design and give suggestions for necessary changes and improvements.

Useful Instructions

It is important that you study Unit 1 of LT-1 course a night before you plan to do this exercise. Also keep Block 1 handy in case you may need to refer to the unit again.

1.2 REQUIREMENTS

Workbook cum Lab. manual

Relevant module: Laboratory Organisation and Management (LOM)

Pencil

Pen

Eraser

Scale

Coloured pens

1.3 PROCEDURE

Visit any lab (physics, chemistry or biology) of your study centre or any other you can get access to and note its features. To guide you through we have listed below the main features along with some hints so that you can examine it in a systematic way and do not miss out something essential. If we have forgotten something that you consider important, you should add to the list. You are expected to observe the features, and make your comments and suggestions keeping in view what you learnt in course LOM.

1. Design and Construction

Note the design of the college building. Also observe the **quality of construction** and the materials (bricks, tiles, stone, cement, mosaic or any other) used for elevation, floors, walls and ceiling. Take a good look at the interiors also. If you find it interesting you may like to make inquiries about it from an architect or engineer. We think it is also important to consider how old the building is.

Design and Construction	Observations	Comments and Suggestions
Design		
Size		

Material used		
Floor		
Wall		
Ceiling		

Try to make a rough drawing of the building.

2. Location and layout

Note the location of the lab with respect to the rest of the building. Is the location satisfactory for efficient functioning? You can study the layout well if you draw a two-dimensional figure to show the position of various rooms in the lab (Ref. to course LOM, Unit 1, Fig. 1. X). Also draw the position of the doors since it is important to see the relationship among various rooms.

Location and layout	Observations	Comments and Suggestions
Location		
Level (Ground, 1 st or 2 nd)		
Other structures (around)		
Greenery		

Draw a two-dimensional layout plan of the building.

3. Entry and exit points

You should see them from the point of view of access, convenience and safety.

Observations

Comments and Suggestions

4. Number of rooms, their size and allocation

Count the number of rooms including ancillaries (if any). Estimate their size and note the allocation of the main lab, preparatory room, store, office and other accommodation (if any). Inquire if there is provision for other facilities such as photographic room, culture room, cold room and instrument room.

Details of the Rooms	Observations	Comments and Suggestions
No. of rooms		
Size of rooms		
Allocation		
Ancillaries, if any		

5. Outdoor facilities, if any

For biology lab there may be an animal house, green house, garden plots, aquarium, a vivarium etc. Also find out how they are connected with the main lab.

Observations

Comments and Suggestions

6. Laboratory staff and students

Give an account of the permanent staff and students using the lab and for what purposes. Here you may use the concept of Laboratory Investigation Unit studied in Unit 1 (Section 1.3).

Staff and students	Observations	Comments and Suggestions
No. of teachers		
No. of supporting staff		

7. Fixed/Flexible design

See how the benches and services are fixed (permanently fixed/movable). Are there any partition walls?

Observations

Comments and Suggestions

8. Provision for services—gas, water and electricity and drainage

Which of the services are given and how are they provided (through walls/floor/ movable service station)? Are there enough outlets? See the plumbing network, condition of taps and drainage. Also check if there is leakage at any point.

Details of Services	No. of outlets	Condition of outlets (Properly maintained/need repairs)
Gas		
Water		
Electricity		

Drainage		
Mains		

Make a detailed diagram to show supply lines of electricity and water below:

9. Main lab in relation to other rooms

See the location of the main lab with respect to other rooms. Try to roughly estimate its area. Is it conveniently placed? Now consider the space and its organisation. Make a rough estimate of the number of students that could be accommodated per batch.

Observations

No. of students/bench

Total students

Make a drawing and show adjacent rooms

10. Benching and its surface

What is the type of benching (perimeter, peninsular or island type, Ref. to Fig. 1.3, Unit 1)? Where are the sinks provided? Is the material used for bench surfaces suitable for the purpose of the lab? Note if there are slabs also.

Type of benching	Type of surface	Comments and Suggestions
Perimeter		
Peninsular		
Island type		

Draw a figure to show the arrangement of benches.

11. Windows and Ventilators

Note the numbers, size and type of windows and ventilators. Are they adequate to allow natural light and ventilation? Is there a provision for forced ventilation also? Also examine them from the point of view of security?

Windows and Ventilators	Type	Comments and Suggestions
No. of windows		
No. of ventilators		
Forced ventilation		
Ancillaries, if any		

12. Lighting, Heating and Cooling

Observe if the lab is well-lit with natural light. What are the arrangements for PSAL (Permanent Supplementary Artificial Light)? Keeping in view the changing weather conditions of the place, note if there are arrangements to maintain a comfortable temperature in the lab.

Arrangement	Observations	Comments and Suggestions
Heating		
Heating		
Cooling		

13. Flooring

Observe what kind of material is used (concrete/mosaic/linoleum/glazed or PVC tiles) for flooring? Is it suitable for this lab? Also note if it is rough, smooth or slippery.

Observations

Comments and Suggestions

14. Fume cupboards

Note its presence and location. Is the location appropriate? What kind of _ fume cupboard has been provided?

Observations

Comments and Suggestions

15. Security and safety

Security and safety are paramount for a lab. Note the provisions made in this regard.

Observations

Comments and Suggestions

16. Maintenance and House keeping

Examine the organisation of the lab. Is it appropriately organised for efficient functioning? Give it a rating for cleanliness and organisation. Also inquire who all are responsible for organisation and maintenance.

Observations

Comments and Suggestions

17. Provision for Disposal

This is very important. See the arrangements in this regard.

Observations

Comments and Suggestions

1.4 REPORT

Now that you have made your observation consolidate your comments and suggestions neatly as follows:

	Features	Comments and Suggestions
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

Discussion

EXERCISE 2 STUDY OF DESIGN AND INFRASTRUCTURE OF A PREPARATION ROOM OF A LABORATORY

2.1 INTRODUCTION

This exercise is based on unit 2 of the LOM course where you were introduced to the essential features of a good preparation room that offers services to a laboratory. In this exercise you will study the preparation room of that particular laboratory the designs and infrastructure of which you studied in Exercise I of this lab course. You will be expected to carefully study the various important features of the preparation room and critically make a report.

For Mode-1 Students

You have to perform this exercise in your place of work.

Objectives

After doing this exercise you should be able to:

- describe the features of the preparation room of the lab you have visited,
- examine and evaluate a preparation room of the lab with regard to its essential features and design, and
- give suggestions for carrying out necessary improvements.

Useful Instructions

It is important that you study unit 2 of LOM course a night before you plan to do this exercise. Also keep LOM handy in case you may need to refer to the unit.

2.2 REQUIREMENTS

Work book cum lab manual

Pen

Pencil

Eraser

Ruler

Colour pencils

2.3 PROCEDURE

Visit the preparation room of the lab (Physics/Chemistry/Zoology/Botany), you studied in Exercise I and note its features. To make your study easy and to guide you, we have listed below the main features along with some hints so that you can pay attention to them in a systematic way and do not miss out essential aspects. You can also consult, if you feel the need, the lab technician associated with the lab for information and help. You are expected to observe the various aspects and features and note them in the columns we have provided. You are also expected to add your own comments, additional information and suggestions whenever you feel the need, keeping in mind what you have learnt. In some cases the columns may prove inadequate for your notes. In such cases use additional sheets and make appropriate columns.

1. Location and layout

Note the location of the preparation room with respect to the laboratory. Is the location satisfactory for efficient functioning? Is it located between two labs? How many labs does it service? Draw a floor plan of the preparation room and the labs it provides service to. Draw the position of the wet and dry bench, water tap etc. whatever you observe in the room somewhat similar to the figure shown here (see Fig. 2.1).

Location of preparation room of _____ lab	No. of labs the preparation room services to
Remarks if any	

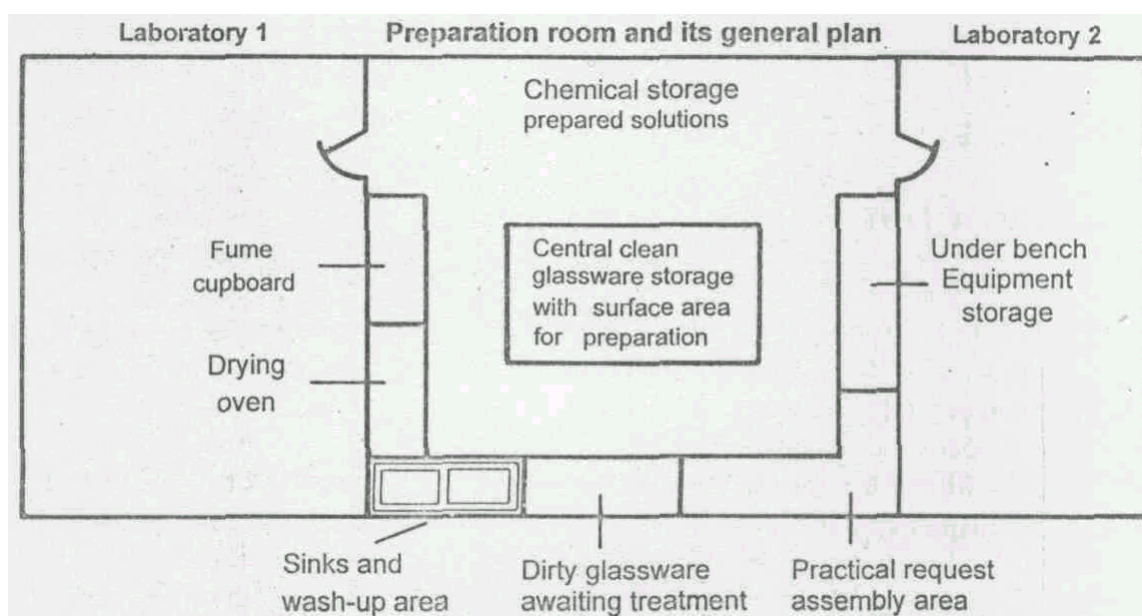


Fig. 2.1: The plan of a preparation room area along with the adjoining laboratories

Floor plan of preparation room with its dimensions (length x breath) as well as position of access, windows, wet bench, dry bench marked out.



2. Entry and exit points: Note the entry and exit points of the preparation room and specify whether the access and entry is restricted and how. Also comment on the convenience and safety of the entry and exit points.

Number of entry points of preparation room as well as how convenient they are	State whether entry restricted or not	To and from movement of people in preparation room
Remarks if any		

3. Infrastructure and Organisation: Give a broad list of the types of things that are kept in the preparation room, their number and use. Also describe how they are kept and how often they are used. All the things listed here may not be in the preparation room that you have taken for your study. For example a physics lab may not have chemicals and a chemistry lab may not have stains. These headings are for your convenience. You can change these headings if need be or leave them blank

List	Quantity	Their use	Their Maintenance	Remarks
a. Chemicals				
Alcohol (any 2)				
Acid (any 2)				
Bases (any 2)				
Stains/pH indicator (any 2)				
b. Equipment (any 10)				
c. Furniture				
Dry bench				
Wet Bench (may not be in a physics lab)				
Tables Cupboards				
Racks				

4. Storage: Note the kind of storage and racks present in the preparation room. Is there enough room for storage? Pay attention to underbench storage also. Note the position of shelves (in the centre of room, along the walls etc.).

Type of material stored	Method of storage of material whether in open or, closed cupboards, racks, filing cabinet etc.	Position of storage - whether above, below, in centre, along wall etc.	Storage space - adequate/inadequate
1) Chemicals			
(2) Equipment			
(3) Paperwork			
Remarks in any			

5. Provision for services – gas, water and electricity and drainage

Observe the kinds of the services that are available in the preparation room and how they are provided (through walls/floor/ movable service station). Note the number of outlets of these services and whether they appear adequate. Observe also the plumbing network and drainage as well as condition of taps (if leaky).

Type of services	Location of mains	No. of outlets – adequate or inadequate	Conditions of outlets (properly maintained/needs repair)
Gas			
Water			
Electricity			
Drainage			
Remarks if any			

6. Windows and Ventilation

Note the number and size of windows and provision for forced ventilation in the form of exhaust fans or air-conditioners. Also note if the preparation room is secure from thieves and vandals.

Type of ventilation - whether only window or/as well as exhaust fan, or/as well as air conditioner	No. of windows or exhaust fans or air-conditioners and whether ventilation adequate	Note if the windows and/or exhaust fan and/or air-conditioners affect security of the preparation room
Remarks if any		

7. Lighting, Heating and Cooling

Observe and note (i) if the room is receiving sufficient natural light (ii). Also observe if there are adequate arrangements for PASL (Permanent Artificial Supplementary Light)? Keeping in view the changing weather condition (in certain parts of the country), also note the kind of arrangements that are provided in the preparation room to maintain comfortable temperature.

(a) Lighting	Illumination	Remarks if any
Type of lighting: <u>Natural</u> Number of windows	Adequate/inadequate	
<u>Artificial</u> Tubes and/or bulbs No. of tubes No. of bulbs Others	Adequate/inadequate	
(b) Heating	Warmth	
(1) Needed/Not needed in _____ months	Adequate/inadequate	
(2) Type of heating by blower and or/radiator and or air-conditioner		
(c) Cooling	Coolness	
(1) Needed/not needed in _____ months	Adequate/inadequate	
(2) Type of cooling by air-conditioner/desert cooler		

[illegible]

EXERCISE 3 STUDY OF DESIGN AND ORGANISATION OF A LABORATORY STORE

3.1 INTRODUCTION

You have studied in Unit 3 of LOM course that storage is usually a necessity in most scientific establishments. You know that sufficient and appropriate storage space should be provided for storing particular items such as solvents, chemicals, glassware and museum specimens.

You have studied in Unit 3 of Hazards in Laboratory and Laboratory Safety (HLLS) course that no chemical can be considered totally safe. Storage and handling of chemical substances are two important duties of a laboratory worker. Chemicals can be poisonous, radioactive, explosives, corrosive substances or flammable substances.

Objectives

After performing this exercise you should be able to:

- describe the design and organisation of a lab store,
- suggest modifications in the store design,
- classify the chemicals in the store as poisonous, explosive, flammable Co substances, etc.
- arrange the chemicals safely in store. j

Useful Instruction

You should study Unit 3 of LOM and Unit 3 of HLLS course before doing this exercise.

3.2 ACTIVITY 1 INVESTIGATION OF THE STORE

Investigate the store of any one of the laboratories in your study centre and write a report in approximately 500 words.

Procedure

Observe the environmental and physical considerations of a store of any one of the laboratories in your study centre. You have already studied about these factors in Unit 3 of the LOM course.

You are instructed to observe and write a report under the following heads compulsorily.

Two - dimensional diagram

Draw a diagram depicting shelving units, entry to the store, storage units for immediate requirements, cupboards and racks.

Diagram

Shelving

Note the different forms of shelving i.e. wooden, metal, plastic-coated metal or concrete and observe the strength of shelving.

Observations

Comments and Suggestions

Ventilation, Windows, Lighting

Observe ventilators and exhaust fans. Observe presence/absence of windows in solvent store, properly lighted or dark.

Observations

Comments and Suggestions

Classification, Arrangement and Compatibility of Items

Note that chemicals are classified according to their compatibility. Two incompatible chemicals kept together can cause serious hazards. You may do any particular location of the store as per the advice of the counsellor.

Observations

Comments and Suggestions

Out of the following items given below, you observe and prepare a report for any three.

Accessibility to the Store

Observe the arrangement of the store, access to the store (free of lab or through the lab), whether design of the store meets the requirements of the establishment.

Observations

Comments and Suggestions

Furniture

List the furniture i.e. number of tables, stools or chairs. Is the number adequate?

Observations

Comments and Suggestions

Safety

Look for fire extinguisher outside the store, note the location of alcohol and the place for transferring liquids.

Observations

Comments and Suggestions

Cleanliness

Take care to see that no chemical/solvent/stain is spilled on the floor, dissecting trays are dry. Note general cleanliness of store.

