

CLTL-101
GOOD LABORATORY PRACTICES:
BASIC EXERCISES

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IMPORTANT

- **Attendance** is compulsory in the Laboratory Course work held generally at the Study Centre.
- The Laboratory Course is worth **2 credits** to be completed over **5 days** duration:
 - **4 days** of **Guided** Laboratory work
 - **1 day** for the **Unguided** Laboratory work
- To successfully complete the laboratory course you will have to pass (at least **35% marks**) in the Guided and Unguided components separately.

GOOD LABORATORY PRACTICES: BASIC EXERCISES

The laboratory course titled '**Good Laboratory Practices: Basic Exercises**'(CLTL-101) is a skill oriented course integrated to the theoretical aspects dealt in the '**Good Laboratory Practices**' course (CLT-101) of the Certificate Programme in Laboratory Techniques. The exercises in this course include activities that can be done in any of the three Science laboratories. Almost every exercise has more than one activity that needs to be written in the laboratory note-book and be reported to the academic counsellor after completion. The experiments in this course would require your hands on involvement in Chemistry, Physics and Biology laboratories. The course is worth **2** credits with **14 Exercises/Experiments** in all.

The first **six** exercises are based on **Blocks 1 and 2** of **CLT-101** course and are related to the laboratory design, organisation and management. **Exercises 1, 2 and 3** deal with the study of laboratory design, preparation room and store. **Exercises 4 to 6** 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 of stock register.

Experiments 7 to 13 are based on **Block 3** of **CLT-101** course. The activities of these experiments include basic electrical maintenance work, supply of essential services in the laboratory, fire safety measures and handling of hazardous chemicals. There are activities based on disposal of unserviceable items, obsolete items and chemical wastes. Some first aid procedures are illustrated through activities. There is an activity on assembling the first aid box. There are three demonstration activities in these experiments which include use of a fire extinguisher and use of a fume cupboard and first aid procedures.

Experiment 14, the last experiment of this course, is an interesting and quite useful experiment that exposes you to the computer applications like, *MS Word* and *MS Excel*.

Expected Learning Outcomes

After performing the Exercises/ Experiments of this course, you should be able to:

- state the design features of a laboratory, its preparation room and its store;
- follow the procedures for stock verification and other laboratory related items;
- follow proper procedures for electrical maintenance like wiring a plug;
- 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 describe how to use a carbon dioxide fire extinguisher;
- classify the chemical substances into different hazard types and use a fume cupboard for carrying out a chemical reaction;
- 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
- apply the computer applications like *MS Word* and *MS Excel* in organising and managing a Science laboratory.

Guidelines for Doing Exercises/ Experiments

While doing the exercises/experiments you must have the block of this course with you for reference. In many of the exercises/experiments, you will find references to the material given in the block.

The **fourteen** exercises/experiments mentioned above are to be completed in **four** days and **eight** laboratory sessions. Two sessions of **four hours** each will be held each day. You will perform the exercises/experiments under the **guidance** of your counsellor. These exercises/experiments are called **Guided exercises/experiments**. The **fifth** day is for the **Term End Exam** in which the assigned exercise/experiment will not be guided by the counsellor. The exercise/experiment assigned for this purpose is called **Unguided exercise/experiment**. The details of the day, the session and the type of laboratory for the conduct of all the exercises/experiments are given in the table on the next page.

Table: Day, Session and Laboratory Type for Exercises/Experiments of CLTL-101

TITLE(S)	DAY	SESSION NO.(S)	LABORATORY TYPE OR CLASSROOM
INTRODUCTION	1	I	Introduction (Any lab*) Exercise 1 & 2 (Any lab)
GUIDED EXERCISES			
Exercise 1: Features of a Science Laboratory			
Exercise 2: Infrastructure of a Preparation Room of Laboratory			
Exercise 3: Organisation of Laboratory Store		II	Exercise 3 (Chem Lab) Exercise 4 (Classroom)
Exercise 4: Regular Duties of Laboratory Staff			
Exercise 5: Purchase of Laboratory Related Items, Inventory Management	2	III	Exercise 5 (Classroom) Exercise 6 (Bot/Zool/Chem Lab)
Exercise 6: Stock Verification and Maintenance of Apparatus			
Experiment 7: Basic Aspects of Electrical Maintenance		IV	Experiment 7 (Any Lab) Experiment 8 (Chem Lab)
Experiment 8: Supply of Gas, Electricity and Water in a Laboratory			
Experiment 9: Fire Safety Measures in a Laboratory	3	V	Experiment 9 (Chem Lab) Experiment 10 (Chem Lab)
Experiment 10: Classification and Handling of Hazardous Chemicals			
Experiment 11: Disposal of Unserviceable and Obsolete Items		VI	Experiment 11 (Classroom) Experiment 12 (Chem Lab) Experiment 13 (Classroom)
Experiment 12: Safe Disposal of Laboratory Waste			
Experiment 13: Attending to Emergency Situations			
Experiment 14: Use of Computers for Science Laboratory	4	VII & VIII	Experiment 9 (Classroom or Any Lab with computer)
ASSIGNED UNGUIDED EXERCISE or EXPERIMENT*	5	IX	Term End Exam (As per the disciplines to which the counsellors belong)*

* The exercises/experiments with the entry 'Any Lab' under the last column can be performed in Botany or Chemistry or Physics or Zoology laboratory.

Assessment of CLTL-101 Course

CLTL-101 course is worth **35 marks**; **15** marks for the continuous assessment (Guided laboratory work to be done over 4 days) and **10** marks for the Term End Exam (Unguided laboratory work to be done on the fifth day). Please remember that for continuous assessment you will be assessed for each and every guided experiment daily. You must score at least **35%** marks in continuous and term end exam separately to pass this course.

EXERCISE 1

FEATURES OF A SCIENCE LABORATORY

Structure

- | | | | |
|-----|----------------------------|-----|-----------|
| 1.1 | Introduction | 1.3 | Procedure |
| | Expected Learning Outcomes | 1.4 | Report |
| 1.2 | Requirements | | |

1.1 INTRODUCTION

In the present exercise of this course you are introduced to the essential features of a good laboratory. Since no two labs are alike, it is important for you to know the design and organisation of the laboratory. For doing this exercise you will visit a lab, observe its features carefully and critically, and prepare a report on your observations.

Expected Learning Outcomes

After doing this exercise, you should be able to:

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

Useful Instructions

It is desirable for you to study Unit 2 of CLT-101 course (Good Laboratory Practices) a night before you plan to undertake this exercise. Also keep Block 1 of this course handy in case you may need to refer to the unit again.

1.2 REQUIREMENTS

Pencil

Pen

Eraser

Scale

Coloured pen and pencils

1.3 Procedure

Visit any laboratory (Physics, Chemistry or Biology) of your study centre or any other for which you can get an access to. You are required to make a note of its features. 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 that is very important and essential from the view point of this exercise. 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 have learnt in Unit 2 of CLT-101 course.

1. Design and Construction

Note the design of the school/college building. Also observe the **quality of construction** and the materials such as bricks, tiles, stone, cement, mosaic or any other used for elevation, floors, walls, ceiling etc. Take a close look at the interiors also. If you find it interesting you may like to enquire about it from an architect or engineer. We think it is also important to note how old the building is.

Design and Construction	Observations	Comments and suggestions
Design		
Size		
Material used		
Floor		
Wall		
Ceiling		

Try to make a rough sketch drawing of the building in the space provided below:

2. Location and Layout

Note the location of the lab in relation 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 Block 1, Unit 2). You are supposed to draw the position of the doors since it is important to see the connectivity of 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 the entry and exit points from the view point of access, convenience and safety of the students as well.

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, preparation room, store, office and other accommodation (if any). Enquire 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 (for keeping fish), a vivarium (for keeping animals) etc. Also find out how they are accessible to 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 the purposes for which it is being used. Here you may use the concept of Laboratory Investigation studied in Unit 2 of CLT-101 course.

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, Electricity and Drainage

Which of the above stated services are given and how are they provided (through walls/floor/ movable service station)? Are there enough outlets? Watch carefully 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/ needs repair)
Gas		
Water		
Electricity		
Drainage		
Mains		

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

9. Main Laboratory in Relation to Other Rooms

See the location of the main laboratory in relation to other rooms. Try to roughly estimate its area. Is it conveniently placed? Take a note of 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 system (perimeter - peninsular or island type)?, Where are the sinks provided? Is the material used for bench surfaces suitable for the purpose of the laboratory? Note if there are slabs also.

Type of benching	Type of surface	Comments and suggestions
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 enough to allow natural light and ventilation? Is there a provision for forced ventilation also? Also examine them from the view point of security?

Windows and Ventilators	Type	Comments and suggestions
No. of Windows No. of Ventilators Forced Ventilation		

12. Lighting, Heating and Cooling

Observe if the laboratory 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 laboratory.

Arrangement	Observations	Comments and suggestions
Lighting Heating Cooling		

13. Flooring

Note what kind of material is used (concrete/mosaic/linoleum/glazed or PVC tiles) for flooring? Is it suitable for this laboratory? 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 laboratory. Note the provisions made in this regard.

Observations

Comments and Suggestions

16. Maintenance and House keeping

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

Observations

Comments and Suggestions

17. Provision for Disposal

This is very important component of the laboratory. 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 under:

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

Discussion

INFRASTRUCTURE OF A PREPARATION ROOM OF LABORATORY

Structure

- | | | | |
|-----|----------------------------|-----|-----------|
| 2.1 | Introduction | 2.3 | Procedure |
| | Expected Learning Outcomes | 2.4 | Reports |
| 2.2 | Requirements | | |

2.1 INTRODUCTION

This exercise is based on Unit 3 of this 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 whose design and infrastructure you have already studied in Exercise 1 of this lab course. You will be expected to carefully study the various important features of the preparation room and critically make a report.

Expected Learning Outcomes

After doing this exercise, you should be able to:

- ❖ describe the features of the preparation room of the lab;
- ❖ 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 in the preparation room.

Useful Instructions

It is important that you study Unit 3 of CLT-101 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.

2.2 REQUIREMENTS

Work book cum lab manual

Pen

Pencil

Eraser

Ruler

Colour pencils

2.3 PROCEDURE

Visit the preparation room of one of the labs (Physics/Chemistry/Zoology/Botany), you studied in Exercise 1 and note its features. To make your study easy and to guide you, we have listed below the main features of a preparation room 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 of the preparation room 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. and whatever you observe in the room. Refer to Fig 2.1 for help.

Location and layout of preparation room of _____ lab	No. of labs the preparation room services
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	
.....	

Remarks if any

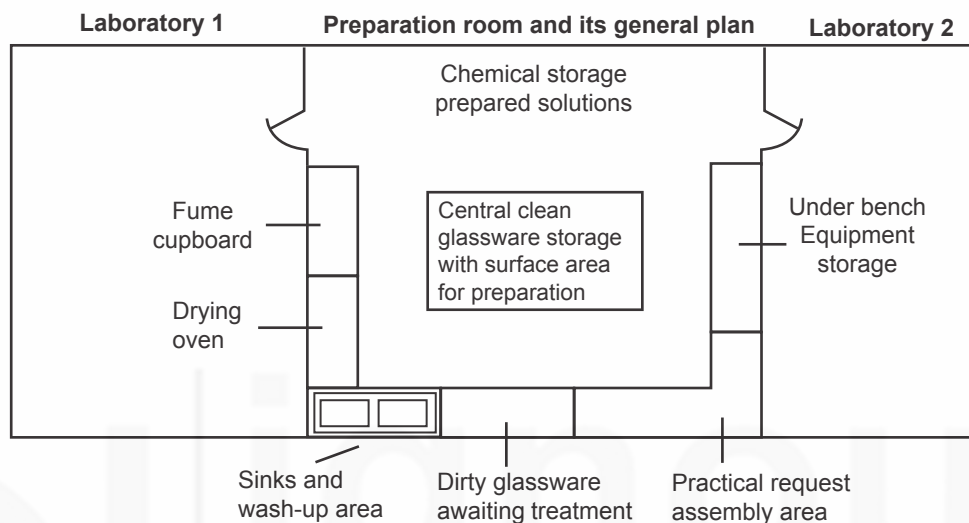


Fig. 2.1: The plan of a preparation room area along with the adjoining laboratories.

Draw the floor plan of the preparation room which you have studied and also give its dimensions (length x breadth) as well as the position of access, windows, wet bench and dry bench.

A large, empty rectangular box provided for the student to draw the floor plan of the preparation room, including dimensions, access points, windows, wet bench, and dry bench.

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.

[illegible]

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 considered 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)				
.....				
.....				
b. Equipment (any 10)				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				
.....				

c. Furniture				
Dry bench/ Wet bench				
.....				
.....				
.....				
.....				
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.
Chemicals			
.....			
.....			
.....			
.....			
.....			
.....			
Equipment			
.....			
.....			
.....			
.....			
.....			
.....			
Paper work			
.....			
.....			
.....			
.....			
.....			
Remarks if any			
.....			
.....			
.....			
.....			
.....			

5. Provision for services—Gas, Water, 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 and whether adequate or inadequate	Condition 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 is 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>	Adequate/inadequate	
Number of windows		
<u>Artificial</u> Tubes and/or bulbs No. of tubes No. of bulbs Others	Adequate/inadequate	
b) Heating	Warmth	
Needed/Not needed in _____ months	Adequate/inadequate	
Type of heating by blower and or/radiator and or air- conditioner		
c) Cooling	Coolness	
.....Needed/not needed in months Type of cooling by air- conditioner/desert cooler	Adequate/inadequate	

2.5 REPORTS

On the basis of your total observation give a combined summary of the various aspects of the preparation room in the space below. (In case the given space is not adequate please use additional loose sheets)

[illegible]

EXERCISE 3

ORGANISATION OF LABORATORY STORE

Structure

- | | |
|--|--|
| 3.1 Introduction | 3.3 Activity 2: Classification of Chemicals in the Store |
| Expected Learning Outcomes | |
| 3.2 Activity 1: Investigation of the Store | |

3.1 INTRODUCTION

You have studied in Unit 3 of CLT-101 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 already studied 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.

Expected Learning Outcomes

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 substances; and
- ❖ arrange the chemicals safely in store.

Useful Instructions

You should study Unit 3 of CLT-101 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 CLT-101 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 it in any particular location of the store as per the advise 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.

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.		

ANNEXURE 1**PARTIAL LIST OF
INCOMPATIBLE CHEMICALS
(REACTIVE HAZARDS)**

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, foam, potassium, lithium, magnesium, calcium, powdered aluminium	Carbon dioxide, carbon tetrachloride and other chlorinated hydrocarbons. (Also prohibit water, 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. Ammonium salts, acids, metal powders, sulphur, finely divided organics or combustibles
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, turpentine.
Trioxide	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, fulminic 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, fulminic 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

REGULAR DUTIES OF LABORATORY STAFF

Structure

4.1	Introduction	Activities Related to Specific Experiments/Demonstrations in Zoology/Botany/Physics/Chemistry Laboratory
4.2	Requirements	
4.3	Duty Procedures of Lab Staff	Stock Replenishing and Repair Jobs
	Check-in and Check-out Procedure	Preparation Prior to Examinations
	Coordination between Lab Assistant/ Technician and the Teaching Staff	Annual/Biannual Cleaning and White-washing
		Any Other Suggestions

4.1 INTRODUCTION

You will recall from Unit 4 of Block 1 of CLT-101 course about the various duties and activities of a lab staff that facilitate the 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.

Expected Learning Outcomes

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 procedures of any two labs;
- ❖ discuss 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 take for a particular experiment of Zoology/Botany/Chemistry/Physics;
- ❖ compare the procedures followed by two different labs with regard to stock replacement and repair of equipment; and
- ❖ state the duties performed at two different labs before the examination, during vacation and at times of annual/biannual cleaning and white washing.

Useful Instructions

It is essential that you study Unit 4 of CLT-101 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/ marker pens

4.3 DUTY PROCEDURES OF LAB STAFF

Choose any two labs from Botany/Zoology/Physics/Chemistry labs of your study centre. This entire exercise will be based on the two labs that you have chosen. Visit the two labs of the Discipline that you have chosen and consult the lab technician or senior laboratory supporting staff of two labs. 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 lab assistant/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.

4.3.1 Check-in and Check-out Procedure

a) Location of Key

Enquire from the lab assistants/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 the number of keys available for the lab and where they are located). Note your findings in Table 4.1.

Table 4.1

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 lab assistants/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? Note all these findings in Table 4.2.

Table 4.2

Lab Technician	Cleaning of floor done by	Dusting of Equipment done by	Supervision of cleaning and dusting done by	Precautions taken during cleaning	Remarks if any
Lab Technician 1 of _____ lab.					
Lab Technician 2 of _____ lab.					

c) Daily Switching on and off of Lights and Equipment

Enquire who switches on the lights as well as equipment like distillation plants, ovens etc. in the morning and who switches them off in the evening before closing. In case of gas being used in the lab, find out if the main supply is switched off daily before the lab is closed. Also enquire:

- if the main switch of the gas supply is located in the lab itself or elsewhere.
- if the technicians also know the location of main switches for electricity and water supply as well as know the location of the fire extinguisher. Note the details in Table 4.3.

Table 4.3

Technicians	Who daily switches on and off the lights and equipment.	Is gas daily switched off from the main supply?	Location of the main water supply: is it close or far from laboratory	Location of the main gas supply: is it located inside or out side the lab	Location of the main electricity supply: is the switch close or far from the laboratory	Location of fire – extinguishers and no. of extinguishers.	Remarks
Technician 1 of ____ lab							
Technician 2 of ____ lab							

4.3.2 Coordination between Lab Assistant/Technician and the Teaching Staff

Enquire from the Lab Assistants/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 lab assistant/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 lab assistant/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 staff or do they just verbally inform the lab staff who records the instructions himself/herself by actually noting down the requirements. Note all your findings in Table 4.4.

Table 4.4

Technicians	Advance time given by the academic staff to the 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.				

4.3.3 Activities Related to Specific Experiments/ Demonstrations in Zoology/Botany/Physics/Chemistry Laboratory

In this subsection of the exercise you will study the various activities that the lab technician has to undertake for a specific experiment. For this purpose we have listed four specific experiments one for each discipline of Zoology/ Botany /Physics/Chemistry. Out of these four, you will be studying the various activities that the lab assistant/technician has to perform with relation to two experiments. These two experiments that you choose should be those that are conducted in the laboratories of the disciplines that you chose earlier, in the beginning of this exercise. Consult the two lab assistants/technicians of the two disciplines regarding the various activities they have to do before, during and after the experiment. Write down the information that you obtain in the tables provided for this purpose.

A: ZOOLOGY AND/OR BOTANY EXPERIMENT – STAINING OF PLANT (STEM/ROOT) AND/OR ANIMAL MATERIAL (GRASSHOPPER TESTIS)

1. Procedure for Procurement of Biological Material

Find out from the lab assistant/technician the details for procuring botanical root and stem material and/or zoological material (grasshopper) and also procuring slides and give in Table 4.5.

Table 4.5

Procedure for procuring Biological material.	Material may be fresh/or stored. If stored-duration for which the material can be kept.	Storage method of the material – in fridge, in fixative, in the animal house.	Remarks if any.
Zoology Animal – Grass hopper Slides			
Botany Plant Monocot-any one root or stem Dicot-any one root or stem Slides			

2. Prior Preparation for Fixing and Staining Animal Tissues and/or Plant Tissues

Find out what procedure the lab assistant/technician follows for preparing fixative for either plant and/or animal tissues, alcohol series and stains for animals (aceto-orcein or aceto carmine) and/or plant (methylene blue).

Further enquire from the lab assistants/technicians on what basis do they calculate the amount of various solutions and stains to be prepared so that they are neither in excess nor are too less. Also enquire whether the quantity of solutions and stains are prepared on the basis of the requirement of each student or is some other calculation used?

Also find out whether the technicians prepare all the solutions and stains that are required a day or two before the experiment or on the same day. Also enquire that do the lab assistants/technicians after the experiment retain any of the prepared chemicals or do they discard them? If the chemicals are not discarded, how long can they be kept without deterioration? Note all the information in Table 4.6.

Table 4.6

Name of reagents and stains.	Procedure for preparation and calculation as to how much solution should be prepared.	If chemicals are kept or discarded after experiment.	Shelf life of the chemicals that are retained.	Remarks if any.
i) Alcohol series				
ii) Name of one fixative – (plant and/or animal) Animal Fixative _____ Plant Fixative _____				
iii) Name of one stain (plant and/or animal) Animal stain _____ Plant stain _____				

3. Glassware Used and Method of Cleaning It

Enquire and list any five types of glassware which the lab assistants/ 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? Give the information in Table 4.7.

Table 4.7

Glassware	Cleaning method of glassware before and after preparation.	Remarks.
Name of 5 glassware items used by Lab assistant/technician in a: i) Zoology lab _____ _____ _____ _____ _____		
ii) Botany Lab _____ _____ _____ _____ _____		
Name of 5 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 lab assistant/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)

Note down all your findings in Table 4.8 given below.

Table 4.8

Biological material	Disposal Method
1a. Zoology Lab–Animal: Grasshopper	
1b. Botany Lab–Plant Material	
2. Slides and cover slips discarded by students during practical i. Zoology Lab and or/ ii. Botany Lab	

Solutions	Disposal Method
3a. Botany Lab–Plant fixative and or/ 3b. Zoology Lab–Animal fixative	
4a. Alcohol in Zoology Lab 4b. Alcohol in Botany Lab	
5a. Plant Stain in Botany Lab – Methylene blue and or/ 5b. Animal stain in Zoology Lab – aceto-orcein or aceto carmine	
6. Paraffin wax	

5. Cleaning and Maintenance Procedure

You can enquire from the lab assistant/technician about the general cleaning and maintenance of permanent slides of plants and/or animals, dissecting and compound microscopes, weighing balances, models and charts. In case of Zoology lab, you can ask about how they maintain dissecting trays, stuffed animals which are museum specimens, mounted specimens and specimens in jars. In case of Botany laboratory enquire how mounted specimens, specimens in jars, and herbarium, etc are cleaned and maintained. Give all the information in Table 4.9.

Table 4.9

Cleaning and maintenance of dissecting microscope and compound microscope.	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.
Dissecting microscope	Rough balance	Animal Slides			
Compound Microscope	Electronic balance	Plant slides			
Remarks if any					

OR

B: CHEMISTRY EXPERIMENT – THE VOLUMETRIC DETERMINATION OF A GIVEN ACETIC ACID SOLUTION BY USING 100 ML. OF A STANDARD CAUSTIC SODA SOLUTION.