Observations

Comments and Suggestions

Mode of handling items

Note availability of ladder to handle solvents/stains kept at a height.

Observations

Comments and Suggestions

Labels or Location Indicators

Observe location of stock register and store guide.

Observations

Comments and Suggestions

Appropriate storage procedure

Note whether there is proper storage procedure for storing animal foodstuffs, glassware, delicate equipment, museum material, herbarium, radioactive sources etc.

Observations

Comments and Suggestions

Disposal procedure

Find out whether proper disposal procedures are followed for flammable liquids, acids, and biological material as and when necessary.

Observations

Comments and Suggestions

Any other remarks you would like to make regarding the stores:

ACTIVITY 2**CLASSIFICATION OF CHEMICALS IN THE STORE**

Your Counsellor will give you names of any five chemicals. You fill up the report in tabular form (Table 1) indicating the name of the chemical, location of storage and list of substances which are incompatible with each chemical. That is, the chemical indicated should not be stored along with the list of substances indicated in each case. A list of incompatible chemicals is given in annexure (Annexure 1).

Table 1: Now you can write a report under the following heads:

Name of the chemical	Location of storage	List of substances that should not be stored with
1. 2. 3- 4. 5.		

Substances in the left-hand column should be stored and handled so that they cannot possibly contact corresponding substances in the right-hand column under uncontrolled conditions by accident. Violent reactions may occur.

Acetic acid	Chromic acid, nitric acid, peroxides and permanganates.
Acetic anhydride	Hydroxyl-containing compounds, perchloric acid.
Acetone	Concentrated nitric and sulphuric acid, hydrogen peroxide.
Acetylene	Chlorine, bromine, copper, silver, fluorine and mercury.
Alkali and alkaline earth metals, such as sodium, potassium lithium, magnesium, calcium, powdered aluminium	Carbon dioxide, carbon tetrachloride and other chlorinated hydrocarbons. (Also prohibit water, foam, and dry chemical on fires).
Ammonia (anhyd.)	Mercury, chlorine, calcium hypochlorite, iodine, bromine and hydrogen fluoride.
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided organics or combustibles.
Aniline	Nitric acid, hydrogen peroxide.
Bromine	Ammonia, acetylene, butadiene, butane and other petroleum Gases, sodium carbide, turpentine, benzene and finely divided metals
Calcium oxide	Water
Carbon, activated	Calcium hypochlorite, other oxidants
Chlorates	Ammonium salts, acids, metal powders, sulphur, finely divided organics or combustibles
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, turpentine alcohol and flammable liquids
Chlorine	Ammonia, acetylene, butadiene, butane and other petroleum gases, hydrogen, sodium carbide, turpentine, benzene and finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine and hydrogen sulphide
Copper	Acetylene, hydrogen peroxide
Fluorine	Isolate from everything
Hydrazine	Hydrogen peroxide, nitric acid, any other oxidant
Hydrocarbons (benzene, butane, propane, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, peroxides
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid,	Ammonia, aqueous or anhydrous
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquids, combustible materials, aniline, nitromethane.

Hydrogen sulphide	Fuming nitric acid, oxidising gases.
Iodine	Acetylene, ammonia (anhydrous or aqueous).
Mercury	Acetylene, fuiminic acid*, ammonia.
Nitric acid (conc.)	Acetic acid, acetone, alcohol, aniline, chromic acid, hydrocyanic acid, hydrogen sulphide, flammable liquids flammable gases and nitratable substances.
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils.
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold.
Phosphorus (white)	Air, oxygen.
Potassium chlorate	Acids (see also chlorates)
Potassium perchlorate	Acids (see also perchloric acid).
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulphuric acid.
Silver	Acetylene, oxalic acid, tartaric acid, fuiminic acid, ammonium compounds.
Sodium	See alkali metals (above).
Sodium nitrite	Ammonium nitrate and other ammonium salts.
Sodium peroxide	Any oxidisable substance, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulphide, glycerol, ethylene glycol, ethyl acetate and furfural.
Sulphuric acid	Chlorates, perchlorates, permanganates.

* Produced in nitric acid-ethanol mixtures.

One topic related to several of the hazardous possibilities above is the use of powerful oxidants or mixtures (nitric acid, dichromate, or chromium trioxide with sulphuric acid) to clean glassware from traces of reaction residues, especially tars of organic derivation. In most cases this is not only potentially hazardous, particularly with large containers or residues, but unnecessary. The specially formulated laboratory detergents which are available are just as effective.

EXERCISE 4 STUDY OF THE REGULAR DUTIES OF LABORATORY STAFF

4.1 INTRODUCTION

You will recall from unit 3 of Block 1 of this course about the various duties and activities of a lab staff that facilitate management of the laboratory in an efficient manner. In this exercise you will study the same duties by actually visiting any two laboratories of your study centre and interacting with the lab technicians or senior laboratory supporting staff of those labs.

Objectives

After doing this exercise based on two different labs of Zoology/Botany/Chemistry/ Physics, you should be able to:

- state the check in and check out procedure of any two labs,
- compare the coordination between academic staff and the lab staff,
- state the prior preparation work as well as wind-up procedure that the lab staff of any two labs chosen by you will under taken for a particular experiment: Zoology/Botany/Chemistry/Physics
- compare the procedures followed by two different labs with regard to stock replacement and repair of equipment,
- state the duties performed at two different labs before the examination, during vacation and at times of annual/biannual cleaning and white washing.

Useful Instruction

It is essential that you study unit 4 of LOM course, a night before you plan this exercise. Also keep Block 1 handy in case you have to refer to the unit.

4.2 REQUIREMENTS

Work book cum lab manual

Pen

Pencil

Loose Sheets

Eraser

Ruler

Coloured pencils

4.3 PROCEDURE

Visit any two labs of your choice (Botany/Zoology/Physics/Chemistry) of your study centre and consult the lab technician or senior laboratory supporting staff and compare the various duties, and functions that they perform:

1. on a daily, weekly and monthly basis.
2. prior to practical examinations.
3. during vacations and
4. during annual or biannual maintenance, and
5. during cleaning and white washing.

In order to give direction to your study as well as to make it easy and fruitful we have listed the broad duties that a technician may be expected to perform, along with some hints. This will help you to proceed in a systematic manner. You may present your observations/suggestions and additional information in the columns we have provided. In case these columns prove inadequate

for your observations and notes, please use the paper provided in your manual cum work book from your notebooks.

1. Check in and check out procedure

a. Location of Key

Enquire from the technicians as to who opens the laboratory. Do the lab staff have to take the keys from the office or do they have personal keys. (Also note how many keys are available for the lab and where they are located.)

Source of Information	No. of keys	Keys - with office/ academic staff in charge/self	Remarks if any
Lab Technician 1 of _____ lab			
Lab Technician 2 of _____ lab			

b. Daily Duties Regarding Cleaning & Dusting

Enquire from the technicians as to who cleans the floors and dusts the equipment and also supervises this cleaning. During cleaning and dusting are there any precautions to be followed?

2. Coordination between Lab Technician and Teaching Staff

Enquire from the technicians how they interact and coordinate with the teaching staff with regard to the following information about the experiments/demonstration to be conducted:

- (1) Type of activity (experiment/demonstration)
- (2) No. of students
- (3) Requirements for the experiment/demonstration
- (4) Chemicals/material needed
- (5) Advance procurement of materials needed
- (6) Preparations to be made by the lab staff

For this, you should also find out how many days (a week/2 weeks/ a month) before do the teaching staff inform the technician about the details of experiment/demonstration to be conducted, and how this information is recorded. If the information is recorded in a register/notebook then request each technician to show you one such page and note down the manner in which the information is recorded. Does it give broad details such as concentrations and volumes of solutions required or minute details regarding preparation of solutions as well? Also note if the recording is done by the academic staffer do they just verbally inform the technician who records the instructions himself/herself by actually noting down the requirements.

Technicians	Advance time is given by academic staff to lab staff for preparation of experiment/ demonstration -daily/weekly/ monthly	Type of information given by academic staff- Broad details or minute details	Method of communication of information (oral/written message) by academic staff	Remarks if any
Technician 1 of _____ Lab				
Technician 2 of _____ Lab				

3. Daily routine of preparation for experiments/demonstration

In order to become familiar with the preparation that a lab staff member makes prior to an experiment/demonstration it is desirable that you discuss this with the two lab technicians you have been consulting. For this we have listed specific experiments for each discipline. You may gather the relevant information (depending on the discipline to which the lab staff belongs).

A

ZOOLOGY AND/OR BOTANY EXPERIMENT – STAINING OF PLANT AND/OR ANIMAL MATERIAL

1. Procedure for Procurement of Biological Material

Find out the details for procuring botanical root and stem material and/or zoological material (rat or other mammals) and procuring slides.

Procedure for procuring Biological material	Material may be fresh/or stored. If stored-duration for which (lie material can be kept	Storage method of the material- in fridge, in fixative, in the animal house	Remarks if any
Zoology (a) Animal – rat or any one mammal (b) Slides			
Botany (a) Plant (i) Monocot-any one root or stem (ii) Dicot-any one root or stem (b) Slides			

2. **Prior preparation for fixing and staining animal tissue and/or plant tissues**

Find out what procedure the lab technician follows for preparing fixath (either plant and/or animal), alcohol series and stain for animal (aceto orcein or aceto carmine) and/or plant (safranin).

Enquire what calculation the technicians undertake to prepare the various solutions and stains so that they are neither in excess nor too little. Also whether the quantities are prepared on the basis of the requirement of each student or is some other calculation used?

Also whether the technicians prepare all the solutions a day or two before the experiment or on the same day. After the experiment do the technicians retail any of the prepared chemicals or do they discard them? If the chemicals are ff discarded, how long can they be kept without deterioration?

Name of reagents and stains	Procedure for preparation and calculation as to how much solution should be prepared	If chemicals kept or discarded after experiment.	Shelf life	Remarks if any
a. Alcohol series				
b. Name of one fixative - (plant and/or animal) Animal Fixative _____ _____ _____ Plant Fixative _____ _____ _____				
c. Name of one stain (plant and/or animal) _____ _____ _____ Plant stain _____ _____ _____				

Glassware used and method of cleaning it

Enquire and list any five types of glassware which the technicians keep at hand for preparing the various chemicals and stains and list any five types of glassware needed by the students for the experiments. How are these glassware cleaned both before and after the experiments?

Glassware	Cleaning method of glassware before and after preparation	Remarks
Name of 5 glassware items used by Lab Technician in a: (i) Zoology lab _____ _____ _____ _____ _____ (ii) Botany _____ _____ _____ _____ _____ _____		
Name of glassware items used by student/researcher (i) Zoology lab _____ _____ _____ _____ _____ (ii) Botany lab _____ _____ _____ _____ _____ _____		

4. Wind-up and Disposal Procedure after the experiment and at the end of the day

Find out from the two of the lab technicians, what cleaning procedures they follow after the experiment and at the end of the day. Also discuss the following:

- (i) Disposal of Biological material
- (ii) Disposal of solutions (fixative, alcohols, stains, paraffin etc)

Biological material	Disposal method
a. Animal – rat and or/ b. Plant – Slides and coverslips discarded by students during practical Animal – and or/ Plant –	
Solutions	Disposal method
Plant fixative and or/ Animal fixative Alcohol Plant stain (Safranin) and or/ Animal stain (aceto-orcein or aceto carmine) Paraffin wax	

5. Cleaning and maintenance procedure

You can enquire from the technician about general cleaning and maintenance of permanent slides of plants and/or animals, dissecting and compound microscopes, weighing balances, models, charts and in case of Zoology lab, about dissecting trays, stuffed animals, mounted specimens, specimens in jars, and in case of Botany laboratory, about mounted specimens, specimens in jars, and herbarium, etc.

Cleaning and maintenance of microscope - Dissection, compound	Cleaning, maintenance of weighing balance	Cleaning and maintenance of slides	Maintenance of models and charts	Cleaning and maintenance of stuffed animals, mounted specimens or specimens in jars	Maintenance of plant herbarium
Dissection microscope	Rough balance	Animal Slides			
Compound Microscope	Electronic balance	Plant slides			
1 Remarks if any					

OR

B

CHEMISTRY EXPERIMENT - THE VOLUMETRIC DETERMINATION OF A GIVEN ACETIC ACID SOLUTION REQUIRED BY USING 100 ML. OF A STANDARD CAUSTIC SODA SOLUTION

Procedure for storage of apparatus and chemicals needed for the experiment

Enquire from the lab technician how the various apparatus and chemicals listed below are used for experiment and how they are stored.

Name of apparatus and Chemicals	Storage area – Room in which stored	Storage method
<u>Apparatus</u>		
(1) Burette	Storage in lab/preparation room	
(2) Pipette	Storage in lab/preparation room	
(3) Titration flask	Storage in lab/preparation room	
(4) Funnel	Storage in lab/preparation room	
(5) Glazed tile	Storage in lab/preparation room	
(6) Burette stand	Storage in lab/preparation room	
(7) Analytical balance	Storage in lab/preparation room	
(8) Weights	Storage in lab/preparation room	
<u>Chemicals/reagents</u>		
(1) Standard caustic soda (NaOH) solution	Storage in lab/preparation room	
(2) Acetic acid solution	Storage-in lab/preparation room	
(3) Phenolphthalein (indicator)	Storage in lab/preparation room	

2. Prior preparation for titration

Enquire from the lab technician about the reagents or solutions he himself prepares and about those which are prepared by students. Also what method the technician uses to prepare the solutions and what amount per student does he prepare?

Name of reagents/solutions	Preparation of the reagent solution by student/lab technician	Method of preparation of reagents prepared by lab technician
Remarks if any		

3. Method of Calculation for amount of solution to be prepared

Find out from the lab technician how he calculates the amount of the solution he has to prepare for all the students so that the solution prepared by the lab technician is neither too much nor too little. Is the amount of solution prepared on the basis of the requirements of each student or is some other calculation made? Also enquire if the solutions are prepared a day or two before the experiments or on the same day. After the experiment do the technicians retain the unused solution or do they discard them. If the chemicals are not discarded, how long can they be kept?

Name of Chemicals	Procedure for calculation of amount of solution to be prepared by lab technician	Unused chemicals kept or discarded after experiment	Shelf-life
Remarks if any			

4. Glasswares used and their method of cleaning it

Enquire and list any five types of glassware which the technicians keep for preparing various solutions and also list any five types of glassware needed by the students for the experiment. How are these glassware cleaned both before and after the experiment?

Glassware		
(a) Name of 5 glassware items used by student		
(b) Name of 5 glassware items used by lab technician		

5. Wind-up and disposal procedure after the experiment and at the end of the day

Find out from the lab technician what cleaning procedure he follows after the experiment and at the end of the day.

Name of Material	Method of disposal	Remarks if any
(a) Chemicals		
(b) Glassware		

6. General cleaning and maintenance of equipment procedure

Enquire from the lab technician how some of the important apparatus used in the chemistry lab experiment are maintained and cleaned.

Cleaning and maintenance of balances	Methods of cleaning and maintenance of gas-burner	Method of maintenance and repair of distillation plant or deionizer	Method of maintenance and cleaning of oven
(1) Rough balance _____ _____ _____ _____			
(2) Electronic balance _____ _____ _____ _____			
(3) Analytical balance _____ _____ _____ _____			

OR
PHYSICS ELECTRICITY EXPERIMENT - TO VERIFY OHM'S LAW WITH THE HELP OF AMMETER AND A VOLTMETER.

1. Procedure for the storage of equipment used in the experiment.

Enquire how the main equipment used in the experiment are stored.

Name of equipment	Storage of equipment in lab/ preparation room	Storage of equipment in cupboard/open area	Remarks if any
(1) A battery of two storage cells			
(2) A voltmeter 0-5 volts			
(3) Ammeter(0-5 amps.) and capable of measuring up to 1/10 amp			
(4) A rheostat (max value 20 ohms)			
(5) A tap key			
(6) A resistance coil of 2 ohms			

2. Prior preparation made by the lab technician for the experiment

Find out from the lab technician if he checks all the equipments that are listed in the column below, before or at the end of the practical. Also what procedure he uses to check if the equipment are in working order.