1. Procedure for Storage of Apparatus and Chemicals Needed for the Experiment

Enquire from the lab assistant/technician how the various apparatus and chemicals listed below are used for the experiment and how they are stored. Note all your findings in Table 4.10.

Table 4.10

Name of apparatus and Chemicals.	Storage area – Room in which stored.	Storage method.
<u>Apparatus</u>		
1) Burette	Storage in lab/preparation room	Cupboard/Open shelves
2) Pipette	Storage in lab/preparation room	Cupboard/Open shelves
3) Titration flask	Storage in lab/preparation room	Cupboard/Open shelves
4) Funnel	Storage in lab/preparation room	Cupboard/Open shelves
5) Glazed tile	Storage in lab/preparation room	Cupboard/Open shelves
6) Burette stand	Storage in lab/preparation room	Cupboard/Open shelves
7) Analytical balance	Storage in lab/preparation room	Cupboard/Open shelves
8) Weights	Storage in lab/preparation room	Cupboard/Open shelves

9) Chemicals/reagents		
i) Standard caustic soda (NaOH) solution	Storage in lab/ preparation room	Cupboard/Open shelves
ii) Acetic acid solution	Storage in lab/ preparation room	Cupboard/Open shelves
iii) Phenolphthalein (indicator)	Storage in lab/ preparation room	Cupboard/Open shelves

2. Prior Preparation for Titration

Enquire from the lab assistant/technician about the reagents or solutions he himself prepares and about those which are prepared by students. Also what method does the technician use to prepare the solutions and what amount of solution per student does she/he prepare? Write all this information in Table 4.11.

Table 4.11

Name of reagents/ solutions.	Preparation of the reagents/ solutions done by student/lab assistant/technician.	Method of preparation of reagents prepared by lab assistant/technician.
Remarks if any		

3. Method of Calculation for Amount of Solution/Reagent to be Prepared

Find out from the lab assistant/technician how she/he calculates the amount of the solution she/he has to prepare for all the students so that the solution prepared by the lab assistant/technician is neither too much nor too little. Is the amount of solution prepared on the basis of the requirement 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? Note down all the information in Table 4.12.

Table 4.12

Name of Chemicals (any two).	Procedure for calculation of amount of solution to be prepared by the lab assistant/ technician.	Unused chemicals/ solutions kept or discarded after experiment.	Shelf-life of chemicals/ solution left after the experiment.
Remarks if any			

4. Glassware Used and Their Method of Cleaning It

Enquire and list any five types of glassware which the lab assistants/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? Give the information in Table 4.13.

Table 4.13

Glassware	Method of cleaning glassware before and after experiment	Remarks if any
Name of 5 glassware items used by student		
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 assistant/technician what cleaning procedure he follows after the experiment and at the end of the day. Give these finding in Table 4.14.

Table 4.14

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. Write this information in Table 4.15.

Table 4.15

Cleaning and maintenance of balances.	Methods of cleaning and maintenance of gas-burner.	Method of maintenance and repair of distillation or deionizer plant.	Method of maintenance and cleaning of oven.
Rough balance			
Electronic balance			
Analytical balance			

OR

C: PHYSICS ELECTRICITY EXPERIMENT – TO VERIFY OHM’S LAW WITH THE HELP OF AN AMMETER AND A VOLTMETER.**1. Procedure for the Storage of Equipment Used in the Experiment**

Enquire from the lab assistant/technician how the main equipment used in the experiment are stored. Give the information in Table 4.16.

Table 4.16

Name of equipment.	Storage of equipment in lab/ preparation room.	Storage of equipment in cupboard/racks.	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 upto 1/10 amp			
4) A rheostat (max ^m value 20 ohms)			
5) A tap key			
6) A resistance coil of 2 ohms			

2. Prior Preparation Made by the Lab Assistant/Technician for the Experiment

Find out from the lab assistant/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 does he use to check if the equipment are in working order. Give the information in the Table 4.17 given below.

Table 4.17

Name of instruments and equipment.	If equipment and instrument are checked before or after experiment.	Procedure for checking if equipment and instrument are in working order.
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 assistant/technician about the procedure he has adopted for issuing the equipment to the students as well as the procedure he follows to get the equipment back from students. Note your findings in Table 4.18 given below.

Table 4.18

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 assistant/technician you are consulting, the procedure for dismantling the set-up of the apparatus after the experiment is over. Write the procedure in Table 4.19.

Table 4.19

Dismantling of set-up of apparatus by student/lab assistant/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 in the experiment, "To verify Ohm's Law with the help of an ammeter and a voltmeter." Also ask him/her the cleaning procedure he/she follows for any 5 important equipment used in the physics lab. Note the given information in the Table 4.20 provided to you.

Table 4.20

Name of Instruments and 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	
Cleaning procedure for 5 equipment	
1)	
2)	
3)	
4)	
5)	

6. Repair and Replacement of the Instruments

Enquire from the lab assistant/technician you are consulting about what action he/she undertakes if the instrument goes out of order or is damaged by the students 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? Give all this information in Table 4.21.

Table 4.21

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.

4.3.4 Stock Replenishing and Repair Jobs

Find out from the two lab staff members what procedure is followed regarding replenishment of stock on a daily/weekly as well as on a six monthly basis. State your findings below in the given Table 4.22.

Table 4.22

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

4.3.5 Preparation Prior to Examinations

Enquire regarding the preparation work undertaken by the lab assistants/ technicians prior to exams and enter the findings in the Table 4.23 below.

Table 4.23

Preparation before exam
(1) ----- Lab.
(2) ----- Lab.

Enquire from the two lab assistants/technicians about the duties they perform during the vacation. Note them down under the following headings in the Table 4.24 given below.

Table 4.24

[illegible]

4.3.7 Any Other Suggestions

[illegible]

EXERCISE 5

PURCHASE OF LABORATORY RELATED ITEMS, INVENTORY MANAGEMENT

Structure

5.1	Introduction	Activity 2: Preparation of Comparative Chart
	Expected Learning Outcomes	
5.2	Requirements	Activity 3: Placement of Order with the Firm for the Supply of Goods
5.3	Procedure	Activity 4: Processing of Bill for Payment
	Activity 1: Invitation of Quotations	

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 process the bill for payment and how to invite quotations and place orders for the supply of goods to be purchased for your laboratory. All the activities given in this exercise are to be performed at the Study Centre. Your resource persons will act as the counsellor.

Expected Learning Outcomes

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; and
- ❖ fill up the order form for the supply of goods.

Useful Instructions

Students are advised to go through Unit 5 of CLT-101 course on Good Laboratory Practices 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 your lab
3. Three envelopes containing bills of items supplied by the firms/agencies/manufacture's
4. A register
5. Pen/pencils and rubber
6. Quotation (format)
7. Order (format)

5.3 PROCEDURE

You will perform four activities in this exercise given in the following subsections. Follow the procedure given under each activity and show the completed activity to your counsellor.

5.3.1 Activity 1: Invitation of Quotations

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

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



INDIRA GANDHI NATIONAL OPEN UNIVERSITY
Maidan Garhi, New Delhi - 110 068

To

No.:

Date:

Sub:- IGNOU-INVITATION FOR QUOTATION FOR SUPPLY OF GOODS

Dear M/s,

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

Sl. 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 upto 3.00 p.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: Store’s offer should strictly conform to your 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
alongwith the quotations. Test certificates wherever necessary should be
forwarded alongwith 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.
4. Corrections, if any, must be attested. All amounts shall be indicated both in words
as well as in figure. Where there is a difference between amount quoted in words
and figures, the amount quoted in words shall prevail.
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/ Head
of institution 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/Head of the institution reserves
the right to cancel the order at the supplier’s risk and cost.
6. 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/ Head of institution

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.

5.3.2 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 counselor for her/his approval.

Comparative Chart

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

5.3.3 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 Elico, Hyderabad.

<u>Item</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.



INDIRA GANDHI NATIONAL OPEN UNIVERSITY
Maidan Garhi, New Delhi - 110 068

To,

.....

Sub: Supply of goods

Dear M/s,

With reference to your quotation No.

..... Dated please supply the following articles on or before

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

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

TERMS AND CONDITIONS

1. The material may be supplied to the, New Delhi 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 Punjab National Bank, New Delhi, 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/her 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/ Head of institution 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/ Head of institution reserves the right to cancel the order at the supplier's risk and cost.
6. In case the supplier backs out of his contract, his 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 placement of this supply order.
8. The bill in triplicate may be sent to the Registrar/ Head of institution, Indira Gandhi National Open University, New Delhi, 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 Sales 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 Delhi.
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/Asstt. Registrar/ Head of Institution

C.C.: Finance & Accounts Div.
Indentor
PS to VC
MF

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

5.3.4 Activity 4: Processing of Bill for Payment

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

Passed for payment for Rs. -----,
Entered in Stock/Inventory Register,
Page No. -----.

Signature of the Lab Assistant

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

EXERCISE 6

STOCK VERIFICATION AND MAINTENANCE OF APPARATUS

Structure

- | | | | |
|-----|--|-----|---|
| 6.1 | Introduction | 6.5 | Activity 3: Preparation of a List of Missing/Surplus/Non-Functional Items |
| | Expected Learning Outcomes | | Report |
| 6.2 | Requirements | | |
| 6.3 | Activity 1: Verification of Stock Register | 6.6 | Activity 4: Maintenance of Apparatus |
| | Procedure | | Procedure |
| | Report | | Report |
| 6.4 | Activity 2: Verification of Stock Items | | |
| | Procedure | | |
| | Report | | |

6.1 INTRODUCTION

In CLT-101 course you have already read about the requirements of laboratories. You also know that these requirements are of 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 laboratory items should be entered into the register meant for this purpose. You have already studied about such registers i.e., inventory register/stock register in Unit 5 of CLT-101 course on “**Good Laboratory Practices**”.

In the previous exercises you have also learnt how to make purchases for laboratory requirements and make entries in the stock register. In the present exercises you will perform various activities regarding study of stock register and physical verification of the articles present in the laboratory as recorded in the stock registers. You will also involve yourself in preparing the list of missing or the excess items and writing to the dealers about servicing and maintenance of the apparatuses that are in use in the laboratory. All the four Activities of this Exercise are to be performed at the individual level at the Study Centre.

Expected Learning Outcomes

After completing this exercise, you should be able to:

- ❖ check the stock register;
- ❖ verify the physical presence of articles present in the laboratory 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 Instructions

You should go through Unit 5 of CLT-101 course before doing this exercise. This exercise is a mix of demonstration and hands on experience. Take the help of your counselor in case you do not understand any aspect of stock register and stock verifications. Before you actually switch on to doing this exercise go through the text of this exercise thoroughly.

6.2 REQUIREMENTS

1. Stock register of a Science laboratory
2. Loose paper sheets
3. Pen
4. Pencil
5. 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 are documented. The first activity regarding stock register is a demonstration activity. Your counselor will discuss the various components of stock register in your group.

6.3.1 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 laboratory 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 CLT-101 course, 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.

6.3.2 Report

Fill the details of the articles in the stock register and the stock book as given below and match the list of articles on index page(s) with the respective sequence pages. The report should be shown to the counsellor.

Stock Register

Name of Articles _____

Month & Date	Particulars	Voucher or Invoice No.	Receipt	Issued	Balance in Stock	Remarks

Stock Book

Articles _____

Month & Date	Particulars	Receipt			Issued Quantity	Balance Stock	Remarks
		Quantity	Rate	Amount			

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.