Name of instruments and equipment	If equipment and instrument checked before or after experiment	Procedure for checking equipment and instrument
(1) A battery of two storage cells		
(2) Voltmeter		
(3) Ammeter		
(4) Rheostat		
(5) Tap key		
6) Resistance coil of 2 Ohms		

3. Method of issue and return of instruments

Enquire from the lab technician about the procedure he has adopted for issuing equipment to the students as well as the procedure he follows to get the equipment back from students.

Name of equipment	Procedure of issue of equipment	Procedure of getting back equipment after experiment	Remarks if any

4. Wind-up procedure after the experiment

Enquire from the lab technician you are consulting, the procedure for dismantling the set-up of the apparatus after the experiment.

Dismantling of set-up of apparatus by student/lab technician	Procedure of dismantling the set-up apparatus

5. Cleaning and maintenance of the instruments

Enquire from the lab technician the cleaning procedure he follows for the instruments used as well as of any 5 important equipment used in the physics lab.

Name of Instruments & Equipment	Method of cleaning and maintenance of equipment and apparatus
(1) A battery of two storage cells	
(2) Voltmeter	
(3) Ammeter	
(4) Rheostat	
(5) Tap key	
(6) A resistance coil of 2 ohms	
(7)	
(8)	
(9)	
(10)	

6. Repair and Replacement of the Instruments

Enquire from the lab technician you are consulting about what action be undertaken if the instrument goes out of order or is damaged by the student while doing the experiment.

Are there extra instruments available in the lab so that the work may continue? What is the ratio of the extra instruments with regard to students? Also enquire from the lab technician as to how he gets the instrument repaired. Does he send it to the workshop or to the company, from which the instrument has been obtained? What procedure does he follow for the replacement of the damaged instruments?

Name of damaged Instrument	Availability of extra instruments required in case of damage. Ratio of extra instruments present. No. of instruments: No. of Students	Procedure for repair and replacement of parts of instrument. Instruments - repaired by self/ workshop	Procedure followed for replacement of damaged instruments

IV Stock replenishing and repair jobs

Find out from the two lab staff members what procedure is followed regarding replenishing of stock on a daily/weekly as well as on a six monthly basis. State your findings below:

Lab Technicians	Replenishing stock		Repairs of equipment		Remarks
	Daily/ weekly	6 monthly/ annually	Daily/ weekly	6 monthly/ annually	
1. Lab Technician of lab _____					
1. Lab Technician of lab _____					

V Preparation Prior to Examinations

Enquire regarding the preparation work undertaken by the technicians prior to exams and enter the findings below:

Preparation before exam
(1) Lab
(2) Lab

VI Annual/Biannual cleaning and white-washing

Enquire from the two technicians about the duties they perform during vacation. Note them down under the following headings.

<p>(1) Time period of Annual/Biannual cleaning of lab and how it is done</p> <hr/> <hr/> <hr/> <hr/>	<p>(1) Time period Annual/Biannual cleaning lab and how it is done</p> <hr/> <hr/> <hr/> <hr/>
<p>(2) White washing time</p> <hr/> <hr/> <hr/> <hr/>	<p>(2) White washing time</p> <hr/> <hr/> <hr/> <hr/>
<p>(3) Repairing furniture and painting time period</p> <hr/> <hr/> <hr/> <hr/>	<p>(3) Repairing furniture and painting time period</p> <hr/> <hr/> <hr/> <hr/>

Any Other Suggestions

[illegible]

[illegible]

EXERCISE 5 STUDY OF PROCEDURE REGARDING PURCHASE OF LABORATORY RELATED ITEMS

5.1 INTRODUCTION

In this exercise you will learn various steps and procedures adopted while purchasing lab-related items. This exercise, will acquaint you with practices of preparing comparative charts of quotations. Besides, you will learn how to pass the bill for payment and how to invite quotations and place orders for the supply of goods.

For Mode-1 Students:

AH the activities given in this exercise are to be performed at the Work Centre. Your resource persons will act as the counsellor.

Objectives

After you have done this exercise, you should be able to:

- prepare a comparative chart of quotations
- fill up the quotations form
- process a bill for payment
- fill up the order form for the supply of goods.

Useful Instructions

Students are advised to go through Unit 5 of Course LOM before taking up this exercise on purchase procedures of lab-related items.

5.2 REQUIREMENTS

1. Loose paper sheets
2. Three envelopes containing quotations of the items to be purchased for
3. your lab
4. Three envelopes containing bills of items supplied by the
5. firms/agencies/manufactures
6. A register
7. Pen/pencils and rubber
8. Quotation (format)
9. Order (format)

5.3 PROCEDURE

Activity 1: Invitation of quotations

A format for inviting a quotation is given below. You are required to fill up the form for finding out the prices of the following items from M/s Shakur Nig. (Ltd.).

- (i) Beakers, 50 ml, 100 ml, 200 ml, 300 ml.
- (ii) Measuring cylinder; 10 ml, 50, 100 ml.
- (iii) Pipette 1 ml, 2 ml, 3 ml, 5 ml.
- (iv) Conical flask 25 ml, 50 ml, 100 ml.

NATIONAL OPEN UNIVERSITY OF NIGERIA
Victoria Island, Lagos - 110 068

To

Sub:- NOUN-INVITATION FOR QUOTATION FOR SUPPLY OF

Dear Sirs,

Please quote your lowest rates for supply of following four items*:

SI. No.	Description of Items	Remarks
1.		
2.		
3.		
4.		

1. You are requested to attach samples of the items wherever required. Please furnish the following information also:
(a) Validity of the quotation.
(b) Your Sales Tax Registration No.
(c) Are you a manufacturer or a supplier?
(d) Delivery period.
2. The quotation in double sealed cover with superscription "Quotation for supply of
..... against Tender Enquiry)
No....." should reach the
.....and shall be received up to 3.00p.m. on
..... The same will be opened at 4.00 p.m. on the same day in the presence
of the tenderers whomsoever are present. Late tenders will not be considered.
3. Specifications: stores offered should strictly conform to our specifications. Deviations, if any, should be clearly indicated by tenderers in their quotation. The tenderer should also indicate the Make /Type, number of the stores offered and provide catalogues, technical literature and samples, wherever necessary along with the quotations. Test certificates wherever necessary should be forwarded along with supplies. Wherever options are called] for in respect of specifications, the tenderer should induct all such options. Wherever specifically mentioned by us the tenderer could suggest changes to specifications with appropriate response for the same.

Corrections, if any, must be attested. All amounts shall be indicated both in words as well as in figures. Where there is a difference between amount quoted in words and figures, the amount quoted in words shall prevail.

If the supplies are not made within the stipulated period and the time is not extended, the supplier will be liable to pay compensation equal to one percent or such small amount of the total amount of contract as the Registrar may decide for every day that the quantity remains incomplete, provided that the entire amount of compensation shall not exceed 10% of the total amount of the contract. In addition, the Registrar reserves the right to cancel the order at the supplier's risk and cost.

The purchaser shall be under no obligation to accept the lowest or any tender and reserves the right of acceptance of the whole or any part of the tender or portion of the quantity offered and the tenderers shall supply the same at the rates quoted.

Yours faithfully,

Deputy Registrar / Asstt. Registrar

The students have to make proper entries in the places marked against the (asterisks (*)).

After performing this activity show the quotation form to your Lab Counsellor for her/his approval to find out whether the form has been filled up correctly.

5.4 ACTIVITY 2

PREPARATION OF COMPARATIVE CHART

You are given three envelopes containing quotations from three firms for two items. You will prepare a comparative chart in the format given below and show it to your counsellor for her/his approval.

Comparative Chart

S. No.	Name of item(s)	Name of the firm	Price
1.			
2.			
3.			

5.5 ACTIVITY 3

PLACEMENT OF ORDER WITH THE FIRM FOR THE SUPPLY OF GOODS

A format of an order form is given below. You are required to fill it for the supply of the following equipments from M/s Bello, Ibadan.

	<u>Items</u>	<u>Quantity</u>
i.	pH meter	One
ii.	Colorimeters	Three
iii.	Spectrophotometers	Two

Fill up the columns of the format given below using your imagination.

NATIONAL OPEN UNIVERSITY OF NIGERIA
Victoria Island, Lagos

To

Sub: Supply of goods.

Dear Sir,

With reference to your quotation No.

.....Datedplease supply the following articles on or
before

S. No.	Description/ Specification	Qty.	Rate	Cost
1	2	3	4	5

The above purchase is subject to the following terms and conditions:

TERMS AND CONDITIONS

1. The material may be supplied to the Lagos by
All correspondence regarding the order should be addressed to the consignee.
2. 100% payment will be made when the material/goods have been received by the University and have been inspected by its inspection unit and accepted by it.
OR
90% payment will be made through Union Bank, Lagos, if the documents are received through a bank.
3. Balance payment of 10% will be made on receipt of material/goods and their inspection by the University Inspection Unit. This payment is subject to the acceptance of goods by the inspection Unit.

4. The goods which are not according to specification and are thus not accepted shall be lifted by the Supplier at his own cost.
5. If the supplies are not made within the stipulated period and the time is not extended the supplier will be liable to pay compensation equal to one percent or such small amount of the total amount of contract as the Registrar may decide for every day that the quantity remains incomplete, provided that the entire amount of compensation shall not exceed 10% of the total amount of contract. In addition, the Registrar reserves the right to cancel the order at the supplier's risk and cost.
6. In case the supplier backs out of his contract, the earnest money if any, shall be forfeited and such other action will be taken as deemed proper.
7. The supply shall be increased/ decreased within day of the placement of this supply order.
8. The bill in triplicate may be sent to the Registrar, National Open University of Nigeria, Lagos, for payment.
9. An extra amount as Sales Tax/ Excise Duty will be paid as applicable under Government Rules if so quoted by the supplier/ contractor in the tender/quotation subject to the certificate in the bill of costs as follows.

Certified that the Sale Tax / Excise duty charges in this bill is leviable under Government Rules.
10. Other material should be packed in a strong case so as to avoid any damage, theft or pilferage in transit, in which case the responsibility shall be that of the supplier.
11. Other terms and conditions are as per terms and conditions specified in the notice inviting tenders.
12. All disparities/ disputes arising out of the order are subject to the jurisdiction of courts at Lagos.
13. Every packing case should contain a packing note mentioning details of the material packed with complete reference to our order. Our address must be superscribed on the side of the packages.
14. The claim for freight charges if admissible in terms of your quotation should be made in your bill.
15. Prices are fixed and are not subject to any variation.

Yours faithfully,

Deputy Registrar/ Assistant Registrar

CC.: Finance & Accounts Dvn.
Indentor
PS to VC

After filling up the order form, show it to your counsellor for his approval to find out whether it has been duly filled up.

5.6 ACTIVITY 4

PROCESSING OF BILL FOR PAYMENT

Your Counsellor will give you one bill. In that bill, you make relevant entries of the following statement using your imagination.

Passed for payment for ~~N~~ _____,
entered in Stock/Inventory register,
Page No. _____.

Signature

After performing this activity show it to your counsellor for her/his approval.

EXERCISE 6 STUDY OF PROCEDURE FOR STOCK VERIFICATION AND MAINTENANCE OF APPARATUS

6.1 INTRODUCTION

Earlier in this course you have read about the requirements of laboratories. You also know that these requirements can be for consumable and non-consumable nature. Once such items are purchased and put into the stock of the laboratory, it becomes important to monitor their availability, use and maintenance. All the records related to the purchase, use and maintenance of lab items should be entered into the register. You have already read about such registers i.e., inventory register/stock register in Unit 5 of the LOM course.

In the previous exercises you have learnt how to make purchases for lab requirements and make entries in the stock register. In the present exercises you will perform activities regarding study of stock register and physical verification of the articles present in the lab as recorded in the stock registers. You will also be involved in preparing the list of missing or the excess items and writing to the dealers about servicing and maintenance of the apparatus.

Objectives

After completing this exercise you should be able to check the stock register, verify the physical presence of articles present in the lab as per the stock register, prepare the list of the items that are found missing subsequent to stock verification, and communicate with the dealers about repair, servicing or maintenance of the apparatus/instruments.

Useful Instruction

You should go through Unit 5 of the LOM course before doing this exercise. This exercise is a mix of demonstration and hands on activities. Take the help of your counsellor in case you do not understand any aspect of stock register and stock verifications. Before actually doing this exercise go through the text of this exercise thoroughly.

6.2 REQUIREMENTS

- Stock register of a science laboratory
- Loose paper sheets
- Pen
- Pencil
- Rubber

6.3 ACTIVITY 1 VERIFICATION OF STOCK REGISTER

A stock register is an important component of any official establishment in which records related to purchase, use and maintenance of all the items is documented. The first activity regarding stock register is a demonstration activity. Your counsellor will discuss the various components of stock register in your group.

Procedure

On opening the stock register, you will see that the first page contains a certificate which certifies the total number of pages in that register. This page is signed by two persons. Generally, one of these is a lab assistant/technical assistant and the other is the Head of the Department or administration incharge. After knowing the number of pages you must physically verify the presence of the certified number of pages in the stock register. If any page of this register is found missing bring it to the notice of your counsellor.

As you have read in Unit 5 of this LOM, few pages after the certificate page of the register are the index pages (content pages) that indicate the name of the articles and the number of sequence pages assigned to each article. You may also recall that the names of the articles are given in alphabetical order. Now match the list of articles on index page(s) with the respective sequence pages. In case you find a sequence page missing, you can check it from the index and find out the items about which the information is missing. You can see in the pages annexed (Stock Register and Stock Book) to this exercise two examples of the sequence pages of the stock registers. As stated earlier you may find small variations in different registers, however, the main information is the same in every register.

6.4 ACTIVITY 2 VERIFICATION OF STOCK ITEMS

Now you know that a stock register is the key for the verification of all the items purchased from time to time. Let us now perform the second activity of this exercise i.e., stock verification.

Procedure

Verify the physical presence of the items kept in the stock that are listed in the register. For this choose any alphabet in the index and take at least two items listed under that alphabet. You should select the items that are listed serialwise and not randomly. Say for example under the letter 'A' you will find in alphabetical order, the name of all the items beginning with the letter 'A' that are present in the stock, e.g., alcohol, ammeter, analogue multimeter, autoclave, etc. Likewise you will find the list of articles under alphabets B, C and so on up to Z.

Now from the index find out the sequence pages of the articles you have chosen to verify. For example from the page 'A' of the index of stock register you have selected "autoclave". From the index find out the sequence page number(s) allotted to "autoclave". Open these sequence pages and read the information given about "autoclave". Make a note of the article and its details like brand (make), details of issues such as purchase date and number, net quantity etc.

In this way you select two items, check the details of these items in the sequence pages and prepare a list in the columns under report I. You should not repeat the items, which other students of your group are dealing with. In your group all the students should preferably select different items. Show the list of the items, you have to verify, to your counsellor and take his/her approval. Seldom it may also happen that sequence pages about any item are completely missing. If so is the case inform your counsellor. You have to write the make/brand and quantity mentioned in the last entry from the specified pages of the stock register in the table given under Report I.

For Mode-1 students:

All the four Activities of this Exercise are to be performed at the individual level at the work centre.

S. No.	Name of item	Make	Quantity
1			

2			
---	--	--	--

6.5 ACTIVITY 3

PREPARATION OF A LIST OF MISSING/SURPLUS/ NON FUNCTIONAL ITEMS

After the second activity you will enter into Activity 3 i.e. verification of the stock leading to preparation of a list of items that are missing, surplus, broken or nonfunctional. As indicated in Activity 2 after going through the indexed list of the items alphabetically in the stock register you must verify the physical presence and status of these items in the laboratory. For example again take the case of an 'autoclave'. Now visit the lab/store and see whether it is physically present in the lab or not. If it is present, check whether the specifications and information given about the autoclave in the stock register match with the autoclave available in the lab. Also see in what condition it is. Is it in working condition, if not, can it be sent for servicing or repair? You must also verify the quantity of the stock available and number of items used with the latest entries in the issue and balance columns of the register.

After completing this exercise you should prepare a list of the items missing, surplus broken or non-functional, if any, in alphabetical order. If the item is non-functional, write whether it is repairable or non-repairable. In case of the non-functional items one should contact the dealer for repair. Regular maintenance of the apparatus is also an important activity for any science laboratory. You will perform this as the next activity. The apparatus/instruments) that has become non-functional, beyond repair or obsolete needs to be disposed off. You will perform the activity related to the disposal of such an instrument later in this course.

For this exercise select the same two items as taken for Report I. Check the details of the status of these items from the lab/store and write the information in the table given under Report II. Show this report to your counsellor.

Report II

S. No.	Name of the Item	Missing/Surplus	Broken/Non-functional: Repairable/Non- repairable
1.			

2.			
----	--	--	--

6.6 ACTIVITY 4 MAINTENANCE OF APPARATUS

Regular maintenance of the lab items such as apparatus/instruments) is a necessary exercise in any laboratory. Maintenance includes proper cleaning, regular servicing, repairing and proper storing to keep the apparatus/ instrument(s) in proper working condition. In this activity you will learn to contact the dealer for the servicing or repairs of the apparatus/instrument. Servicing of the instruments can be done in the following two ways.

- I. According to the service contract with the firm/agency from where you have acquired the apparatus/instrument. (Generally in such cases payment for service contract for a specific time such as one year is made while making the purchase or immediately after the warranty period is over. This type of servicing is called **preventive maintenance** and the contract is renewed annually. The apparatus/ instrument(s) can be serviced regularly without the annual contract also. But in such cases payment is to be made every time the servicing is done.
- II. As and when any apparatus/instrument goes out of order and needs repair. This type of servicing is known as **repair maintenance**.

When the instrument is under service contract, the firm or the agency sends its own people at required intervals for servicing/repair of that instrument. A record of the contract and the servicing of the instrument(s) is maintained in the lab. In this activity you will write a letter to the firm/agency about servicing/ repair/replacement of the instrument you have purchased from that dealer. The firm/agency will send an engineer to look into the type of problem and rectify it. After the work is accomplished you should check that the repair/servicing work is successfully accomplished i.e., the instrument is now in perfect working condition. If payment is to be made for the servicing/repair work, you must sign the bills submitted by the dealer and give the same to your superior responsible for processing and payment of the bill.

By now you know how to write an official letter. Given below is the format of the letter you will use to write to the dealer for repair, service or replacement of a laboratory equipment. Show your letter to your counsellor. The detail information about the equipment should be clearly mentioned in the letter. The name of the item, its detail and information about the dealer/manufacture will be provided to you by your counsellor. All the students in your group should write individual letters.

To,

M/s _____

Date _____

Subject:

Dear Sir,

Thanking you,

Yours faithfully,
(Lab-in-charge)

Stock Register

Name of Articles _____

[illegible]

Stock Book

Article

[illegible]

EXERCISE 7 STUDY OF BASIC ASPECTS OF ELECTRICAL MAINTENANCE

7.1 INTRODUCTION

You have studied about the hazards of electricity in Unit 1 of HLLS. You have learnt that most of the electrical accidents like shock, fire, etc. occur often due to the neglect of fundamentals of electricity. The cause may be as simple as an improper wiring, a wrong choice of the fuse or wire (over- or underrated), or a problem with the earthing of the equipment. You have learnt about the theoretical basis of these functional aspects of electricity. You would have appreciated that through proper electrical maintenance/safe conduct, the mishaps due to electrical equipment can be minimised.

In this exercise we intend to provide you with some practical experience in electrical maintenance. You will do activities like, calculating the amount of current drawn by given appliance/instrument/equipment, suggesting proper procedures for wiring a plug, constructing a continuity testing device and using it to check the earthing of an appliance.

This will enable you to observe general precautions in the laboratory and undertake (if required) preliminary steps like, checking the wire / fuse / earthing of an appliance, if it is not working properly. It is like giving a first aid till the doctor (electrician in the present case) comes. We do not intend to make electricians out of you.

Objectives

After performing the activities under this exercise you should be able to:

- calculate the current drawn by a given instrument/equipment /appliance and suggest a fuse rating and the kind of plug to be used for the appliance,
- connect a plug to the wire of an appliance,
- construct and test the continuity testing device, and
- check the effectiveness of earthing in a given appliance using the continuity testing device.

Useful Instruction

You are advised to give a reading to Unit 11 before taking up this exercise.

7.2 ACTIVITY 1 TO CALCULATE CURRENT DRAWN BY THE GIVEN APPLIANCES AND SUGGEST PROPER FUSE RATING AND PLUG TYPE

In subsection 1.2.2 of Unit 1 of the course Hazards in Laboratory and Laboratory Safety (hereafter referred to as HLLS), you have learnt how to calculate the current drawn by an appliance by using the formula, $I = W/V$. You are going to use this formula here to calculate the current rating of the given appliances.

7.2.1 Requirements

Any 4-5 electrical appliances in the lab.

7.2.2 Procedure

- Take any appliance/ equipment in the laboratory e.g., the oven, electric heater, sodium lamp, immersion rod, the vacuum pump, autoclave, heating mantle, refrigerator, incubator, electrical balance or any other electrical equipment.
- Locate the specification plate of the equipment. Normally it is fixed at the back side or under the instrument or on the side panels.

- Note down the wattage of the equipment and calculate the operating current after noting down the mains voltage, use the formula $I = W/V$.
- Suggest the fuse rating for the equipment on the basis of current calculation.
- Write down the type of plug (6/16 A) to be used for the same.
- Repeat the procedure for at least three more equipment/appliances.
- Show the table to your counsellor for evaluation.

7.2.3 Report

The details of operating current, suggested fuse rating and recommended plug are given below.

S. No.	Name of the equipment	Wattage (W)	Mains voltage (V)	Operating current (I) $I = W/V$	Suggested* fuse rating	Type of plug recommended 6A/16A
1.						
2.						
3.						
4.						

You would recall that suggested fuse rating is 20% (1/5 time) larger than the calculated current
Therefore, suggested fuse rating = calculated current $\times 6/5$

7.3 ACTIVITY 2 WIRING A PLUG TO AN APPLIANCE

In the previous activity, you worked out the operating current of different electrical equipment/appliances and suggested proper fuse and plug ratings for the same. In this activity you will take any one equipment, without a plug attached to its cable and learn how to connect a suitable plug to it. You may be knowing the procedure or might have connected plugs a number of times; yet you are expected to do this activity because it is linked to the next activity. Also, in the course of doing it, you might pick up some important tips.

7.3.1 Requirements

Screwdriver - 1

Wire stripper - 1

6/16A Plug-1

Electrical appliance (any, without plug) - 1

7.3.2 Procedure

- Unscrew the plug top with the help of a screwdriver. Remove one of the screws on the wire clamp and loosen the other.
- Cut away about 50 mm of the outer sheath of the flex, taking care not to damage the insulation on the three separate wires.
- Fasten the sheath firmly under the clamp so that the terminals in the plug are not under strain.
- Cut the wires to reach about 10 mm beyond the appropriate terminal. You would recall from unit 1, subsection 1.2.1 of the HLLS course, that the green, red and black wires are to be attached to the earth, live and neutral terminals, respectively.
- Use the wire strippers to remove sufficient insulation to expose enough wire to make the connections taking care not to damage the wires.
- Twist the strands of each wire in turn and fit them into the hole or loop them clockwise around the terminal and tighten the screw.
- Check that there are no stray 'whiskers' of bare wire which could cause short circuits with in the plug and check that the wires are connected to the correct terminals.
- Check that the screws holding the wires in place are tight enough.
- Refit the plug top with the help of a screwdriver.
- Draw a diagram showing the connections you have made. You may use colour pencils to make it very clear and, show the plug to your counsellor.

7.3.3 Report

The plug has been connected as per instructions and submitted for scrutiny. The drawing of the same is given below.

7.4 ACTIVITY 3 TO ASSEMBLE A CONTINUITY TESTING DEVICE AND TO USE IT FOR CHECKING THE EFFECTIVENESS OF EARTHING IN AN APPLIANCE

In subsection 1.2.4 of Unit 1 of course HLLS, you read about earthing as an essential requirement for all instruments which are not insulated. Since improper earthing is a potential electric hazard in the laboratory, we must ensure that all the appliances are properly earthed. To perform this simple but extremely important act of electrical maintenance, you need a device and also know how to use it. In this activity you are going to assemble and handle such a device.

7.4.1 Requirements

Cell holder - 1
Bulb holder - 1
Wire - 1
Bulb (2.0 V) - 1
Cells (1.5V) - 2
Plug (6/16 A) - 1
Screwdriver - 1
Crocodile clips - 1 pair
Wire stripper - 1

7.4.2 Procedure

There are two parts of this activity. Part A deals with the assembling of the continuity testing device (CTD) and Part B deals with checking the effectiveness of earthing. The procedures for these two are given under these two heads.

A. Assembling the Device

- Take three pieces of wires about half a meter long each.
- Connect one of the terminals of the cell holders to one of the terminals of the bulb holder using a wire.
- Connect the second terminal of the bulb holder to second piece of wire.
- The third piece of wire is attached to the second terminal of the cell holder.
- Connect a crocodile clip each to the two unconnected ends of the wire.
- Insert the cells in the cell holder in proper position, ensuring that the (+) and (-) terminals of the cells are according to the (+) and (-) sign marked on the holder.
- Insert the bulb in the bulb holder.
- Short the two unconnected terminals and check whether the bulb is glowing or not - if it does not glow, there is a possibility that the bulb is not fitted properly. You can consult your counsellor at this stage. If the bulb glows, your device is ready. Draw a sketch of the device you have assembled in the space provided in the subsection 7.4.3.

IF THERE IS SOME KIND OF CONTINUITY BETWEEN THE PLUG'S EARTH AND LIVE PIN IT INDICATES DANGER.

B. Checking the Continuity and Effectiveness of Earthing in an Equipment/Appliance

- Take any appliance, say, a heater or an oven or any instrument used in tin lab and locate where the lead is entering the instrument. Open the plate covering it with the help of a screwdriver.
- You will see three connections there which may be differently placed in different appliances. Locate and identify E, L and N for earth, live and neutral connections, respectively. If you look closely these are normally written near the connecting screws.
- Clamp one of the ends of the continuity testing device on to the earth pin of the plug and other one on the earth connection in the appliance. A bright glowing bulb indicates the continuity.
- Repeat the above with live (L) and neutral (N) pins also by connecting the live pin of the plug to the live pin of appliance and the neutral to the neutral.
- To check the effectiveness of earthing, fit one end of the CTD to earth pin 1 on the plug and other to the chassis of the appliance. A bright glow indicates good earth while a dim glow means the earthing is poor. The bulb would not glow if there is no earth circuit.
- Record your observations in the table given in the next subsection.

7.4.3 Report

1. The diagram of the assembled CTD is given below.

2. The status of continuity among the different constituents is shown in the following table.

S. No.	Name of plug pin connected to terminal I of CTD	Terminal-II of CTD connected to	Bulb glows / does not glow	Inference
1	Earth	Earth pin of the appliance		
2	Neutral	Neutral pin of the appliance		
3	Live	Live pin of the appliance		
4	Earth	Chassis of the appliance		
5	Earth	Live pin of the plug		

EXERCISE 8 STUDY OF SUPPLY OF GAS, ELECTRICITY AND WATER IN A LABORATORY

8.1 INTRODUCTION

Gas, Electricity and water are integral parts of any science laboratory. You would have realised from personal experience (if any) and in the course of your study of Unit 1 of the HLLS course that these services can also be potential hazards in the laboratory. For example, water can get sprinkled on an electrical socket by a leaking tap leading to a short circuit followed by, may be a fire. In case of an eventuality, probably the first and foremost step would be cutting down the supply of gas, electricity, or water to the lab. This necessarily means that one must know the respective control points. In fact, this exercise is intended to familiarise you regarding the source and the control points of all these essential services.

Objectives

After completing this exercise you should be able to:

- locate the source and control points of gas/electricity/water supply in the
- lab you have visited,
- describe the distribution of these services in the lab, and
- state the measures to be taken in case of emergency situations concerning
- their supply.

Useful Instructions

You may perform this exercise preferably in a chemistry lab. This exercise can be performed in a group of 3-4 students. You may read Unit 1 and Unit 11 before taking up this exercise.

For Mode-1 students:

This exercise is an individual level Activity to be performed at the Work Centre. The student must imagine him/herself as a single person team.

8.2 PROCEDURE

A. For Gas Supply

- Visit the LPG gas store room / cracking plant along with your counsellor or
- the lab incharge and note the way supply of gas is regulated. It may not be
- obvious; have discussion with the counsellor.
- Note the provisions for ventilation. Why do we need ventilation?
- Follow the supply line into the lab, note the colour of the pipeline.
- In the lab, continue tracking the gas supply to different work-benches,
- fume cupboard, preparation room etc. Do not fail to mark the control
- points/distribution points.
- Check the condition of rubber tubing, look for the cracks, if any.
- Check the burner knobs for smoothness of operation.
- Discuss with your counsellor the possible hazards associated with gas
- supply and measures to be followed in case of an eventuality.

B. For Electricity Supply

- Locate the mains for electricity supply along with your counsellor or lab incharge.
- Follow the route of supply through wires to the lab keeping in mind the control points etc. Do you see any specific colour for the pipes carrying electrical wires?

- Locate the switch boards. Check carefully the positioning of the switch boards on the work benches. These should be far away from water taps to prevent any short circuit due to sprinkling of water on the switch boards or sockets.
- Check all the switches for their proper functioning.
- Check the condition of the sockets and cable/wire. See if there are any cracks in the sockets and bare wires.

C. For Water Supply

- Locate the main water supply pipe line and study its distribution to different work benches, fume cupboard, water distillation plant and washing sinks etc. carefully observing the control points. Note the colour of water pipes, if any.
- Check the connections between the water pipes. See if there is any leakage in the joints.
- Check for the working condition of the taps present in work bench sinks and fume cupboard sinks etc.
- Look for the provisions of a continuous water supply in the lab.

Draw schematic diagrams showing gas, electricity and water supply to the lab you have visited.

8.3 REPORT

A

A schematic outline of the gas supply line in the laboratory is provided below along with control points/valves.

A schematic diagram for layout of the electricity supply in the laboratory is given below.

A layout for water supply in the laboratory is given below.

B

The status of supply of essential services is as follows.

- | | | |
|--------|---|--------|
| (i) | The pipeline/rubber tubing used for the gas supply was in good condition (without a possibility of gas leakage). | Yes/No |
| (ii) | The place where the cylinders were kept was well ventilated. | Yes/No |
| (iii) | The control points/burner knobs were accessible and smooth enough to put on/off. | Yes/No |
| (iv) | The wiring/cable used for electricity supply was in good condition and without any bare wire exposure. | Yes/No |
| (v) | The sockets and switch boards in the lab were in good condition. | Yes/No |
| (vi) | The on/off points for electricity were in working condition. | Yes/No |
| (vii) | The taps in the sinks of work benches and of the fume cupboard were in working order and away from switch boards. | Yes/No |
| (viii) | The supply of water was found to be continuous in the lab. | Yes/No |
| (ix) | There was no leakage found from the water pipe joints. | Yes/No |
| (x) | There was an emergency provision available in the lab to prevent flooding, gas leakage and current tripping. | Yes/No |

- (i) If on opening the lab, it is observed that the lab is flooded with water the following action is to be taken.

- (ii) If a student reports that the water tap in the laboratory is giving a shock, the following action is to be taken.

- (iii) In the case of LPG gas leakage, the following action is to be taken.

Note: If needed, discussion may be held with other members of the group or with the counsellor in order to be sure of the right actions to be taken.