6.4.1 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 upto 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 1. 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 1.

6.4.2 Report

Make the entries in the following table as Report 1.

Report 1

S. No	Name of the 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 laboratory/store and see whether it is physically present in the laboratory or not. If it is present, check whether the specifications and information given about the autoclave available in the laboratory. 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 the 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/

instrument(s) that has become non-functional, beyond repair or obsolete needs to be disposed off or write 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 1. check the details of the status of these items from the laboratory/store and write the information in the table given under Report 2. Show this report to your counsellor.

6.5.1 Report

Make the entries in the following table as Report 2.

Report 2

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 laboratory items such as apparatus/instrument(s) is a essential 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.

6.6.1 Procedure

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 period 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. 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 the required intervals for servicing/repair of that instrument. A record of the contract and the servicing of the instrument(s) is maintained in the laboratory. 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 done successfully 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.

6.6.2 Report

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/manufacturer will be provided to you by your counsellor. All the students in your group are supposed to write individual letters.

To,

Date

M/s

.....

.....

.....

Subject:

.....

Dear Sir,

.....
.....
.....
.....
.....
.....

Thanking you,

Yours faithfully,

.....
(Lab-in-charge)

EXPERIMENT 7

BASIC ASPECTS OF ELECTRICAL MAINTENANCE

Structure

7.1	Introduction Expected Learning Outcomes	7.3	Activity 2: Wiring a Plug to an Appliance Requirements Procedure Report
7.2	Activity 1: To Calculate Current Drawn by the Given Appliances and Suggest Proper Fuse Rating and Plug Type Requirements Procedure Report		

7.1 INTRODUCTION

You have studied about the hazards of electricity in Unit 8 of Block 3 of CLT -101 course. 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-under-rated), or a problem with the earthing of the equipment. You would have appreciated that through proper electrical maintenance/safe conduct, the mishaps due to electrical equipment can be minimized.

In this experiment 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 and suggesting proper procedures for wiring a plug.

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.

Expected Learning Outcomes

After performing the activities of this experiment, you will 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; and
- ❖ write the report of the activities done.

Useful Instructions

You are advised to give a reading to Unit 8 of CLT -101 course before taking up this experiment.

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

In Subsection 8.2.2 of Unit 8 of Block 3 of CLT -101 course, 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 laboratory

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 atleast 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 now 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 in the course of doing it, you might pick up some important tips.

7.3.1 Requirements

Screw driver – 1

Wire stripper – 1

6 / 16 A Plug – 1

Electrical appliance (any, without plug) – 1

7.3.2 Procedure

- Unscrew the plug top with the help of a screw driver. Remove one of the screws on the wire clamp and loosen the other.
- Cut away about 5 cm 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 8, subsection 8.2.1, that the green, red and black wires are to be attached to the earth, live and neutral terminal, 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 within 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 screw driver.
- Draw a diagram showing the connections you have made. You may use colour pencils to make 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.

SUPPLY OF GAS, ELECTRICITY AND WATER IN A LABORATORY

Structure

8.1	Introduction	For Electricity Supply
	Expected Learning Outcomes	For Water Supply
8.2	Procedure	8.3 Report
	For Gas Supply	

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 8 of CLT-101 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 laboratory. This necessarily means that one must know the respective control points. In fact, this exercise is intended to familiarize you regarding the source and the control points of all these essential services.

Expected Learning Outcomes

After completing this experiment, you will be able to:

- ❖ locate the source and control points of gas/electricity/water supply in the laboratory you have visited;
- ❖ describe the distribution of these services in the laboratory;
- ❖ state the measures to be taken in case of emergency situations concerning their supply; and
- ❖ write the report of the activities done.

Useful Instructions

1. You may perform this exercise preferably in a Chemistry laboratory.
2. This exercise can be performed in a group of 3-4 students.
3. You may read Unit 2 and Unit 8 of CLT-101 course before taking up this experiment.

8.2 PROCEDURE

The procedures for familiarizing with the supply of Gas, Electricity and water in the laboratory are given in the following subsections. You have to follow the procedures and report to the counsellor.

8.2.1 For Gas Supply

- Visit the LPG gas store room plant along with your counsellor or the laboratory incharge and note the way supply of gas is regulated. It may not be obvious; have discussion with counsellor.
- Note the provisions for ventilation. Why do we need ventilation?
- Follow the supply line into the laboratory, note the colour of the pipeline.
- In the laboratory, 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.

8.2.2 For Electricity Supply

- Locate the mains for electricity supply along with your counsellor or laboratory incharge.
- Follow the route of supply through wires to the laboratory 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.

8.2.3 For Water Supply

- Locate the main water supply pipeline 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 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 laboratory.

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

8.3 REPORT

In **Part A**, the outline, the diagram and the layout to be given as part of the report can be presented in the spaces given below or in your laboratory notebook and should be shown to the counsellor. In **Part B** the status of

supply of essential services should be reported and in Part C answers to the situations given can be given in the spaces provided in your notebook

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 working 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 laboratory. | 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 |

A brief report in the light of the above may be prepared and be submitted to the counsellor.

C

- i) If on opening the laboratory, it is observed that the laboratory 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 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.



FIRE SAFETY MEASURES IN A LABORATORY

Structure

9.1	Introduction	9.3	Activity 2: To Learn the Use of a Carbon Dioxide Fire Extinguisher
	Expected Learning Outcomes		Requirements
9.2	Activity 1: To Survey a Laboratory for its Fire Preparedness		Procedure
	Procedure		Report
	Report		

9.1 INTRODUCTION

In Unit 9 of CLT-101 course you have studied about the fire hazards, various causes of fires and the precautions to be taken to avoid them. You also learn 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 minimizing the hazards. We have discussed these aspects in Unit 9 and Unit 10. 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 experiment, you will be doing two activities related to the safety measures. In the first activity you are going to survey the laboratories for their fire preparedness i.e., how well the laboratories 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.

Expected Learning Outcomes

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

- ❖ enlist all the fire extinguishers available in the laboratories and relate them to the type of fire they can be used for;
- ❖ locate the fire alarm in the laboratory/institution;
- ❖ handle/use a carbon dioxide fire extinguisher; and
- ❖ write the report of the activities done.

Useful Instructions

1. You are advised to read Unit 9 of CLT-101 course again before you take up this experiment.
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.

9.2 ACTIVITY 1: TO SURVEY A LABORATORY FOR ITS FIRE PREPAREDNESS

As said earlier in this activity you are going to survey the laboratories 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 9. You may follow the procedure given below and prepare a report.

9.2.1 Procedure

You can take note of the following and enter in Table 9.1 accordingly.

- Look for different type of extinguisher available in the laboratory.
- 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.

Table 9.1 gives the details regarding fire extinguishers in the laboratory.

Table 9.1: Details of fire extinguishers in the laboratory

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

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

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

9.2.2 Report

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

- | | |
|--|--------|
| 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 laboratory. | Yes/No |

9.3 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 laboratories 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 counselor 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.

9.3.1 Requirements

Carbon dioxide fire extinguisher.

Flammable liquid like petrol, alcohol etc. or some old newspaper pages or dried leaves/straw.

9.3.2 Procedure

- A mock fire may be created by spilling a flammable liquid like alcohol, petrol etc. or some rough papers, straw, dried leaves or wood pieces 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 9.4.2 of Unit 9.
- The fire is driven towards the far edge until all the flames are extinguished.
- The extinguisher is closed and replaced on the wall.

9.3.3 Report

A brief description of the demonstration exercise is given below.

.....

.....

.....

.....

.....

.....

EXPERIMENT 10

CLASSIFICATION AND HANDLING OF HAZARDOUS CHEMICALS

Structure

10.1 Introduction	10.3 Activity 2: To Learn the Handling of Hazardous Chemicals: Use of Fume Cupboard
Expected Learning Outcomes	Requirements
10.2 Activity 1: To Classify Hazardous Chemicals Based on the Information Given on the Labels	Procedure
Requirements	Report
Procedure	
Report	

10.1 INTRODUCTION

You have studied about chemical hazards in Unit 10 of Block 3 of CLT-101 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 cupboard is an important for everybody working in the laboratory. Fume cupboard is an important component of a Chemistry laboratory. A knowledge about when and how to use a fume cupboard is also important for a laboratory worker. This experiment has been designed keeping these objectives in mind. It consists of two activities. The first activity is a familiarisation 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 counselor would demonstrate how fume cupboard is useful in handling of hazardous chemicals and their reactions.

Expected Learning Outcomes

After completing this experiment, 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,
- ❖ describe a fume cupboard and its use in the laboratory, and
- ❖ write the report of the activities done.

Useful Instructions

You are advised to read Subsection 10.3.2 of Unit 10 of CLT -101 course before you take up this experiment.

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

10.2.1 Requirements

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

10.2.2 Procedure

For this activity, your counselor will provide you with around 20 bottles of different chemicals.

- Take any two bottles at a times 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 information obtained in Table 10.1 given in subsection 10.2.3. An example has been given to guide you for the same. You will have to record in the similar fashion for at least ten bottles of chemicals.

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

10.2.3 Report

Table 10.1: Classification of the hazardous chemicals on the basis of information given in the label

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. 10.3.1 of Unit 10 of CLT-101 course and see that a given chemical may belong to more than one type of hazard class.

Note: What do you observe? Do you realize 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.

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

You have read in Unit 10 and Unit 3 of CLT-101 course 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 counselor will demonstrate some chemical reaction showing the use and significance of fume cupboard.

10.3.1 Requirements

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

Fume cupboard.

10.3.2 Procedure

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

10.3.3 Report

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



EXPERIMENT 11

DISPOSAL OF UNSERVICEABLE AND OBSOLETE ITEMS

Structure

11.1 Introduction	11.3 Procedure
Expected Learning Outcomes	11.4 Report
11.2 Requirements	

11.1 INTRODUCTION

In Unit 11 of the CLT-101 course you have learnt about unserviceable and obsolete items in a laboratory. These occupy space and sometimes may act as a hindrance for the free movement in the laboratory. These may also be the cause of some accidents in the laboratory. Therefore, these need to be disposed of routinely. This experiment illustrates the procedure generally followed for 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 experiment, which involves role-playing by three of you and the Counsellor. You would be performing two activities in this experiment. In the first activity you would work as a member of a group, and prepare a report on the disposal of any three unserviceable / obsolete items in a laboratory. In the second activity you would work individually and carry out the entry in the dummy stock register pertaining to the disposal of any one of the items identified in the first activity.

Expected Learning Outcomes

After going through the contents of this experiment and performing the given activities, you should be able to:

- ❖ explain the steps undertaken for the disposal of unserviceable and obsolete items in a laboratory;
- ❖ prepare a report on unserviceable and obsolete items to be disposed of in a laboratory, indicating the reserve price in each case; and
- ❖ make entries pertaining to the disposal of unserviceable and obsolete items in a stock register.