EXERCISE 9 IDENTIFICATION OF COMPRESSED GASES AND STUDY OF THEIR HANDLING AND STORAGE

9.1 INTRODUCTION

You would recall from your study of Unit 1 of the course HLLS, that LPG (liquefied petroleum gas) and other compressed gases can pose a danger in the lab. The gas (LPG) supply distribution has been covered in the previous exercise and the main danger associated with it i.e. fire is dealt in the next exercise. In the context of compressed gases you had learnt about the colour codes used to indicate the content and nature of the gas in the cylinder. You would have realised that these cylinders being heavy objects are potential mechanical hazards. The hazards of gas cylinders are further increased by the toxic/ reactive properties of their contents. You have learnt about the precautions to be observed in the storage and handling of these gas cylinders. In this exercise you will be using the gas cylinder colour codes to identify the contents of the gas cylinder and study about their storage and handling in the lab.

Objectives

After doing this exercise you should be able to:

- identify the contents of the gas cylinder by observing the colour code,
- state the nature of the gas present in the cylinder,
- explain the steps to be taken in case of gas cylinder leakage, and
- assess the compressed gas storage and handling in the lab.

Useful Instruction

We advise you to go through subsections 1.2 and 1.3 of Unit 1 of the HLLS course to do this exercise.

9.2 REQUIREMENTS

Compressed gas cylinders of N_2 / CO_2 / NH_3 / Cl_2 / O_2

9.3 PROCEDURE

- Locate the gas cylinders available in the lab.
- Note the colour of the cylinder (to a maximum of two and exclude the
- LPG) and bands on it (if any) and record them in the column (i) and (ii) of
- the table given under report.
- Identify the gas and its nature and complete the information in the other
- columns of the table.
- Repeat the same procedure for all the cylinders.
- Carefully observe the way, gas cylinders are stored and used in the
- laboratory, and mark your observations in the report.

9.4 REPORT

s. No.	Colour of the cylinder (i)	Colour of bands (if any) (ii)	Gas present in the cylinder (iii)	Nature of the gas (iv)	Steps to be taken in case of leakage* (v)
1.					
2.					

*You may refer to section 1.3.3 of Unit 1 of the HLLS course to fill this column.

The status of gas storage and handling in the lab is as follows:

- (i) The gas cylinders were stored in a well ventilated/open space and protected from water. Yes/No
- (ii) Cylinders were clamped properly in a vertical position. Yes/No
- (iii) The valve protection cap was intact when the cylinder was not in use. Yes/No
- (iv) There was a trap present attached to the gas cylinder through a tube to prevent any back suction. Yes/No
- (v) The safety sheets for different gases were available in the lab. Yes/No
- (vi) The emergency contact numbers of the gas supplier, fire brigade, doctor, etc. were available in the lab. Yes/No
- (vii) Any suggestion that you would like to give keeping in view safety aspect:

EXERCISE 10 STUDY OF FIRE SAFETY MEASURES IN A LABORATORY

10.1 INTRODUCTION

In Unit 2 of the HLLS course, you have studied about the fire hazards, various causes of fires and the precautions to be taken to avoid them. You also learnt about various types of fire extinguishers available to stop fire and also how to use the extinguishers effectively. As you are aware, the laboratories, especially the chemical laboratories, pose a potential risk of fire due to the nature of work being done; and the chemicals being stored and used. Appropriate provisions for the storage and handling methods go a long way towards minimising the hazards. We have discussed these aspects in Unit 2 and Unit 3 of the HLLS course. Nevertheless, there is always a probability of fire. A suitable training to the technical staff of the laboratory is essential for effectively dealing with fire accidents. In this exercise, you will be doing two activities related to the fire safety measures. In the first activity you are going to survey the labs for their fire preparedness i.e. how well the labs are equipped with fire fighting mechanisms in case of a mishap. In the second activity you will learn about the use of a fire extinguisher.

Objectives

After you have completed this exercise, you should be able to:

- list all the fire extinguishers available in the labs and relate them to the type of fire they can be used for,
- locate the fire alarm in the lab/institution, and
- handle/use a carbon dioxide fire extinguisher.

Useful Instructions

1. You are advised to read Unit 2 of the HLLS course again before you take up this exercise.
2. Ensure that there is a carbon dioxide fire extinguisher available in the lab.
3. Before starting this activity carefully read the instructions given on the extinguisher.

10.2 ACTIVITY 1 TO SURVEY A LAB FOR ITS FIRE PREPAREDNESS

As said earlier in this activity you are going to survey the labs of the institution where you are working at. Look for the fire safety measures adopted by it. (Prepare a critical report in the light of what you have studied in Unit 2 of HLLS. You may

- look for different types of fire extinguishers available in the lab.
- make a list of all the types of fire extinguishers and the type of fire they can be used for.
- note the condition of fire extinguishers, their date of inspection or validity.
- check for the positioning and accessibility of the extinguishers.
- conduct a survey to find out how many members of the staff are aware of the placement of fire alarms and use of fire extinguishers.
- look for alternative exit routes and emergency phone numbers in case of an outbreak of fire.
- record your observations in the table and respond to the statement given under report.

10.2.1 Report

The following table gives details regarding fire extinguishers in the laboratory

s. No.	Type of fire extinguisher (i)	Number of fire extinguishers available* (ii)	Type of fire suitable for (iii)	Date of inspection/ validity of the fire extinguisher # (iv)
1.	Sand buckets			
2.	CO ₂ Fire Extinguisher			
3.	Any other type (Names specified)			
4.				

* In case of non-availability, enter 'nil' in this column.

Wherever found necessary, enter 'not applicable' in this column.

The following other observations were made regarding the status of fire preparedness of the lab.

- | | | |
|-------|---|--------|
| (i) | Fire extinguishers were accessible for use. | Yes/No |
| (ii) | The use of fire extinguishers was known to lab staff. | Yes/No |
| (iii) | Alternative exit routes to be used in case of an outbreak of fire were present. | Yes/No |
| (iv) | A list of emergency phone numbers was available in the lab. | Yes/No |

10.3 ACTIVITY 2 TO LEARN THE USE OF A CARBON DIOXIDE FIRE EXTINGUISHER

All chemical laboratories should be provided with carbon dioxide and / or dry chemical fire extinguishers. Carbon dioxide fire extinguisher is most suitable because labs contain a variety of chemicals and instruments / electronic equipment. Carbon dioxide extinguisher requires skills for the effective use and these skills can be acquired easily. This activity is designed as a demonstration exercise where your counsellor would create a mock fire and show how to extinguish it with the help of a carbon dioxide fire extinguisher. You have to write the description of the demonstration in your own words.

10.3.1 Requirements

Carbon dioxide fire extinguisher

Flammable liquid like petrol, alcohol etc.

10.3.2 Procedure

- A mock fire may be created by spilling a flammable liquid like alcohol, petrol etc. and lighting it at a safe place away from the equipments and working benches.
- The extinguisher is removed from the wall. Taking a proper position, the extinguisher is opened and the discharge is directed at the base of the fire starting near the edge of the fire as explained in subsection 2.4.2 of Unit 2 of the HLLS course.
- The fire is driven towards the far edge until all the flames are extinguished.
- The extinguisher is closed and replaced on the wall.

10.3.3 Report

A brief description of the demonstration exercise is given below.

EXERCISE 11 CLASSIFYING AND HANDLING OF HAZARDOUS CHEMICALS

11.1 INTRODUCTION

You have studied about chemical hazards in Unit 3 of the HLLS course and would have learnt that many chemicals are hazardous. A good practice is to exercise caution in handling all chemicals and minimize your exposure to them. Further, you would have realised that the labels on the containers / bottles of the chemicals carry a great deal of important information regarding the nature of the chemicals, their important physical properties, potential risks and corresponding warning symbols besides statutory instructions regarding safe usage.

A familiarity with the use/interpretation of labels so as to identify the potential hazard of a chemical and the precautions to be taken in handling and storage of chemicals are very important for everybody working in the laboratory. Fume cupboard is an important component of a chemical laboratory. A knowledge of when and how to use a fume cupboard is also important for a laboratory worker. This exercise has been designed keeping these objectives in mind. It consists of two activities. The first activity is a familiarization activity. It gives you a chance to look into the label of some common chemicals and interpret the same to get information about the chemicals. The second activity is a demonstration activity. In this activity, your counsellor would demonstrate how fume cupboard is useful in handling of hazardous chemicals and their reactions.

Objectives

After completing this exercise, you should be able to:

- explain the significance of the labels of the bottles containing different chemicals,
- classify different chemicals into different hazard types they belong to,
- draw the hazard symbol for the different hazard, and
- describe a fume cupboard and its use in the laboratory.

Useful Instruction

You are advised to read subsection 3.3.2 of Unit 3 of the HLLS course before you take up this exercise.

11.2 ACTIVITY 1 TO CLASSIFY HAZARDOUS CHEMICALS BASED ON THE INFORMATION GIVEN ON THE LABELS

11.2.1 Requirements

Bottles containing chemicals (generally used in a lab) \approx 20 in number.


11.2.2 Procedure

For this activity, your counsellor will provide you with around 20 bottles of different chemicals. Take any two bottles at a time from the lot to your seat.

Read the labels of the bottles carefully and try to gather as much information as you can for a given chemical. Record the same in the table given below. An example has been given to guide you for the same. You will have to record on the similar fashion for at least ten bottles of chemicals.

CARE: Don't hold the bottles from their neck. You may use a tray for carrying them.

11.2.3 Report

S. No.	Name of the chemical	Name of the manufacturer	Nature of the chemical	Hazard class*	Hazard symbol	Any special instruction
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
1.	Orthophosphoric acid	Qualigens Fine Chemicals	Severe damage by chemical action to tissue or other material	Corrosive Class - 8		Keep container tightly enclosed
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

*For identifying class, refer to subsection 3.3.1 of Unit 3 of the HLLS course and see that a given chemical may belong to more than one type of hazard class.

Note: What do you observe? Do you realise that the common chemicals you have been handling casually at your laboratory (if any, with which you are working) are quite hazardous and need special care in handling.

You may preserve this table and display it at a convenient place in the laboratory where you work. You may make this table more exhaustive.

11.3 ACTIVITY 2 TO LEARN THE HANDLING OF HAZARDOUS CHEMICALS: USE OF FUME CUPBOARD

You have read in Unit 2 of the course LOM and Unit 3 of the course HLLS about the importance of fume cupboard and its usage. There are many chemicals which are very corrosive causing serious burns to skins and eyes and give away poisonous vapours when the container is opened. Bromine, carbon tetrachloride and organic solvents are some examples. Also, there could be a chemical reaction which results in the production of corrosive fumes with violent reaction, foul smell etc. for example, nitration, benzylation and bromination reactions etc. For such chemicals and chemical reactions, a fume cupboard is to be used. You know how a fume cupboard looks like. Your counsellor will demonstrate some chemical reaction showing the use and significance of fume cupboard.

11.3.1 Requirements

Apparatus and Chemicals - to be arranged by the counsellor depending upon the experiment to be carried out in the fume cupboard.

Fume cupboard

11.3.2 Procedure

Observe carefully the demonstration of the reaction carried out by your counsellor in the fume cupboard. Submit the report to your counsellor in the format given below.

11.3.3 Report

A schematic diagram of the fume cupboard is given below. Positions for supply of gas, water and electricity and, ventilation is indicated.

A brief description of the experiment is given below:

The fume cupboard is needed for the experiment for the following reason(s):

EXERCISE 12 STUDY OF STERILIZATION AND SAFE DISPOSAL steps METHODS OF BIOLOGICAL MATERIALS

12.1 INTRODUCTION

In any laboratory dealing with biological experiments, hazards can occur mainly due to chemicals and biological materials. In the previous exercise you have done the activity of classifying hazardous chemicals and you also learnt the skill of handling such chemicals. In this exercise you will carry out the activities related to the disposal of biological materials after the experimental work with such materials is over. Disposal activities are related to microorganisms and dead animals. Since these materials cause contamination and infections very rapidly, more care is required in their disposal. Disposal of plant materials is comparatively simpler. Put all the used plant materials in a disposable bag, seal or tie the bag and put it in the waste collecting bins.

Objectives

After completing this exercise you will be able to:

- sterilize and dispose off microbial cultures,
- dispose off the carcass of laboratory animals and the experimental animals treated with radioactive materials.

Useful Instructions

It is advisable that you should go through Unit 4 of the course HLLS before going for this exercise. Handling the microbes and dead animals requires precautions. It is important to wear gloves and aprons while doing the activities and wash the hands with disinfectant before and after doing the activity.

12.2 ACTIVITY 1 DISPOSAL OF MICROBIAL CULTURES

After the study is finished microbial cultures should not be left in the laboratory or taken out of the laboratory alive because availability of the medium can help many other types of microbes to grow in abundance, and as you are aware many of the microbes are pathogenic. The non-pathogenic microbes also cause problems like infections if they grow in abundance.

12.2.1 Requirements

Autoclave

Microbial cultures - liquid/solid

Disinfectant

Spatula

Disposable bags

12.2.2 Procedure

Steps 1 to 3 and step 5 are demonstration steps and will be performed by your counsellor. Observe these steps carefully.

1. The cotton plugs/caps of the test tubes, flasks and bottles containing microbial cultures are loosened so that during autoclaving adequate heat can penetrate into the bottle/test tube/flask to kill the microbes.
2. The cultures in glass flasks, bottles, tubes and petridishes at 15 psi are autoclaved for 15 minutes at 120°C so that the microbes are killed. If a pressure cooker is used for this purpose, it is to be heated for 30 minutes after the pressure is formed.

3. After pressure in the autoclave is completely down, i.e. at zero, the lid of the autoclave is opened. The glassware containers are allowed to cool down for some time and then taken out carefully one by one from the autoclave so that culture material is not spilled out.
4. After the counsellor has taken out the glassware from the autoclave, with the help of a spatula empty the autoclaved culture material from the flasks/bottles/test tubes/petriplates in a disposable bag and seal the bag.
5. This autoclaved culture material can be disposed off by two methods: (i) burying, (ii) incineration. You will learn the process of burying while performing Activity 3 of this exercise. Incineration means heating the material at a very high temperature so that biological material is turned into ash. The incineration is done to destroy the dead culture materials and medium completely so that nutrients are not available for regrowth of microbes. Keep the material to be incinerated in a heat-resistant container. Put this container in the incinerator and switch it on. Do not open the incinerator when the switch is on or until the temperature has come down to zero after the incineration process is over. Your counsellor will demonstrate the process of incineration for you.
6. You can dispose the autoclaved material by any of these methods that is available at your study centre. If you undertake the incineration process, collect the ash in a paper bag, seal it and put this bag in the collecting bin. For burying, put the autoclaved culture material in a disposable bag and seal it and follow the steps given in Activity 3.

12.2.3 Report

Explain in your own words the observed procedural steps of autoclaving of culture materials.

2. Why is autoclaving necessary before the disposal of culture material?

12.3 ACTIVITY 2 STERILIZATION OF GLASSWARE

Activity 1 and Activity 2 are related activities. Whenever you require the glassware for doing an experiment you can follow the procedure given in Activity 2 independent of Activity 1. However, Activity 2 has to be performed along with Activity 1.

The glassware used for microbial studies need to be cleaned and sterilized properly. If not done so, the glassware will get contaminated which can cause health problems as well as contamination of experimental microbial cultures that are used for the purpose of study.

12.3.1 Requirements

Glassware like flask, petri plates, test tubes, pipettes

Disinfectant

Cleaning brush

Liquid soap solution

Bucket

Enamel tray/Steel tray

Aluminium foil/Brown paper

Oven

Cardboard boxes

12.3.2 Procedure

1. Soak the emptied glassware in disinfectant or liquid soap solution overnight. If you use disinfectant, dip the glassware in soap solution before washing, Rub clean the glassware with a brush and thoroughly clean with water.
2. Air dry the washed glassware by keeping them open in the tray. Cover the petriplates with the lids. Wrap the glassware with aluminium foil and then keep in the oven for 16 to 18 hours at 160°C for dry sterilization. You have already read in Unit 3 of THE LOM course about the functioning of a hot air oven. After sterilization you can reuse the glassware for further work.
3. Do not leave the sterilized glassware in the open. Pack them into the packets/boxes until you use them next. You should sterilize the newly purchased glassware before using them by the method describe above.