11.2 REQUIREMENTS

Stock/Inventory registers

11.3 PROCEDURE

As mentioned in the introduction, in this experiment you are going to perform two activities. The procedures of these are as given below:

Activity 1: Preparing a list of unserviceable and obsolete items to be disposed of in a laboratory

- I. In this activity your Counsellor would act as the Head of the Institution and would choose three of you and form a **Survey Committee** as follows:
 - One of you would be chosen as the as Head of the Department and act as the Convenor of the committee
 - Another student would act as the Administrative Officer / Finance Officer of the Institution
 - The third student would act as the expert having knowledge about the cost of the laboratory articles
- II. You and the other two members of the survey committee would visit either Chemistry or Physics or Botany or Zoology laboratory and give recommendations regarding any three items from the lab to be disposed of. The format of recording the recommendations of the Committee is given below in Part I of the report in Sec. 11.4.
- III. The Convenor of the Committee shall submit the report to the Head of the Institution (i.e., the Counsellor).
- IV. The Head of the Institution would give his / her approval (in the report itself) suggesting the mode of disposal as
 - a) 'sale' or 'open auction' or
 - b) 'to be written off'

Activity 2: Making entries pertaining to the disposal of unserviceable and obsolete items in a stock register

- I. Assume that the required steps have been taken for disposal of the unserviceable and obsolete items identified in the first activity and the items have been disposed of.
- II. You are required to make entry in the stock register / inventory register regarding the disposal of one of the items. This entry helps in arriving at the final stock balance for the same.
- III. An extract of the page of the stock register is given as a table in Part II of Section 11.4, and the instructions for making the entries are given along with that. **Each one of you would make relevant entry in this table, as explained, for any one item supposedly disposed of.**

11.4 REPORT

There are two parts of the report pertaining to the two activities. The formats of these are given as under.

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. (Tick the relevant laboratory)

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

(Fill in the names of the students acting as the members of the committee)

The following is the list of items recommended for disposal.

Sl. No.	Name of the item	Name of the stock register and page number	Original cost price	Reserve price	Reason for disposal
		(a)	(b)	(c)	(d)
1.					
2.					
3.					

Date

Signature of the members
of the Committee

Signature of the Convenor
of the Committee

Remarks of the Head of the Institution

Signature of the Head of the
Institute (Counsellor) with date

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

Reserve price [column (c)] is the minimum price at which the item may be sold. The committee has to use its judgment or imagination in fixing reserve price. The following guidelines would be useful.

- 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 of the item. The scrap value is the approximate price based on the usable constituents of an item 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.

The reason for disposal [column (d)] may be given as:

‘unserviceable’ or

‘non-functional and of no commercial value’

Part II: Making entry in the extract of the relevant page of the Stock Register

Name of the item disposed of:

Name of the stock register:

Page No.:

I	II	III			IV	V	VI
Date	Particulars	Receipt			Quantity issued	Stock balance	Remarks
		Quantity	Rate	Amount			
		---	---	---			
		---	---	---			

Note: While filling up the details in the extract of the stock register given above, follow the guidelines given below:

- Enter date in column I
- In column II under particulars give details of the items disposed of as
Disposal of (give number).....(give name of the item)
through sale / open auction as per the approval of the Head of the
Institution dated.”
or
“Written off (give number).....(give name of the item)
as per approval of the Head of the Institution dated”
- The columns III on ‘receipt’ is to be left blank
- The column IV on ‘Quantity issued’ is filled up as per number of the particular item disposed of or written off.
- The present stock balance in column V is arrived at by subtracting the number of the particular item disposed of from the stock balance shown in the previous entry. (In the row above the entry)
- In column VI on remarks make the following entry (using your imagination to fill in the blanks) in case of sale or open auction,
“The amount of Rs. (Rupees) collected
towards sale / open auction was deposited to the office of the institution on
..... (date) wide receipt number.....”

EXPERIMENT 12

SAFE DISPOSAL OF LABORATORY WASTE

Structure

12.1 Introduction	Demonstration 6: Changing the Nature of the Spilled Chemical that is Fairly Reactive with Water.
Expected Learning Outcomes	
12.2 Requirements	
12.3 Procedure	Demonstration 7: Treating Organic Bases which are Immiscible with Water
Demonstration 1: Miscibility in Water	
Demonstration 2: Solubility in Water	12.4 To Identify Suitable Disposal Method for Given Chemical Wastes and to State the Underlying Principles
Demonstration 3: Volatility of Solvents	
Demonstration 4: Emulsification	
Demonstration 5: Changing the Nature of the Spilled Chemical that Reacts Violently with Water	12.5 Report

12.1 INTRODUCTION

In section 11.4 of the Unit 11 of CLT-101 course, you have learnt about the causes of generation of chemical waste in the laboratory and also about the importance of its safe disposal. You would recall that all chemicals are considered to be harmful. If these are not disposed of properly, these may pose a risk to the safety of the laboratory workers. You have also learnt in detail the methods of disposal of different types of chemical wastes. The disposal method depends on the nature of the chemical waste.

In this experiment, your counsellor would perform a number of demonstrations that form the basis for the disposal of some common laboratory chemicals. Your Counsellor would explain the principle behind each demonstration and also relate the demonstrations with the disposal method of the chemicals involved. You would be required to carefully observe these demonstrations, learn the underlying principles and the relationship between the nature of the chemicals involved and their disposal method.

Your counsellor would then allocate five simple chemicals for which you would have to identify the disposal method and to state the underlying principle. You are advised to revisit subsec. 11.4.2 of Unit 11 of CLT-101 course before attempting this experiment.

Expected Learning Outcomes

After going through the contents of this experiment and performing the suggested activity, you should be able to:

- ❖ state the need for understanding the characteristics of a chemical waste before disposing of the same in garbage or in drainage;
- ❖ list different methods of disposal of chemical waste and state the principle behind each one of them;
- ❖ identify the suitable method for disposal of a given chemical waste; and
- ❖ state the principle behind the identified waste disposal method.

12.2 REQUIREMENTS

Chemicals		Apparatus	
Acetone (or ethyl methyl ketone)	1 cm ³	Test tubes	10
Vegetable Oil	2 cm ³	Watch glasses	3
Sodium hydroxide (or potassium hydroxide)	1 pellet	Beakers (100 cm ³)	5
Diethyl ether	1 cm ³	China dish	1
Ethyl acetate (or hexane or carbon tetrachloride)	1 cm ³	Wire gauze	1
Toluene (or benzene or chloroform)	1 cm ³	Pair of tongs	1
Soap or detergent solution	10 cm ³		
Sodium metal	5 small pieces		
Ethanol (or propan-2-ol)	50 cm ³		
Concentrated sulphuric acid	2 cm ³		
Sodium carbonate	40 g		
Calcium carbonate	1 g		
Calcium oxide (freshly heated and cooled lime stone is preferable)	2 g		
Aniline	5 cm ³		
2 M Hydrochloride acid	10 cm ³		

12.3 PROCEDURE

As mentioned in the introduction, in this experiment your Counsellor will perform certain demonstration experiments related to the disposal of

chemical wastes and explain the underlying principle. The procedures for the demonstration activities are as under:

12.3.1 Demonstration 1: Miscibility in Water

- Take about 1 cm³ of water each in two test tubes.
- Add one drop of vegetable oil to one of the test tubes and 2-3 drops of acetone in the other.
- Shake the test tubes vigorously to mix the contents, keep for about two minutes and observe.

You would observe that the test tube containing oil and water has two layers of the liquid whereas water and acetone mixture gives a single layer. This demonstrates that while **acetone and water are miscible the oil and water are immiscible**.

12.3.2 Demonstration 2: Solubility in Water

- Take about 2 cm³ of water each in two test tubes.
- Add a few crystals of Na₂CO₃ to one of the test tubes and a few crystals of CaCO₃ in the other.
- Shake the test tubes to mix the contents, and observe.

You would observe that the test tube containing water and Na₂CO₃ has a clear solution whereas the other test tube has the crystals of CaCO₃ lying at the bottom of the test tube. This indicates that while sodium carbonate is soluble in water, calcium carbonate is insoluble in water.

These two demonstrations (1 and 2) form the basis of the common disposal method, namely, **mopping with plenty of water and running it into the drainage**.

- ❖ The chemical wastes that are miscible with or soluble in water may be allowed to run into the drainage with plenty of water. The common chemicals that can be disposed of using this method are: acetone, methanol, ethanol, dioxin, acetic acid, ethyl methyl ketone, ammonia solution, hydrogen peroxide, oxalic acid, dimethyl sulphoxide, hydroquinone, p-benzoquinone, ammonium sulphide, potassium hydroxide and sodium hydroxide.

12.3.3 Demonstration 3: Volatility of Solvents

- Take three small watch glasses and label them as 1, 2 and 3
- Add 2 drops of diethyl ether on the watch glass number 1, 2 drops of ethyl acetate on the watch glass number 2 and 2 drops of vegetable oil on the watch glass labeled as 3.
- Keep the watch glasses in open and wait for about 2-3 minutes and observe.

You would observe that all the ether has disappeared from the first watch glass, the ethyl acetate on watch glass number 2 has decreased in volume whereas the volume of vegetable oil on watch glass number 3 is not changed much. We can draw the following conclusions from these observations.

- a) Diethyl ether and ethyl acetate are volatile whereas vegetable oil is not.
- b) Diethyl ether is more volatile than ethyl acetate.

This demonstration forms the basis for two of the disposal methods, namely, **providing effective ventilation** and **transferring the waste to open for evaporation**

- ❖ Highly volatile liquid wastes like diethyl ether could be disposed of by providing effective ventilation in the laboratory. On the other hand moderately volatile liquid wastes like ethyl acetate, hexane, petroleum ether, amyl alcohol, carbon disulphide and carbon tetrachloride can be disposed of by absorbing them on sand and leaving for evaporation in an open area.

12.3.4 Demonstration 4: Emulsification

- Take about 2 cm³ of distilled water in a test tube and add 2 drops of toluene to it.
- Shake the test tube vigorously and keep it undisturbed till the droplets of toluene in water separate as a layer.
- Add a few drops of soap or detergent solution to the test tube and shake again and observe.

You would observe that when toluene and water are mixed they form two layers indicating that these are not miscible. However when we add a solution of soap or a detergent to it and shake well, the toluene gets dispersed into water as tiny droplets. Such a dispersion of a liquid in another liquid is termed as **emulsification**. This phenomenon of emulsification is behind the disposal method, “**emulsifying the spilled chemical**”. In this method the spilled liquid is scrubbed with brush in presence of soap or detergent solution. The emulsion so formed is run into the drainage with plenty of water.

- ❖ Some examples of the common chemicals that can be disposed of by this method are benzene, toluene, cyclohexane, nitrobenzene, carbon disulphide, cresols, chlorobenzene and chloroform.

You would have noticed by now that most of the methods used for disposing of the chemical waste employ water. However, there are a number of chemical substances that may react with water either vigorously or strongly. In such cases we need to alter the nature of waste material so that the reaction of the chemical with water is not violent and we can use water in its disposal. The next two demonstrations are designed to achieve this objective

12.3.5 Demonstration 5: Changing the Nature of the Spilled Chemical that Reacts Violently with Water

- Take about 20 cm³ of water in a china dish and keep the dish in the washbasin.
- Take a tiny piece of sodium metal, press and wipe it dry with the help of a filter paper.
- Pick up the piece of sodium metal with the help of pair of tongs, put it into the water taken in the china dish and immediately cover it with a wire gauze and observe.

You would observe a violent reaction between water and sodium that may be accompanied by fire

- Now take about 5 cm³ of commercial sample of ethanol in another china dish, add a drop of water to it and mix.
- Take a tiny piece of sodium metal, press and wipe it dry with the help of a filter paper.
- Pick up the piece of sodium metal with the help of pair of tongs, put it into the ethanol taken in the china dish, stir it with a glass rod and observe.

You would observe that the sodium metal reacts gently with ethanol accompanied with the evolution of hydrogen gas (observed as bubbles) and

dissolves. You may also observe a little bit of violent reaction between sodium metal and the traces of water in the sample of ethanol.

- Again take about 5 cm³ of the sample of commercial ethanol in a china dish and add about 1 g of anhydrous sodium carbonate to it
- Take a tiny piece of sodium metal, press and wipe it dry with the help of a filter paper
- Pick up the piece of sodium metal with the help of pair of tongs, put it into the china dish, stir it with a glass rod and observe.

You would observe that the sodium metal reacts gently with ethanol accompanied with the evolution of hydrogen gas (observed as bubbles). However, there is no violent reaction this time. This is because the anhydrous sodium carbonate absorbs the traces of water, if any, in ethanol. The reaction of sodium with ethanol gives a solution of sodium ethoxide that mixes easily with water. It can be diluted with water and disposed of in drain. Thus,

- ❖ *The substances like sodium metal, 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.*

12.3.6 Demonstration 6: Changing the Nature of the Spilled Chemical that is Fairly Reactive with Water

- Take about 2 g of calcium oxide (crush it if it is a lump) in a small china dish and add about 20 cm³ of water to it.
- Stir with a glass rod and observe. Keep a safe distance from the reaction mixture and do not touch the china dish as it would be very hot and can cause burns.

You will observe that CaO and water react fairly strongly accompanied by bubbles and smoke. Further, as a large amount of heat is released in the reaction the reaction mixture becomes very hot. Once cooled the products of the reaction can be disposed of in drain. Thus,

- ❖ *Those substances, which generate large amount of heat on mixing with water, are treated carefully with large quantity of water in a safe area and then disposed of into the drain e.g., calcium oxide.*

In many cases the chemical waste generated in the laboratory is highly acidic or alkaline and it is not advisable to allow highly alkaline or highly acidic waste to be put in the drainage system. Therefore, we need to learn managing the chemical waste that is highly acidic or alkaline. We take the example of an organic base, aniline.

12.3.7 Demonstration 7: Treating Organic Bases which are Immiscible with Water

- Take about 1 cm³ of water in a test tube and add 2-3 drops of aniline to it; shake vigorously and leave till you get two layers indicating immiscibility of aniline and water
- Now add a few drops of dilute hydrochloric acid; shake again and leave for some time.

You would observe that you get a clear solution now. This is due to the formation of a salt by reaction between aniline and hydrochloric acid. This salt can be safely sent to the drain with water. The demonstrations 6-8 form the basis for the waste disposal method, “**Changing the nature of the spilled chemical**”.

Having observed the demonstrations and their relationship with the methods of disposal of chemical waste you can perform the following activity.

12.4 TO IDENTIFY SUITABLE DISPOSAL METHOD FOR GIVEN CHEMICAL WASTES AND TO STATE THE UNDERLYING PRINCIPLES

Your counselor would allocate five chemicals to be considered as having got spilled in the laboratory and need to be disposed of. On the basis of what you have learnt from the demonstrations and the contents of Unit 11 of CLT-101 course identify suitable disposal method for them and state the underlying principle. You would write your responses as per the Table given in Sec. 12.5.

12.5 REPORT

The chosen method for safe disposal for the allocated chemical wastes and the principle behind them are given in the following table.

S. No.	Name of the Chemical Waste	Suitable Disposal Method	The Underlying Principle
	Acetone	Providing effective ventilation	Volatility of the chemical waste
1			
2			
3			
4			
5			

(You are required to list in the second column the chemical wastes allocated to you by your counselor and then fill the other columns. The entry on acetone is given as an example.)

EXPERIMENT 13

ATTENDING TO EMERGENCY SITUATIONS

Structure

- | | |
|----------------------------|----------------|
| 13.1 Introduction | 13.3 Procedure |
| Expected Learning Outcomes | 13.4 Report |
| 13.2 Requirements | |

13.1 INTRODUCTION

In the Unit 12 of the CLT-101 course you have learnt about the possible accidents in a Science laboratory and the preparedness required to deal with them. It is wise to identify the causes for the possible accidents in the laboratory and to take suitable preventive measures. However, the accidents can still happen and we need to deal with them. You would agree that in such times of anxiety and tension, it becomes difficult to plan and execute remedial measures. It is therefore, necessary that we should be prepared beforehand to handle such a situation. In this experiment we will try to put the learning from Unit 12 of CLT-101 course to use and prepare a plan for follow up actions at least for the accidents which are likely to occur. This experiment contains five activities requiring your participation at the individual level for some and as a group for others as shown below:

- **At the individual level, you will**
 - I. Prepare a list of important contact phone / mobile numbers to be used during emergency time,
 - II. Assemble an improvised first aid box, and
 - III. Prepare a report for an imaginary accident.
- **As a member of a group, you will**
 - I. Prepare charts indicating first aid procedures for assigned type of laboratory accidents, and
 - II. Attend a session in which your Counsellor will arrange for demonstration of some first aid procedures.

It would be advisable to have a relook at the Unit 12 of the CLT-101 course before attempting the activities in this experiment.

Expected Learning Outcomes

After going through the contents of this experiment and performing the activities given here, you should be able to:

- ❖ prepare a list of contact phone / mobile 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 imaginary laboratory accident

13.2 REQUIREMENTS

In order to perform the activities designed in this experiment, you would need certain material (as given in Table 1) that you would need to bring with you. You would use these materials in making a first aid kit, which you would take home for personal use.

Table 1: Materials that must be brought by each student

	Item	Quantity
i)	For preparation of charts	
	Chart papers of different colours, if possible	3
	Green coloured wrapping paper	1
ii)	For assembling improvised first aid box	
	Thoroughly washed and sun-dried thin cloth (from old saree or lungi or muslin cloth)	1½ m
	Thoroughly washed thick cloth (Khadi type)	1 m
	Cotton roll (small size)	1
	Half ounce packet of sterilized cotton wool	1
	Safety pins (assorted, rust proof)	3
	Sticks (from fresh broom)	3
	Burnol tube (small)	1
	Dettol / Savlon bottle (small)	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" × 12" × 6"	1

In addition, the study centre must have a first aid box with contents outlined in Table 2.

Table 2: Materials that must be available at the Study Centre as part of first aid box

Item	Quantity
Individually wrapped sterile adhesive dressing (assorted)	5
Cotton roll	1
Half ounce packets of sterilized 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 un-medicated wound dressings of sizes:	
Medium (10 cm × 8 cm)	2
Large (13 cm × 9 cm)	2
Extra large (28 cm × 17.5 cm)	2
Glucose	200 g
Burnol® tube	1
Dettol® / Savlon® bottle	1
Spirit bottle (100 cm ³)	1
Stainless steel spoon (padded) or Tongue depressor	1
Safety pins (assorted, rust proof)	6
Cardboard (8" to 12" and 6" to 8" width)	1
Old newspaper sheets (rolled and held with a rubber band)	6
Scissors (5-inch, blunt pointed)	1
Pen torch	1

* (The counselor should ensure that the first aid box with the contents outlined is available in the laboratory of the Study Centre).

13.3 PROCEDURE

As mentioned in the introduction, you are going to perform five activities in this experiment. The procedures for these are given as under.

Activity 1: Preparation of a List of Emergency Contact (phone/mobile) Numbers

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

Name (s)	Address (es)	Contact Number (s) (Phone /mobile)
Head of the institution		
Head of the Department		
Doctors: (Physicians / Surgeons)		
Nearby 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 dealers		
Police		
Electricity supply agency		
Authorized 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)		

Activity 2: To Assemble an Improvised First Aid Box

You counselor will show you the first aid box available at the Study Centre. You are advised to observe the contents of the First aid box carefully.

As part of this activity, you are required to assemble a 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, scissor and dettol® bottle) which are to be purchased from medical / general merchants shops and
- improvised items (clean dressings, clean cotton pads, bandage rolls of various sizes, padded spoon and swab sticks).

Improvised items: The prepared items prepared by using locally available source materials.

Preparation of Improvised Items

- A) Prepare the following four items from the thoroughly washed and **sun-dried old and thin cloth** (which may be cut from an old saree or lungi or

muslin cloth), of 1½ m length, which you brought with yourself.

- i) **Individually wrapped clean dressings:** 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 newspaper sheets.

- ii) **Clean cotton pads in separate packets:** You are advised to cut one piece each of clean cotton pads of thickness ½" and sizes 1" × 1", 6" × 4" and 6" × 6". Cover each from top and bottom with thin cloth of same size and wrap each with a portion of newspaper sheet.

- iii) **Bandage rolls:** using thin cloth, cut one piece each of size 3' × 1", 3' × 2½", 3' × 3½" and 3' × 5" and roll each of them separately.

- iv) **Padded spoon:** Take a stainless steel spoon and cover it (leaving the handle uncovered) with a clean cotton pad of thickness ½" and size 1" × 1" prepared in (ii) above.

- B) **Swab sticks:** Wash three sticks taken from a fresh broom and break them into a size of about 6" each. Cover each of them with a bud of cotton.

- C) **Triangular bandages:** Take a thoroughly washed piece of thick cloth (such as khadi), of size 38" × 38" and cut it diagonally into two pieces. You would get two pieces of triangular bandages. Fold and keep them to be used later.

Using these materials and, other materials mentioned in Table 2 in Sec. 13.2 of this experiment, assemble the first aid box as per Table 3. Keep these materials in a cardboard box or metal box. Paste a green paper on the top of the box and make a Red Cross mark on it.

Table 3: 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	

The clean dressing, 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.

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"

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

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

Activity 3: Preparation of Guidance Charts for First Aid

Your Counsellor will form groups of 4-5 students each. Using the materials from the sections of Unit 12 of CLT-101 course mentioned in each case below, each group has to prepare the set of guidelines for the first aid concerning two of the following types of accidents in a laboratory on the chart papers (your counsellor will allocate work to each group).

- 1) Chemical burns (Sec. 12.7)
- 2) Slight bleeding (Sec. 12.8)
- 3) Splashes on the eyes (Sub sec. 12.10.3)
- 4) Ingestion of chemicals (Sec. 12.7)
- 5) Thermal burns (Subsec. 12.10.1)
- 6) Shock (Sec. 12.9)
- 7) Electric Shock (Sec. 12.5)
- 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. 12.6).

One example is given below. You may use coloured chart papers and any format of your choice.

Sample guidelines: First aid for Chemical Burns

The procedure is as follows

- 1) Remove contaminated clothes, rings, watches and other ornaments in the affected area
- 2) Drench the affected area with large amounts of running water. Continue for at least five minutes or until you are satisfied that the chemical is no more in contact with the skin. Take care that the washings do not go onto the unaffected portion of the skin. Save yourself also.
- 3) Chemicals known to be insoluble in water can be removed with soap under a running tap.
- 4) In cases where the water supply is limited, it is best to wipe as much as possible of the acid or other corrosive liquid from the skin quickly with clean cloth before using the little water, which is available to wash the affected area.

Avoid using neutralising solutions on acid or alkali spills as these generate heat, and can increase damage.

- 5) If the victim is seriously injured or if the burn was caused by splashes of hydrogen fluoride or other extremely dangerous substances, arrange immediate transportation to the nearest doctor.

Antidotes for some common chemicals that may cause chemical burns are

Bromine	Wash with 2 M ammonia, keep the affected part dipped in sodium bisulphite solution for some time.
Phenol	Apply ethanol or glycol on a cotton wool pad.
Sodium	Apply ethanol on a cotton wool pad.