In any lab there can be certain apparatus that are delicate and cannot withstand heat such as plastics. Disinfect these by cleaning and wiping with spirit or any other germicidal chemical used in your study centre/work place. Dip them in liquid soap solution overnight, wash, air dry and pack them in boxes/packets.

12.3.3 Report

Now that you have performed this activity, answer the following questions:

1. How many glassware items did you sterilize?
2. What disinfectant have you used for soaking the glassware?
3. For how long did you keep the washed glassware in a hot air oven?
4. How did you pack the sterilized glassware?

12.4 ACTIVITY 3 DISPOSAL OF CARCASS

After the experiment with an animal is over, the dead animal, i.e. carcass should not be left in the laboratory. The dead animals start decaying and putrefying by invasion of microbes and this leads to contamination and foul odour in the lab. The carcass may be of two types: (1) untreated animals (2) radioactive-treated animals. You must take care to wear apron and gloves while

handling dead animals especially the ones treated with radioactive material. As said earlier this activity is a demonstration activity.

12.4.1 Requirements

Experimental animals

Digging and scooping equipment

Disposable bags

12.4.2 Procedure

1. After the dissection experiment is over the dead animals are put in disposable paper bags and the bag is sealed. Animal tissues and excreta should also be put and sealed in disposable bags.
2. The packet containing the carcasses, tissues and excreta is taken to a place which has been marked for burying of such biological materials.
3. A deep pit is dug at the marked place, the packet is put in this pit. The pit is covered with litter and soil. If the pit is not dug deep and not covered properly, scavenging and wild animals like hyenas, wolves, dogs etc. will dig up the pit, may eat the carcass and leave everything in the open. If the wild animals eat the carcass treated with radioactive material they may fall sick and transmit the radioactivity to other fellow life forms. To ensure that the pit is not dug up by such animals the pit should be dug deep enough.
4. The size of the pit depends on the number and size of animals. For one animal like a frog or a rat a pit of approximately $2' \times 2' \times 2'$ size should dug.
5. A similar pit is dug to bury the microbial culture materials for their disposal.

12.4.3 Report

The following queries are related to this activity. Tick mark the option that stands correct after your observation.

1. What kind of bag was used for disposing off the animal(s) and animal materials(s)?
Jute bag/Paper bag/Polythene bag/Cloth bag.
2. How was the bag sealed?
By folding/By tying/By using tape/By using staples
3. How deep was the pit?
 $1\frac{1}{2}'/4'/8'$
4. What material was used for covering the pit?
Soil/Pebbles/Litter/All the three.

EXERCISE 13 DISPOSAL OF UNSERVICEABLE AND OBSOLETE ITEMS

13.1 INTRODUCTION

You may find this exercise as a practical illustration for the procedure; generally followed in the disposal of unserviceable and obsolete items in a laboratory. It is possible that a similar procedure exists in your laboratory or institution also. This is a mock exercise which involves role-playing by three of you and the Counsellor.

For Mode-1 students:

This exercise is an individual level Activity to be performed at the Work Centre. You must imagine yourself as a single person team. Part I of the report may be modified accordingly. You will sign above the entry, Convenor. For Part II, you will make relevant entry for any one item disposed of.

As a member of a group, you will be involved in preparing a report (Part I) on the disposal of any three unserviceable/obsolete items in a laboratory.

At the individual level, you will carry out the entry in the stock register pertaining to the disposal of any one of these items (Part II).

Objectives

After you do this exercise, you should be able to

- prepare a list of unserviceable and obsolete items to be disposed of, after indicating the reserve price in each case, and
- explain the steps used in the disposal of unserviceable and obsolete items.

Useful Instruction

You are required to study Subsection 5.4.1 of Unit 5 (HLLS course) before doing this exercise.

13.2 REQUIREMENTS

Stock registers/Inventory registers

13.3 PROCEDURE

1. Assume that your Counsellor is the Head of the Institution. : 2. Your Counsellor will choose three of you and form a **Survey Committee** as follows:

- One of you as Head of the Department - Convenor of the Committee
 - Another student as the Administrative Officer/ Finance Officer of the Institution
 - The third as the expert who has knowledge on the cost of the laboratory articles
- } - Members of the Committee

You and the other two members visit Chemistry or Physics or Botany or Zoology laboratory and give recommendations regarding any three items to be disposed of. The format for recording the recommendations of the Committee is given below in Part I of Sec. 13.4.

The Convenor of the Committee shall submit the report to the Head of the Institution (i.e., the Counsellor).

5. The Head of the Institution gives his/her approval (in the report itself) suggesting the mode of disposal as
 - (a) 'sale or open auction' or
 - (b) 'to be written off.
6. You assume that steps have been taken for disposal.
7. Part II of the report is illustrative of the entry to be made in the stock register/inventory register regarding the disposal of the item. This entry helps in arriving at the final stock balance. An extract of the page of the stock register is given as a table in Part II. **Each of you make relevant entry in this table for any one item disposed of.**

13.4 REPORT

Part I The Survey Committee Recommendations

The Survey Committee, consisting of the following three members, surveyed Chemistry/Physics/Botany/Zoology laboratory for identifying unserviceable and obsolete items.

S. No.	Name	Designation	Position in the Committee
1.		Head of the Department	Governor
2.		Administrative Officer/Finance Officer	Member
3.		Expert	Member

The following is the list of items recommended for disposal.

Sl. No.	Name of the item	Name of the stock register and page number (a)	Original cost price (b)	Reserve price (c)	Reason for disposal (d)

Date

Signatures of the members
of the Committee

Signature of the Convenor
of the Committee

Remarks of the Head of the Institution with signature and date.

Note: (a) and (b): The entries for these columns may be taken from the relevant stock/inventory registers.

(c): Reserve price is the minimum price at which an item may be sold. The committee has to use its judgement or imagination in fixing reserve price.

- For obsolete and functional items, reserve price may be approximately fixed on the basis of its worth.
- In the case of non-functional items, reserve price may be fixed based on the scrap value. The scrap value is the approximate price fixed

depending on the usable constituents of an item just as a dealer of waste materials does.

- In extreme cases, the Committee may recommend writing off the item, if it is of no commercial value and, the reserve price is taken as zero.

(d): The reason for disposal may be given as:
'unserviceable' or
'obsolete' or
'nonfunctional and of no commercial value'

Part II Making Entry in the Extract of the Relevant Page of the Stock Register

Name of the item:

Name of the stock register:

Page no.:

Date	Particulars	Receipt			Quantity issued	Stock balance	Remarks
		Quantity	Rate	Amount			

Note: While filling up the details in Part II, the guidelines given below may be followed:

- (1) There should be two entries in the tabular column.
- (2) The first entry in each column is to be made on the basis of the last entry in the stock/inventory register of the relevant item.
- (3) The second entry is made as follows:
 - The disposal method is indicated under the column, 'Particulars' as shown below:
"Disposal of..... numbers through sale/open auction as per approval of the Head of the Institution dt.
or "Written off numbers as per approval of the Head of the Institution dt."
 - The columns under 'Receipt' are to be left blank.

- The column under 'Quantity issued'¹ is filled up as per number of (or quantity of) the particular item disposed of or written off.
- The present stock balance is arrived at by subtracting the number of (or quantity of) the particular item disposed of from the stock balance shown in the previous entry.
- In case of sale or open auction, make the following entry (using your imagination to fill in the blanks) in the column marked as 'Remarks':
 "The amount of ~~N.~~ (Naira
) that was collected towards sale/open auction was deposited to the office of the institution on (date).

EXERCISE 14 DISPOSAL OF CHEMICAL WASTES

14.1 INTRODUCTION

In this activity, your Counsellor will perform some experiments illustrating the principles behind some of the disposal procedures. These principles are given below along with examples of wastes which could be disposed of using particular methods.

1. Dissolution and dilution

Water soluble/ miscible chemical wastes which are harmless in high ° dilution may be run into the drainage with plenty of water. **It may be noted that alkali wastes also come under this category of treatment.**

Examples: Acetone, methanol, ethanol, dioxan, acetic acid, ethyl methyl ketone, ammonia (solution), hydrogen peroxide, oxalic acid, dimethyl sulphoxide, hydroquinone, p-benzoquinone, ammonium sulphide, potassium hydroxide and sodium hydroxide.

2. Evaporation

- Highly volatile liquid wastes could be disposed of by effective ventilation. Example : Diethyl ether.
- Moderately volatile liquid wastes can be absorbed on sand and left for evaporation in an open area.

Examples: Ethyl acetate, hexane, petroleum ether, amyl alcohol, carbon disulphide and carbon tetrachloride.

3. Emulsification

Water immiscible liquid wastes can be emulsified using soap or detergent solution and then run into the drainage.

Examples: Benzene, toluene, cyclohexane, nitrobenzene, carbon disulphide, cresols, chlorobenzene, and chloroform.

4. Chemical reactivity

- The substances which react violently or produce flame on contact with water can be given suitable chemical treatment to convert them into nonreactive form before running into the drainage. Example: Sodium metal.
- Those substances which generate heat on mixing with water are treated carefully with large quantity of water in a safe area. Example: Calcium oxide.
- Acidic chemical wastes are first treated with large quantity of sodium carbonate and then with a large quantity of water. The treatment with sodium carbonate neutralises the acid

since the former is a base. **Apart from acidic waste, bromine waste is also treated using this method.**

Examples: Perchloric acid, sulphuric acid, hydrochloric acid, nitric acid, phosphoric acid, acetyl chloride, benzoyl chloride, tin (IV) chloride, bromine, chromium trioxide and chromyl chloride.

- Some water immiscible and hazardous materials can be washed into the drainage after changing them into soluble compounds. Examples: Aniline and iodine.

After carefully watching the demonstration experiments, you have to indicate the linkages between

- the principles mentioned above, and
- the chemical waste disposal methods discussed in Subsection 5.4.2 of Unit 5 of HLLS for five chemical wastes that will be specified by your Counsellor. Entries for acetone have been provided as an example in the table given in Sec. 5.4 (HLLS).

For Mode-1 students:

The Resource Person will perform the demonstration experiments.

Objectives

After observing the demonstration experiments, you should be able to:

- state the need for understanding the characteristics of a chemical waste before disposing the same in garbage or drainage, and
- explain the principles behind the chemical waste disposal procedures of the demonstration experiments performed by your Counsellor.

Useful Instruction

Before observing the demonstration experiments, you are advised to go through Subsec. 5.4.2 of Unit 5 (HLLS) for these and other methods of chemical waste disposal.

14.2 REQUIREMENTS

Chemicals

The following materials are common for the whole batch of students at the Study Centre, since this is a demonstration exercise.

Acetone (or ethyl methyl ketone or glacial acetic acid or methanol or dioxan)	1 ml
Sodium hydroxide (or potassium hydroxide)	1 pellet
Diethyl ether	1 ml
Ethyl acetate (or hexane or carbon disulphide or petroleum ether or carbon tetrachloride)	1 ml
Toluene (or benzene or nitrobenzene or chlorobenzene or chloroform)	1 ml
Soap or detergent solution	10 ml
Sodium metal	5 small pieces
Ethanol (or propan -2-ol)	50 ml
Concentrated sulphuric acid	2 ml
Sodium carbonate	40 g
Calcium oxide (freshly heated and cooled lime stone is 2 g preferable)	2 g
Aniline 5 ml	5 ml
2 M Hydrochloric acid 10 ml	10 ml

Sodium thiosulphate crystals 5 g	5 g
Iodine	2 crystals

Apparatus

Test tubes	10
Watch glasses	2
100 ml beakers	5
China dish	1

14.3 PROCEDURE

Your Counsellor will be performing the following experiments. You are advised to observe the disposal methods carefully.

Experiment 1: Test for studying miscibility /solubility in water

Acetone and sodium hydroxide are tested individually for miscibility/solubility in water.

Experiment 2: Test for studying volatility

Diethyl ether and ethyl acetate are tested for volatility using watch glasses.

Experiment 3: Test for studying the process of emulsification

Miscibility of toluene is tested with

- water and,
- soap or detergent solution.

Experiment 4: Test for studying suitable chemical treatment for changing the chemical nature of a substance which is highly reactive with water

The reactivity of sodium is tested with

- water,
- ethanol, and
- ethanol containing anhydrous sodium carbonate.

In case ethanol contains considerable water, flame also could be seen during the reaction between sodium and ethanol. It is preferable to use 2-propanol, if available.

Anhydrous sodium carbonate is helpful in removing water partly from ethanol and, in facilitating a mild reaction by separating sodium pieces during the reaction between sodium and ethanol.

Experiment 5: Test for studying water treatment method for a substance which is fairly reactive with water

Reactivity of calcium oxide with water is tested.

Experiment 6: Test for studying suitable chemical treatment for changing the chemical nature of acidic substances

The difference in reactivity of sulphuric acid with water is tested in the absence and, presence of sodium carbonate.

Experiment 7: Test for studying suitable chemical treatment for changing; the chemical nature of organic bases which are immiscible with water

Miscibility of aniline with water is tested in the absence and, presence of dilute hydrochloric acid.

Experiment 8: Test for studying suitable chemical treatment for changin; the chemical nature of iodine

Reactivity of iodine is tested with

- water and,
- sodium thiosulphate solution.

14.4 REPORT

The linkages between the principles mentioned in Section 14.1 of this exercise, and the chemical waste disposal methods discussed in Subsec. 14.4.2 of Unit 14 are given in the following table for five chemical wastes:

Name of the chemical waste	Name of the principle of disposal method mentioned in Sec. 14.1 of this exercise	No. of the disposal method suggested in Subsection 14.4.2 of Unit 14
Acetone	Dissolution and dilution	I (a)

EXERCISE 15 ATTENDING TO EMERGENCY SITUATIONS

15.1 INTRODUCTION

By doing this exercise, you will learn how to deal with emergency situations arising out of laboratory accidents. You are aware that a tense situation arises once an accident takes place. Amidst anxiety and tension, it becomes difficult to plan and execute remedial measures. No doubt that wiser action will be to identify the causes for the possible accidents and to take preventive measures. Besides, it is better to be prepared with a plan for follow up actions at least for those accidents which are likely to occur. In order to face an emergency situation properly, the following would be of great help:

- (i) Knowledge of first aid procedures
- (ii) First aid box (properly maintained)
- (iii) List of emergency contact phone numbers
- (iv) Communication skill for contacting fire service/hospitals/doctors etc.

It is desirable for you to know the procedure for preparing accident report.

This exercise contains a number of activities requiring your participation at the individual level for some and as a member of a group for others as shown below:

- * **At the individual level**, you will be involved in the preparation of
 - list of contact phone numbers to be used during emergency time,
 - first aid box, and
 - a report for an imaginary accident.
- * **As a member of a group**, you will
 - prepare charts indicating first aid procedures, and
 - attend a session in which your Counsellor will arrange for demonstration of some first aid procedures.

The contents of Units 1 (on gas related emergencies), 2 (on fire related emergencies) (HLLS COURSE) and the present one could help you in getting adequate training for handling lab related emergencies.

Objectives

After doing this exercise, you should be able to:

- prepare a list of contact phone numbers required for handling laboratory accidents,
- state the contents of first aid box,
- assemble an improvised first aid box,
- design charts indicating the first aid actions to be taken during common laboratory accidents, and
- prepare report for an accident.

Useful Instruction

In the table given below, you can find references to the locations of materials related to this exercise. You are advised to go through these materials (in course HLLS) to understand the significance of this exercise.