Activity 4: Demonstration of First Aid Procedures

This is a demonstration activity. Your Counsellor will explain the first aid procedures for common accidents, by demonstrating them. Carefully observe all the steps and try to relate

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

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

As a part of this activity, your counselor will give you the background details of an imaginary case of an accident. Each of you would prepare the report by filling the relevant entries in the proforma given in Sec. 13.4 using the details given by your Counsellor and your imagination.

13.4 REPORT

You are required to submit the following to your Counsellor:

1. The chart containing list of emergency contact phone / mobile 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 following format.

Accident report

1. The date, time and location of the accident

2. A brief description of the accident (In case of ingestion, inhalation or spilling of chemical state the name and concentration of the chemical)

3. A description of the first aid treatment given

S. No	Name, age, sex and address of the victim	Details of any injuries suffered or suspected	Type of first aid given [#]	The name of the person who gave the first aid treatment	A description of any further action taken, e.g. calling a doctor removal to hospital

[#] For each group give the identification name only

4. The name and addresses of witnesses, (if any)

5. Measures taken to control the damage

*

Signature and designation
of the laboratory worker

Date:

To,

(Address of the Head of the Institution)

(* Sign here)

EXPERIMENT 14

USE OF COMPUTERS FOR SCIENCE LABORATORY

Structure

14.1 Introduction	14.3 Procedure
Expected Learning Outcomes	Creating an MS Word Document
14.2 Requirements	Creating an MS Excel Worksheet
	14.4 Activities

14.1 INTRODUCTION

In Unit 7 of the course on Good Laboratory Practices (CLT-101) you learnt about the components of a computer and its overall functions. You were also familiarised with the terminology and basic software that you would require to use a computer in managing the activities in a science laboratory.

In this exercise we will give you step by step instructions on using some of the key features available in MS Word to create and format a Word document and in MS Excel to create an Excel worksheet.

Expected Learning Outcomes

After you have done this experiments you should:

- ❖ become familiar with using, MS Word and MS Excel
- ❖ be able to create, format and save a MS word document related to laboratory work,
- ❖ be able to create and format an Excel worksheet/ file using given data

14.2 REQUIREMENTS

1. Desktop/Laptop with MS Office (Version 7)
2. Printing facility
3. Block 2 of CLT-101

14.3 PROCEDURE

If you are not very familiar with using the computer, it will be useful to practice

using the keyboard and mouse reading the description given below so that you can learn the potential of these two input devices:

Keys on the Keyboard

1. **Enter:** The large key on the right side of the keyboard.
2. **Space key:** The large key at the bottom of the keyboard that makes space between alphabets/words.
3. **ESC:** Means escape key which you press to escape from any control key you have pressed.
4. **Tab:** This makes indents that is, a bigger space than normal space between the margin and text.
5. **Shift:** This key allows you to use capital letters when pressed along with any lower case alphabet key. It is also useful when you want to print punctuation marks or symbols that are given in the top portion of the keys with numbers. For example, if you need the percentage sign then you press Shift and number 5 together.
6. **Cap lock:** if you press this key then a green light appears on the right hand of the key board and all typing that you do will be in capital letters.
7. **Delete:** This is an eraser – it erases or deletes any letter, word, or line or paragraph you decide you don't want anymore. If it is a letter, use the mouse to go to the letter and click on the letter. Then press delete – the letter in front of the cursor will be deleted. Sometimes it is easier and quicker to use the mouse to select a letter or word or line or a paragraph by clicking on the left button of the mouse and dragging it over the whole text you want to delete. This is called HIGHLIGHTING a section and the screen shows this by making the section blue and the typing black. Then press delete and the whole text will disappear
8. **Backspace:** Arrow just above the Enter button which can be used if you want to delete the last letter you have typed.
9. **Arrows:** Use the arrows on the right hand side of the letters on the keyboard to move the cursor (line on the screen showing you the position – where the next letter will be typed) up, down or sideways. You can also use the mouse to do this. If you want to add or delete something, move your cursor to the right place and then either delete or add letters.
10. **Page Up and Page Down:** Take you to the top and bottom of the page you are currently working on.
11. **Home:** If you press this you will get to the first letter of the line you are typing. If you press Ctrl [control] and Home at the same time you will get to the first letter of the first word of your document. This is useful if you have typed a long document and want to make a change in the first paragraph.
12. **End:** Takes you to the end of a line. Ctrl and End at the same time takes you to the very end of the whole document.

Mouse

There are two buttons on the mouse one on the left hand side and the other on the right hand side. In the center is a roller for scrolling the text on the screen

If you click on the left button, it takes the cursor to any place on the screen where you want it to point. Clicking on the right button opens up options for editing and changes in fonts etc., in the document you are working on.

14.3.1 Creating an MS Word Document

Switch on your computer and wait until picture symbols appear with a **Start button** on the bottom left of the screen (Fig.14. 1).

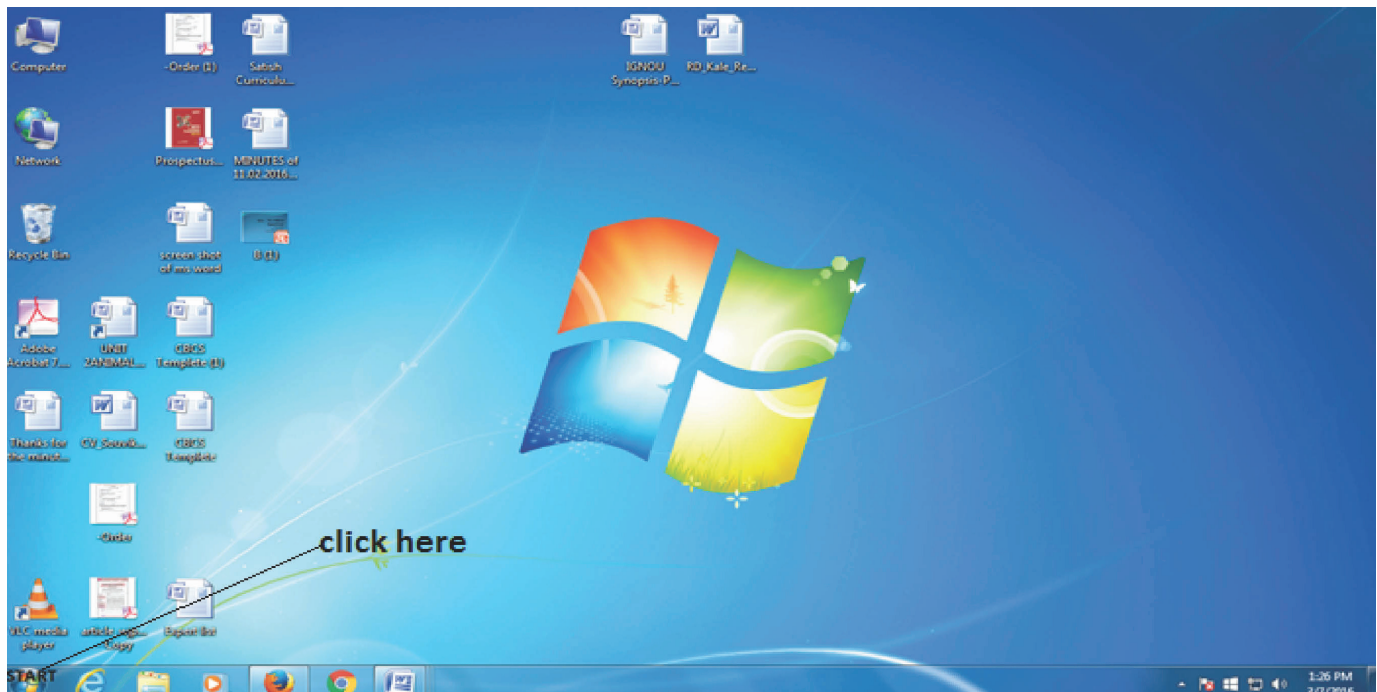


Fig. 14.1: Windows screen.

Use the left button on the mouse to click on the **Start button**. Click on **All Programmes** → **Microsoft Office**, →**Microsoft Word** when that option appears. The Microsoft Word programme will appear on the screen as a blank page called **Document 1**(see Fig.14. 2). Before you begin creating documents you should become familiar with the layout of the screen.

Above the blank screen on the top is the **Title Bar** that has the name of the document displayed. On the right top most corner of the screen are three buttons **Minimise**, **Maximise/Restore** and **Close** (See Figure 14.2).

Below the Title Bar is the **Ribbon**. The Ribbon is divided into 7 **Tabs** like: **Home, Insert, Page layout, References, Mailings, Review and View**. Within each tab is a group of commands arranged for similar functions.

For instance examine Home Tab, it has the following command groups under it:

Home: *Clipboard, Font, Paragraph, Styles, Change styles and Editing*. You should explore the other tabs and see the command groups located under them.

Below the Ribbon is a line that shows your page margins – it is called the **Ruler**.

On the top left hand side is the **Quick Access Tool Bar** with the *Save button*, *Undo and Redo buttons*. For easy access, you can add more icons for commands that you use very frequently

On the top most left corner is the **Microsoft Office Button**.

Clicking on the button brings up a list of options that show all the basic commands that you need to create and work on a document. On the left you can see the commands for opening a new documents, saving, printing and sharing a file. On the right is a list of recently opened documents.

On the bottom of the screen you can see the **Status Bar** that displays the current page number, words etc., of the document. On the right hand side of the status bar is **the Zoom Slider**. Using this slider you can increase or decrease the size of the display on the screen. On the right hand side is also the **Vertical Scroll Bar** that moves the page up or down.