No. of the Activity	Reference to the Unit	Mode of Performance
1	Sec. 4. 2 of Unit 4	Individual level

2	Subsec. 5.3.3 of Unit 5	Individual level
3	Secs.5.5 to 5.10 of Unit 5	In groups each containing four students
4	Secs. 5.5 to 5.10 of Unit 5	Demonstration for the whole batch of students
5	Sec. 5.2 of Unit 5	Individual level

For **Mode-1** students: Activity 3 is an individual level Activity to be performed at the Work Centre along with Activities 1, 2 and 5. You will prepare Guidance Charts for any two items out of eight mentioned in Activity 3 of Sec. 15.3.3. Only Activity 4 is the Study Centre Activity.

15.2 REQUIREMENTS

A first aid box containing materials as per Table I must be available in the laboratory of the Study Centre.

Table I: Materials that must be available at the Study Centre as part of first aid box
Item

Item	Quantity
Individually wrapped sterile adhesive dressings (assorted)	5
Cotton roll	1
Half ounce packets of sterilised cotton roll	3
Sterile cotton pads in sealed packets	3
Half ounce packets of gauze, plain white	3
Swab sticks	6
Triangular bandages	2
Bandage rolls of 1", 2" and 2½" width	2 each
Individually wrapped sterile unmedicated wound dressings of sizes:	
Medium 10 cm × 8cm	2
Large 13 cm × 9 cm	2
Extra large 28 cm × 17.5 cm	2
Glucose	200 grams
Burnol tube	1
Dettol bottle	1
Spirit bottle (100 ml)	1
Stainless steel spoon (padded) or Tongue depressor	1
Safety pins (assorted, rust-proof)	6
Cardboard (8" to 12" length and 6" to 8" width)	1
Old news paper sheets (rolled using a rubber band)	6
Scissors (5-inch, blunt pointed)	1
Pen torch	1

You are advised to bring the materials as per Table II.

Table II: Materials that must be brought by each student

Item	Quantity
(i) For preparation of charts	
Chart papers of various colours, if possible	3
Green coloured wrapper paper	1
(ii) For assembling improvised first aid box	
Thoroughly washed and sun-dried thin cloth (from old saree or lungi or muslin cloth)	1 ½ metres
Thoroughly washed thick cloth (Khadhi type)	1 metre
Cotton roll (small size)	1
Half ounce packet of sterilised cotton wool	1
Safety pins (assorted, rust-proof)	3
Sticks (from fresh broom)	3
Bumol tube	1
Dettol bottle	1
Stainless steel spoon	1
Old news paper sheets	6
Scissors (5", blunt pointed)	1
Cardboard box (available in shops dealing with gift articles) or aluminium metal box of size 12"x12"x6"	1

15.3 PROCEDURE

15.3.1 Activity 1: Preparation of a List of Emergency Contact Numbers

The list is to be prepared by each of you in a chart paper (preferably coloured). You may use the following or any format as per your imagination; take care to see that it attracts the attention of the onlooker.

Name(s)	Address(es)	Contact Number(s) (Telephone/pager/mobile)
Head of the Institution:		
Head of the Department:		
Doctors: (Physicians/Surgeons)		
Hospitals/Nursing homes/Clinics, etc.:		
Ambulance services/Trauma services:		
Fire service (Fire service may be called for rescue operations during fire, building collapse, explosion, drowning, gas leakage, etc.):		
Fire fighting equipment:		
Police:		
Electricity supply agency:		
Authorised electricians for electrical repair work:		

Fuel gas supply agency:		
Gas cylinder supply agencies (in case ammonia, carbon dioxide, oxygen, etc., gas cylinders are used in the lab):		
Water supply agencies:		
Generator set agencies (for hiring purposes):		

15.3.2 Activity 2: Assembling First Aid Box

Your Counsellor will show you the contents of the first aid box available at the Study Centre. You observe the contents.

As part of this activity, you are also to assemble the contents of first aid box as per Table III. It is advisable to procure all the first aid materials from medical/general merchant shops. **It is also useful to know how to prepare improvised first aid materials such as bandage etc. This practice will help you in offering first aid to a bleeding victim using locally available materials. With this purpose, you will assemble a first aid box** which contains both

- first aid materials (sterilised cotton wool, burnol tube, safety pins, scissors and dettol bottle) which are to be purchased from medical/general merchant shops and
- improvised items (clean dressings, clean cotton pads, bandage rolls of various sizes, padded spoon and swab sticks).

Improvised items: To prepare items using locally available source materials.

Preparation of Improvised Items

(A) Using a thoroughly washed and **sun-dried old and thin cloth** of 1½ metres length (which may be cut from an old muslin cloth), prepare the following four items:

- (i) **Individually wrapped clean dressings:** You cut one piece each of following sizes using the thin cloth:
 1" × 1"; 2" × 2"; 2" × 4"; 6" × 4" and 6" × 6"
 Fold each of them such that the edges are inside and wrap them in clean news papers.

The clean dressings, clean cotton pads, and swab sticks are useful to treat cases of bleeding. The bandage rolls are useful in keeping the dressing and cotton pad in position. Bandages help in controlling bleeding and in preventing or reducing swelling.

- (ii) **Clean cotton pads in separate packets:** You are advised to cut one piece each of clean cotton pads of thickness 1/2" and sizes 1" × 1", 6" × 4" and 6" × 6". Cover each from top and below with thin cloth of same size and wrap each with a portion of news paper sheet.
- (iii) **Bandage rolls:** Using thin cloth, cut one piece each of sizes 3' × 1", 3' × 2½" and 3' × 3½" and 3' × 5" and roll each of them separately.

Recommended sizes of roller bandages or bandage rolls for various parts of the body are as follows:

Fingers	1"
Head and arms	2½ "
Leg	3½ "
Trunk	5"

- (iv) **Padded spoon:** A stainless steel spoon is to be covered with a clean cotton pad of thickness 1/2" and size 1"×1" prepared in (ii) above.

The padded spoon is useful for keeping the mouth open during resuscitation.

- (B) **Swab sticks:** Wash three sticks taken from a fresh broom. Cut them into 6" size. Cover each of them with a bud of cotton.
- (C) **Triangular bandages:** Using a thoroughly washed piece of thick cloth, you can prepare triangular bandages. You have to cut diagonally a thick piece of cloth of size 38"×38" into two pieces. Each piece is a triangular bandage. When not in use, the bandage has to be kept folded.

Triangular bandages are used in cases of fracture or severe bleeding. Old newspaper sheets could also be used in these cases to support the affected area.

Using these materials and, others mentioned in Table II in Sec. 15.2 of this exercise, assemble the first aid box as per Table III. Keep these materials in a cardboard box or metal box and paste a green paper on it. A red cross mark may be made on it.

Table III: The contents of the first aid box to be assembled by each student

Item	Quantity	Source
Individually wrapped clean dressings (of sizes): 1"×1"; 2"×2"; 2"×4"; 6"×4" and 6"×6"	1 Each	To be prepared by You using the methods given above
Clean cotton pads in separate packets (of sizes): 1"×1"; 6"×4" and 6"×6"	1 Each	
Bandage rolls (of sizes): 3'×1"; 3'×2½"; 3'×3½" and 3'×5"	1 Each	
Padded spoon	1	
Swab sticks	6	
Triangular bandages	2	
Half ounce packet of sterilised cotton wool	1	To be procured by You from the shop
Safety pins (assorted, rust-proof)	3	
Old news paper sheets	6	
Scissors (5", blunt pointed)	1	
Burnol tube	1	
Dettol bottle	1	

You may carry back home, the first aid box you assembled.

15.3.3 Activity 3: Preparation of Guidance Charts for First Aid

Your Counsellor will form groups of four students. Using the materials from the sections of Unit 6 (HLLS course) mentioned in each case below, **each group has to prepare in chart papers the set of guidelines for the first aid** concerning the following:

- (1) Chemical burns (Sec 6.7)
- (2) Slight bleeding (Sec 6.8)
- (3) Splashes on the eyes (Subsec 6.10.3)
- (4) Ingestion of chemicals (Sec 6.7)
- (5) Thermal burns (Subsec 6.10.1)
- (6) Shock (Sec 6.9)
- (7) Electric shock (Sec 6.5)
- (8) Fainting/unconscious casualties (for cases of breathing and heart beat stoppage - write details of three steps for resuscitation given under the headings, 'Opening the airway, mouth-to-mouth artificial respiration and heart massage for restoring circulation' in Sec. 6.6).

Each of you have to prepare charts for two first aid procedures. One example is given below. You may use coloured chart papers as also a format of your choice.

First aid for chemical burns

1.
 - * Wash the affected area with large amount of running water to remove the chemical substance completely.
 - * If water is in short supply, wipe the affected area using a clean cloth before the wash.
 - * In case of splash of insoluble chemicals, use soap along with water.
2. Carefully remove all contaminated clothing.
3.

Splash of acids:	Wash with 10% sodium bicarbonate solution and then apply vaseline.
Splash of alkalis :	Wash with 1% acetic acid and then apply vaseline.
Splash of bromine :	Wash with 2 M ammonia and keep the affected part dipped in sodium bisulphite solution.
Splash of phenol : or sodium	Apply ethanol on a cotton wool pad.
4. In case of severe injury, arrange immediate transportation to the nearest doctor.

15.3.4 Activity 4: First Aid Procedures

Your Counsellor will explain the first aid procedures through a demonstration session. Carefully observe all the steps. Try to relate

- the contents of the first aid box
- the guidance charts, and
- the first aid procedures shown through demonstration.

15.3.5 Activity 5: Preparation of Report for an Imaginary Accident

In case of serious accidents, accident report has to be sent to the Head of the Institution who may use it for official purposes, police enquiry and taking preventive measures.

Some of the categories of serious accidents are mentioned below:

- Fracture
- Amputation of a hand or foot
- Loss of sight of an eye

- Any injury which causes the casualty to be detained in hospital as in-patient for over 24 hours
- Any injury resulting in the casualty's absence for more than three days from attending to the work at the institution
- Death

Your Counsellor will give you the background details of an imaginary case of an accident. **Each of you prepare the report by filling the relevant entries in the proforma given in Sec. 15.4 using**

- the details given by your Counsellor,
- Unit 6 (HLLS course.) material, and
- your imagination.

15.4 REPORT

You are required to submit the following to your Counsellor:

1. The chart containing list of emergency contact phone numbers (prepared by each of you).
2. The first aid box (prepared by each of you).
3. Guidance charts for first aid (prepared as a group activity along with a sheet containing names of students involved in the activity).
4. A detailed accident report (prepared by each of you) in the proforma that follows.

Accident Report

1. Date, time and location of the accident:
2. A brief description of the accident:
(In case of chemical ingestion/inhalation/ splashes of chemicals, name of the reagent and its approximate concentration may also be given)
3. Details regarding first aid given:

Sl. No.	Name, age and address of (each) victim	Nature of injury suffered or suspected #	Type of first aid given #	Name of the person who administered first aid	Any further action taken (summoning doctor, removal to hospital etc.)#

Mention the identifiable name only for each class

4. The name and address of eye witness:
 5. Action taken to control the damage:
- Date:

*Signature of the lab staff and designation
(* Sign here)

To
(Write the address of the Head of the Institution)

EXERCISE 16 GROUP INTERACTION

16.1 INTRODUCTION

What are we going to do in this exercise? - this might be the question arising in your mind. If you have not already guessed from the above title, the central theme of this exercise is - oral communication. While developing this course as a holistic training package, the course-team was quite conscious not to miss out on the component of communication skills. You had a fairly good grind regarding the development of written skills through your earlier exercises. Also, Unit 8 (LOM course) entitled 'Scientific Reporting' familiarized you with the theoretical elements and the ways of communication by means of written words. The main purpose of this exercise is to impress upon you the importance, and the ways of developing and refining the oral communication skills as this is the most commonly used form of communication.

We all use oral communication in one form or the other in our day to day life but its forms of usage at home and at the place of work are different in many ways. If you work in an academic institution, or a governmental laboratory, then you must be familiar with group discussions, debates, panel discussions, brainstorming sessions, seminars and symposia, and so on. These are some of the formats of oral communication. For this exercise, we have chosen the format of group discussion. This, we thought would be an ideal format considering the time constraint. The other advantage of this format is that a number of students can share a common platform at a given time, and the audience can also gain by listening to them. Now your attention is drawn to the main title of the exercise that reads 'Group Interaction.....' why interaction, and not discussion? This is because we expect each and every individual in the group to participate actively and share his/her viewpoints and experiences through this exercise. Another point, whenever you come across the term discussion in this exercise, read it in the sense of interaction.

Objectives

While undertaking this exercise and after its completion, you should be able to:

- share with your peer group, the relevant information/ knowledge/opinions with regard to the selected topic of discussion;
- describe the necessary preparations required for organizing, and participating in a group interaction session;
- explain the advantages of such an interaction;
- freely interact with your peer group, and others at your workplace about the day to day work, as well as the problems faced, and if required suggest possible corrective measures too; and
- critically reflect on the topic discussed.

16.2 HOW TO ORGANISE AN INTERACTION SESSION?

How should we begin? What are the norms? What is the time slot? Any assessment criteria? These and many such questions may be coming to your mind. The guidelines given below would help you find answer to all such questions as well as guide you as to how to carry out this exercise.

How to form a group? -You could begin with by forming your group. An ideal group has 3 to 5 (maximum number) participants. Once your group is formed, convey the names of your group members to your counsellor.

Deciding on a topic of discussion - Next identify the topic for interaction. **Eight themes are given in the following section. You may either choose any one of these, or take any topic**

other than the ones mentioned here, and decide on the focus of your topic. The guidelines provided for each of these themes are merely suggestive. You are free to develop your own set of points for discussion. After final agreement on the topic and its focus, it will be useful to jot down the objectives. This would help you to focus your discussion sharply.

The role of each individual in the team - With the mutual consent of the team, each individual can choose his/her role in the group, one person can become a **convenor** of the team and coordinate the activities of the team including the preparation and circulation of a write-up (more details regarding this are given below).

Another person from the group can become the **chairperson** whose task is to facilitate a smooth, purposeful transaction of ideas, opinions and information among the participants during the Interaction Session. The chairperson is also expected to boost the morale of the team, bring in the inhibited participants; and give equal opportunities for discussion to all the group members. While doing all these he/she also has to watch out that anything in the Interaction Session may not hurt the sensitivities of any person.

Yet another person can be a **recorder** also known as **rapporteur**, who can keep a written record of the issues taken up, the suggestions that emerged, the consensus, any strong or differing opinions of the panelists. Notes-taking itself is a task requiring intense concentration. Therefore the recorder is usually exempted from participating directly in the discussion.

Any one participant may **volunteer to sum up** the salient points of discussion. This job could also be done either by the chairperson or the recorder, this you can decide amongst yourselves. Your counsellor would always be there, if you need any help.

Knowing the relevant details regarding the Interaction Session - Make sure to enquire about all the details regarding the interaction session, viz., *date, time, duration* and *venue* from your counsellor, well in advance. We feel that a time slot of 1½ to 2 hours duration should be sufficient for one such group interaction session. This means, you have to do all your home-work or any preparation earlier. That time is not counted in the time slot mentioned above.

Preparing for the Interaction Session - It is a necessary step for an endeavour like this. It involves making an in-depth study and thinking deeply about the chosen topic. In this process one explores the literature, and interacts with people. This helps in clarifying many points, widening one's perspective and developing an insight into the topic. We advise you to undergo this rigour. Rest assured, not only would the quality of your presentation, but also the quality of your participation in the interaction would be of high order!

Preparing and Circulating the Write-up - In order to have a fruitful interaction it is essential that your team prepares a one-page write up - the precise topic, its objectives, and the line of discussion to be taken up at the interaction session. The write-up may be prepared by the convenor, or any person from the team. It is always helpful that the person handling this job should interact, and take the inputs of the team members, before finalising the write-up. This exercise would help the team as a whole to know the exact focus of the discussion. It would be useful, if the write-up is circulated among the participants at least one day in advance, so that they can concretise their thoughts and reactions to the issues mentioned therein. Some copies of the write-up should also be kept handy for the desirous persons from the audience.

What to carry for the Interaction Session - Remember to bring along the paper(s) on which you have noted down your points earlier for easy recall, and other things such as transparencies,

pictures and so on, that you intend to use in the session. Some loose sheets/writing pad and pen/pencil should not be forgotten.

Arrangements at the Interaction Session - After you have assembled at the venue at the designated hour, take your seat. Make sure that the seating arrangement is such that you are able to easily view or rather establish eye contact with your other team members. Three such seating plans are given in Fig. 16.1.

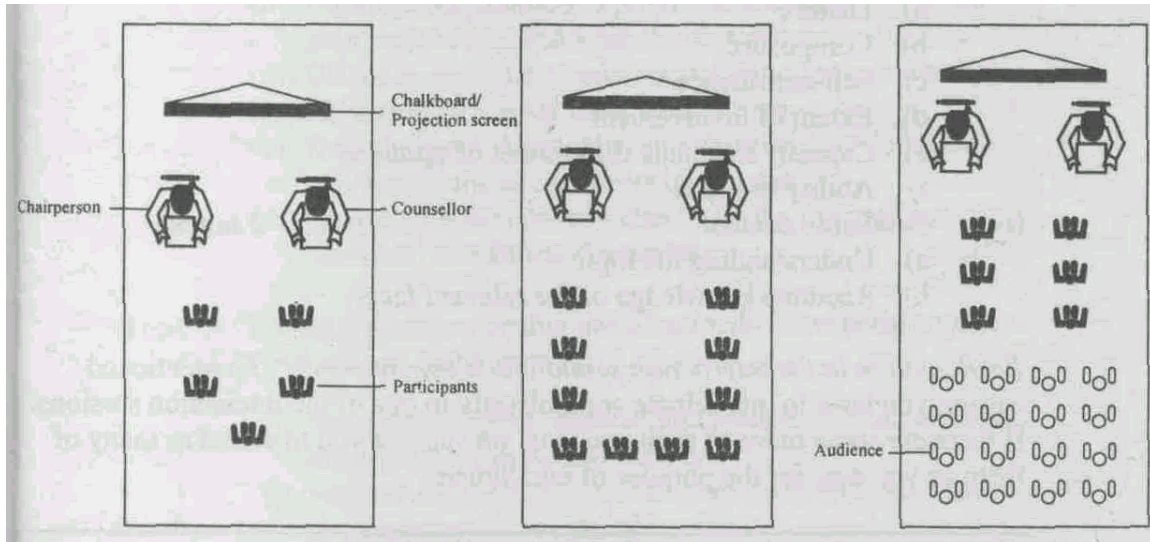


Fig. 16.1: (a) A seating arrangement for a small group, (b) An arrangement for a larger discussion group, (c) Another arrangement for the discussion group along with audience

How to participate effectively in the session - Here are some points, a mix of norms and tips, that would help you to make your interaction session a success and an experience to remember. The foremost requirement is - a thorough preparation, and clear thinking about the various facets of the proposed topic of discussion. Once you have occupied your seat, bring yourself to the level of your best concentration and alertness. Remember to be a patient listener to the points raised, the arguments developed, the explanations made and the data presented during the discussion. Participate unhesitatingly in the discussion and express your viewpoints freely. Always seek the permission of the chairperson before speaking. Try to be perceptive to the sensitivities of people and take the utmost care not to hurt the feelings of any one. While you speak, your tone should be moderate, firm and audible to all. Note down any points coming to your mind while the discussion is on, and you can take them up subsequently in the discussion, at the right moments.

Assessment Criteria for the Session - **This is a mandatory exercise** carrying a weightage often marks (the break-up is given below). You would be assessed by your counsellor. The assessment criteria given below would give you an idea of the elements important for a session like this.

Items of assessment		Weightage (out of 10)
(i)	Extent of prior-preparation (moderate/external)	1 mark
(ii)	Aspects of oral communication skills	4 marks
(a)	Language clarity (simple and short sentences, familiar words, active verbs)	
(b)	Style, tone and voice quality	

- (friendly, clear, measured neutral tone)*
- (c) Readiness to speak with facts and evidence for developing the argument
- (d) Alertness in picking up the thread
(concentration and presence of mind, quick recall)
- (iii) How do you carry your self during the session? **3 marks**
- (a) Posture
- (b) Composure
- (c) Self-confidence
- (d) Extent of involvement
- (e) Capacity to handle differences of opinions
- (f) Ability to listen
- (iv) Academic content **2 marks**
- (a) Understanding the topic
- (b) Accurate knowledge of the relevant facts

Participation in the interaction session: is it compulsory? - As mentioned earlier, you have to participate compulsorily in one of the interaction sessions. If there are some more of such sessions, we suggest you to attend as many of them as you can, for the purpose of enrichment.

16.3 SOME THEMES FOR DISCUSSION

Given below are eight themes, along with some discussion points. We suggest you to go through all of them quickly and then either choose any one of them or take up a new theme not mentioned here. These guidelines are just to give you idea about some of the ways of developing a discussion.

16.3.1 Use of Live Animal Material for Experimentation

Under this topic a variety of issues can be taken up. Some of the issues that can be raised are listed below (as Topic 1,2 and 3) along with the guidelines.

Topic 1: Procuring and storing animal materials.

- (i) You can begin by asking for a clarification or reaching a common understanding regarding the oft-used terminology, for instance, animal cages, breeder, experiment, Institutional Animals' Use Ethics Committee, and so on.
- (ii) The process of acquiring live materials
- Prior information required - number of students, the kind of experiment, precise time of requirement, the rightful source for procuring material.
- (iii) Receiving and stocking the live materials
- Preparation to be made in advance
 - Examining the actual storage conditions
 - Thinking and preparing for likely emergencies from past experiences, for instance, coping with extreme ambient temperature conditions
 - Adequate preparations for stocking live materials causing minimum suffering to them - Animal house, animal cage conforming to the standards, training of the attendant, duration of storage, making arrangements for looking after the animals during off-hours and on holidays.

Topic 2: Conducting experiments on animals.

- (i) The qualifications or experience of the person(s) performing experiments on animals,
- (ii) Comfortable conditions provided, and animals looked after well before and after the experiment,

- (iii) Use of anaesthetic to prevent suffering to the animal(s),
- (iv) Relieving an animal from its suffering,
- (v) Knowledge of the regulatory principles laid down for conducting the experiments on animals,
- (vi) Keeping records for any checks by the Institutional Animals' Use Ethics Committee.

Topic 3: Ethical issues concerning use of animals for experimentation and educational purposes.

- (i) Animals procured, handled and looked after according to the regulatory principles laid down,
- (ii) Minimising the use of live animal material; trying other alternatives,
- (iii) Optimum utilisation of a living being, but without causing any kind of suffering to it,
- (iv) Proper/decent disposal of the dead animals,
- (v) Are the available regulatory procedures enough? What more is required in them? What are the non-relevant portions that could be deleted?
- (vi) The regulatory principles alone, are not enough. These need a back-up of self-discipline and self-check.

16.3.2 Judicious use of Plant/Animal Material for Lab. Purposes

Live or preserved biological material is an essential requirement in all bio-labs. This material needs to be brought in regularly for immediate use or for replenishment of the stocks. It is a common sight to see a large portion of the material brought, later being dumped as waste. Can we think of making a judicious use of the biological material be it of plant origin or animal?

- (i) Making the right judgment of the amount of material required for use in the lab.
 - Just enough, and no shortage
 - Minimal wastage
- (ii) Dealing with the 'left-overs'
 - Fixing for future use
 - Making Herbarium/Museum specimens based on need
 - Providing it to others who are looking for it.
 - Putting to various uses, e.g., flowers can be processed for making dry arrangements/greeting cards during free time.
 - Wastes could be buried in a pit for making organic manure, this could reduce the daily garbage load; manure formed could be used in flower pots/gardens. All this not only adds to the aesthetics of a place, but is also very satisfying.

16.3.4 Preventive measures for minimising accidents in Laboratories

Topic 1: Preventive measures for ensuring safety in a chemical laboratory.

- (i) Identifying chemical hazards (Ref. Unit 13, Sec. 13.3)
- (ii) Identifying fire hazards (Ref. Unit 12, Sec. 12.3)
- (iii) Identifying incompatible substances (Ref. Unit 13, Appendix)
- (iv) Treatment of chemical wastes (Ref. Unit 15, Sec. 15.4)
- (v) Usage of protective clothing (Ref. Unit 15, Sub Sec. 15.3.3)
- (vi) Observing safe laboratory practices (Ref. Unit 15, Sub Sec. 15.3.2 and Unit 13, Sub Sec. 13.3.2).
- (vii) Safe Handling of chemicals/instruments (Ref. Unit 15, Sec. 15.6)
- (viii) Hazardous chemicals rules
- (ix) Observance of fire safety rules

Topic 2: Preventive measures with respect to electricity supply and electrical equipment in the laboratory.

The questionnaire-cum-checklist given below could be of immense help for taking up the appropriate preventive measures.

- (i) How is electricity supplied to your laboratory?
(Broad idea of an electric power station, long distance transmission of electricity, transformer, supply cable).
- (ii) At what voltage electricity is supplied in your laboratory? Is this voltage the same as the voltage at which electricity is transmitted from electric power generation station to the local electric station in your town?
(Electric power is transmitted between long distances at high voltage to minimise transmission loss. In the laboratory it is supplied at 240V)
- (iii) Are all the electrical accessories in conformity with the requisite standards?
- (iv) What is the purpose of a fuse in electrical wiring? How does it work?
- (v) What is the purpose of earthing in electrical wiring? How does it work?
- (vi) In some of the electrical equipment a separate fuse is provided. Why?
- (vii) What may happen if you connect an electrical equipment to the mains without using a plug?
(Loose connection may cause a spark and damage the socket)
- (viii) Are all electrical installations subjected to regular inspection?
- (ix) Are all electrical gadgets handled with care and caution?
- (x) Are all electrical installations - wiring, connection, and maintenance of electric equipments carried out by skilled electricians only?
- (xi) Are there any temporary electric connections in your lab. as a quick-fix solution? Is it desirable? Why?
- (xii) Are you careful to switch off the mains whenever any repairs (even of minor nature) are carried out?
- (xiii) Do you take care to keep electrical equipment free from dust, dirt, splashes of liquids and moisture? xiv) Are warning signs, indicator lights, markings made use of to draw the attention of persons to the possible dangers? xv) What are the dos and don'ts in case of fire caused due to electricity?
(Never use water for extinguishing electric fire; switch off the mains; only use CO₂ type fire extinguishers)
- (xvi) What are the first-aid measures for a person suffering from electrical shock?
(Restore her/his respiration by rythemically pushing her/his back to apply pressure on lungs).

16.3.5 Preventive Maintenance of Laboratory and Equipment

Topic: Role of lab. staff in preventive maintenance of laboratory and its equipment.

- (i) Daily maintenance (Ref. Exercise-4)
 - Routine cleaning
 - Garbage disposal
 - Sorting out waste
 - Shut-down and check-in sequences
 - Running machines
- (ii) Weekly or monthly maintenance

- Sinks
- Drainage
- Distilled water plant
- (iii) Annual maintenance
 - Gas source
 - Fire extinguishers
 - Electricity connection points
 - Fire buckets
 - Devices for protection from chemical vapours
 - Water line
 - Table tops
 - Furniture-varnishing, repair etc.
- (iv) Soliciting maintenance contract and keeping to the schedule
- (v) Checking instruments which are occasionally used. Costly equipment should be kept functional.

16.3.6 Professional Requirements of Laboratory Staff for Better Performance

Some points that could be taken up for discussion on this theme are listed below. In addition, it would be very useful to have another look at the following references of this course: Unit 5, Sections 5.2 and 5.3 (HLLS course); and Exercise 4.

- (i) Knowing your job well.
 - Prior knowledge/training is an asset.
 - For fresh recruits, efforts put in to know the various spheres and requirements of the job would prove both satisfying and rewarding in the long run.
- (ii) Stringently following the code of behaviour laid down by the institution.
- (iii) Personal rules and self checks
 - Discipline
 - Cordial behaviour
 - Willingness to help anyone, and undertake extra work if need be
 - Guidance to new entrants in the lab.
 - Empathy for staff as well as the users of lab.
- (iv) Preparation of duty chart for various activities in the lab.
 - Daily chores - opening/closing, cleaning, dusting
 - Maintenance - repairs, oiling, cleaning
 - Specific responsibilities - person(s) incharge
- (v) Calendar of activities for one self helps in efficient working
 - Daily (specific requirements)
 - Monthly (special preparations required, tasks to attend to)
 - Annual (tasks to be undertaken on annual basis - preparation for examination, procurement of specimens/materials; maintenance of lab. - white washing, varnishing, annual cleaning)
- (vi) Organisation of lab. with efficient use of space, accessibility and safety being the main considerations.
 - Arranging things according to usage (immediate use; less frequently used; hazardous material; delicate material; materials requiring special conditions, e.g., cold, protection from direct light and so on.)
 - Labelling indicating all the required details (name, concentration, expiry date and so on.)
- (vii) Establishing a direct, regular and frank communication channel with the users of lab.

- Regular, contact for knowing about the requirements in advance -
- items required, time when required, amount or quantity, source if any. viii)
- Record keeping habit
- Record of the whereabouts of the items in the lab. (immense help to one self and others)
- Breakage records
- Instrument servicing records
- Replenishment records
- (Which items? When? From whom? Amount/quantity)
- (ix) Reference copy
Information about the methods of preparation, and calculations involved in the preparation of solutions; details/preparations used often in the labs.
- (x) Procuring right amount of fresh material for work - not too less causing shortage, nor too much leading to wastage
- (xi) Keeping lab. in order
 - As often as possible in a day
 - Must, at the end of the day
 - Always keeping the emergency escape routes clear
- (xii) Safety concerns
 - Awareness of potential dangers, and emergency procedures
 - Knowledge of the measures to be taken to avoid accidents.
 - Use of safety/protective devices while working, e.g., exhaust fans,
 - fume cupboards, lab. coats/aprons, gloves, goggles and so on.
 - Knowledge of, and following the operation rules of instruments and other gadgets.
- (xiii) Professional development as an essential and continuous endeavour
 - Self-initiative is the best
 - Urge to learn to improve performance
 - Open-mindedness
 - Attending relevant courses
 - Exploring and reading newer literature
 - Interacting with colleagues
 - Visiting other labs to know about their good points.

16.3.7 Follow-up Action for Emergency Situations in Laboratories

Follow-up action for emergency

- (i) Proper First-Aid training
- (ii) Maintenance of First-Aid facilities
- (iii) Mock exercises or drills for various possible hazards - Gas leakage/lab. fire and dealing with fire accident victims to minimise injury/electric shock/chemical splash
- (iv) Importance of observing safety day or week
- (v) Emergency call address and mode of communication
- (vi) Updating occasional verifications for change of phone numbers and addresses

16.3.8 Professional Development of Laboratory Staff

- (i) Why it is necessary?
 - For moving up in the career ladder
 - Constant updating - need of the time
 - Self confidence

- (ii) Areas of Professional Development ?
 - Academic
 - Skill enhancement
 - Any area concerning the laboratory situation
 - (*Design, Arrangement, Increasing efficiency, Coping with work pressures*)
- (iii) How it could be done?
 - By Interaction with specialists
 - (*Talks, Lectures, Seminars etc.*)
 - Common forum providing regular interaction with peers
 - (*Exchange of views, Development of critical thinking*)
 - Tailor-made courses
 - (*Duration, On demand to cater to specific needs, Who would develop and provide these courses?*)
- (iv) Time slot for Professional Development
 - Compulsory
 - Timing in the year Group Interaction-Laws,
 - Duration Regulations and Related Issues
 - Can it be made mandatory?
- (v) Incentives for Professional Development
 - Present situations
 - What more is required in this area?
 - Awards/Recognition
 - (*Levels - Institution/State/National*)