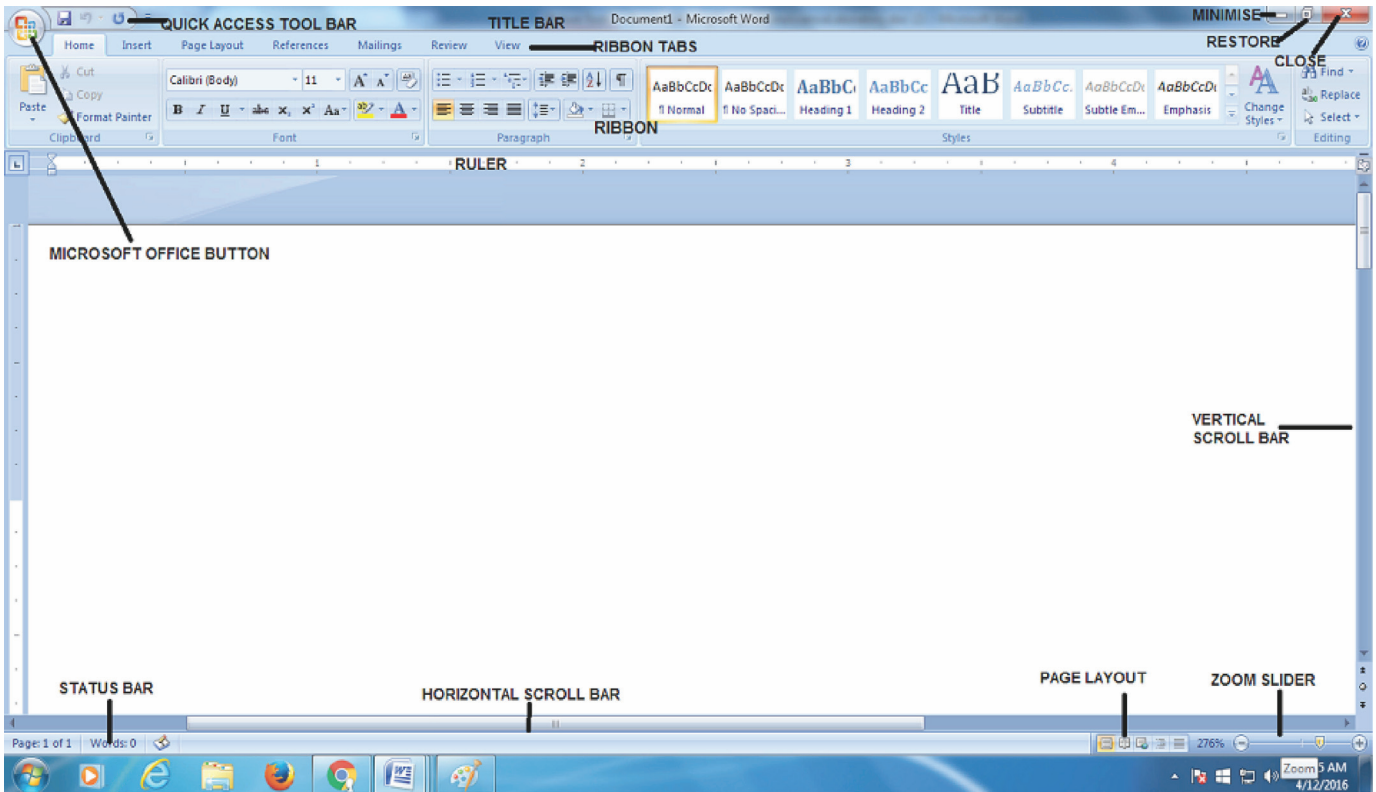


Fig. 14.2: Word document.

Let us start with the basics of working with a text document

Opening a Document

- ➔ Click on the Office Button, a tool box will open.
- ➔ To start a new document click on **New** in the box, you will get the option of a blank document, make sure it is selected and then click on **Create** to open the new document (see Fig. 14.3).

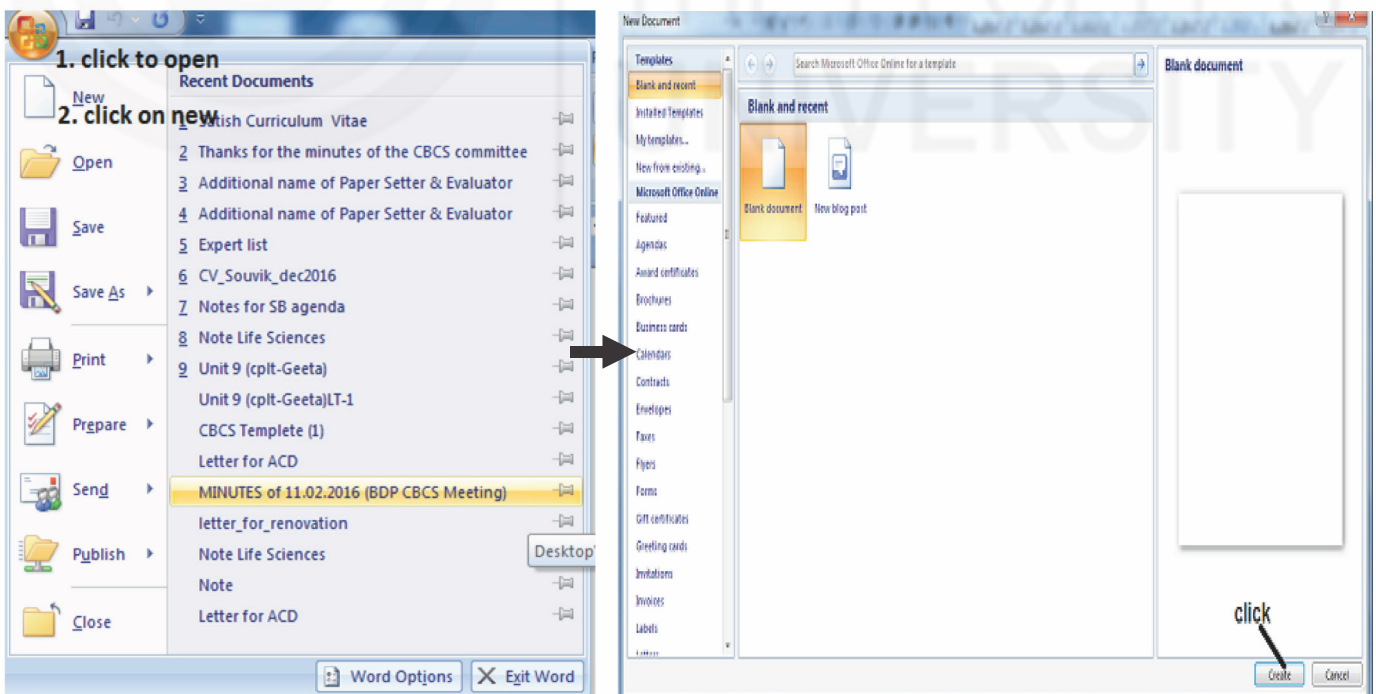


Fig. 14.3: Opening a new document.

- To open a document that already exists, click on Office button and if the document has been recently created it will be listed on the right hand side, if you cannot see it in the list then go to **Open**.
- Click on Open to see the existing documents in the library and other locations in the computer.
- To **insert** text in a new document left-click on the blank word document that is your **insertion point**, Now start typing your text.
- To **delete text** go to the word on the text that you wish to delete, left click to bring the cursor there, on the keyboard press the backspace key to delete on the right of the word and press delete button to delete the text on the left
- To **select text** bring cursor to the text you want to select, pressing the left button on the mouse drag it across the text that is to be selected. Now leave the mouse key and the text will be selected in a blue box.
- To minimize and maximize/restore your documents click on the top right hand corner of the document on the related buttons (see Fig.14.2 again).

Practice Exercise 1

- Open a new document, Type your name, address and telephone number in three separate lines.
- Delete one line of the address using the delete key.
- Delete the second line using the backspace key.

Copy and Paste

- To **copy and paste** text, select the text that you want to copy, go to the clipboard under **Home tab** click on **Copy**.
- Go to the part of text where you want the copied text pasted, click on **Paste** in the clipboard. Alternately you can select text and copy by right clicking to open a shortcut and click on copy; then go to the place where you want to paste it and right click again and click on paste.
- **Cut**: this allows you to delete a section but not to throw it away completely in case you need it later. Use your mouse and drag it over the section you want to delete. Then click Cut. If you want to use the section again you can add it in later or move it to another section
- You use the **Paste** command to move the cut section to a new place. Take your cursor to where you want to place the section. Click Paste and the cut section will be pasted or put in this new place. This is called *Cutting and Pasting*.
- For copy and paste you can use your keyboard instead of the mouse. Copy=Ctrl+C and paste =Ctrl+V.
- Select the text you want, using the left button of the mouse drag the text to another location, the cursor will have a box below it to indicate that the text is being moved, release the cursor. This is known as the **drag and drop** function.

NOTE: Your computer will only keep the last section that you cut or copied. As soon as you cut or copy another section, the first one will be deleted.

Practice Exercise 2

Use any existing document to complete the exercise.

- Open an existing document
- Select a sentence
- Copy and paste it from one location to another,
- Select another sentence
- Drag and drop it at another location in the text
- Select another section cut it and paste at another location in the text.

Saving a Document

- You can save your document by clicking on the save icon in the Quick Access Tool Bar or by clicking on **Save** option in the box that opens when the Office Button is clicked (see Fig.14.3 again). When you save the document for the first time it will be saved under its heading in the general folder called **Documents**. It is very important that you save your file frequently during typing by clicking on the icon of the floppy disc on the Quick Access Tool Bar or you might lose all your work if by any chance the computer shuts down in the middle of your work.
- **Save As** allows you to save a document under a new name in the folder of your choice. When you click on Save As, a new box will open on screen (Fig.14.4). First go to the **Save In square**. It should say **Documents Library** (1). In the block below yellow folders will appear if you have made them earlier OR you can click on new **New Folder** (2) to create an additional folder if you wish to save your document in it. Click on the folder you want to save the document in (3). Click on Open. Then check that you like the name of the document. (4) If you like it press Save (6). If you don't like it delete the file name and type a new name. Then click **Save**.
- If your document is an update of an old document but you want to save it as a new version go to the **Save as type** box under file. Select the version in which you want to save and click **Save**.

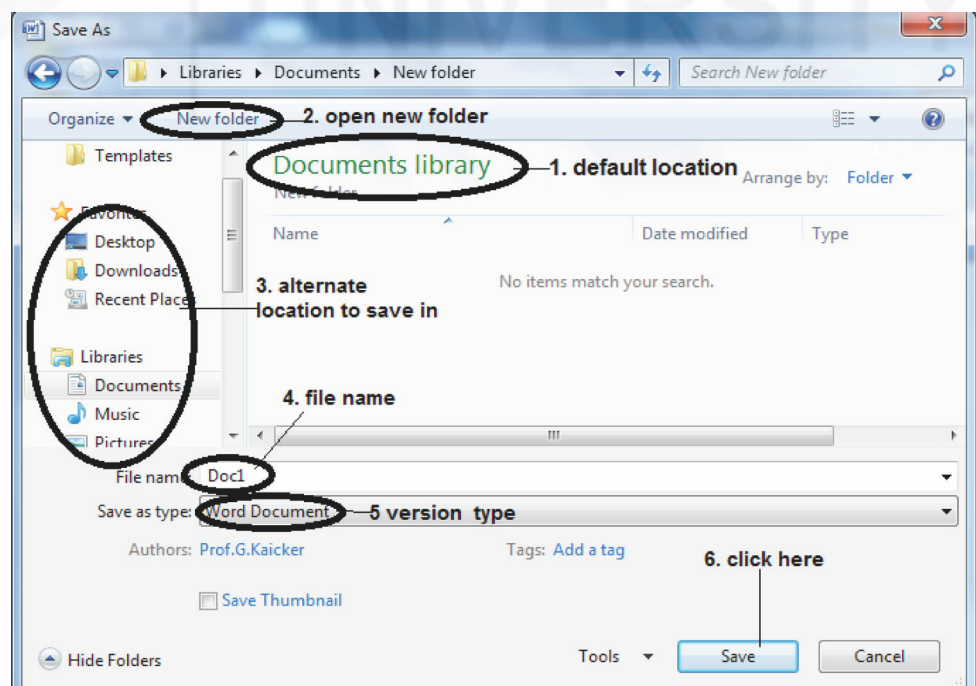


Fig.14.4: Saving a new document

Practice Exercise: 3

- Open a new document type Apples are red and bananas are yellow
- Save the document with the file name Practice
- Choose desktop as the location to save the file
- Open an existing document
- Save the document on desktop under file name Practice2

Proof- Reading your Text

Word also provides tools for correcting text if you make mistakes while typing.

- If there is a spelling or grammar error in the text automatically a coloured wavy line appears under the word. Red line appears under a spelling error; green line appears for a grammatical error and blue for a contextual error (Fig. 14.5)
- Right click on the word that is underlined with red and a spelling suggestion appears; similarly right click on the grammatical error and a suggestion appears for grammar correction. Select the option you want.

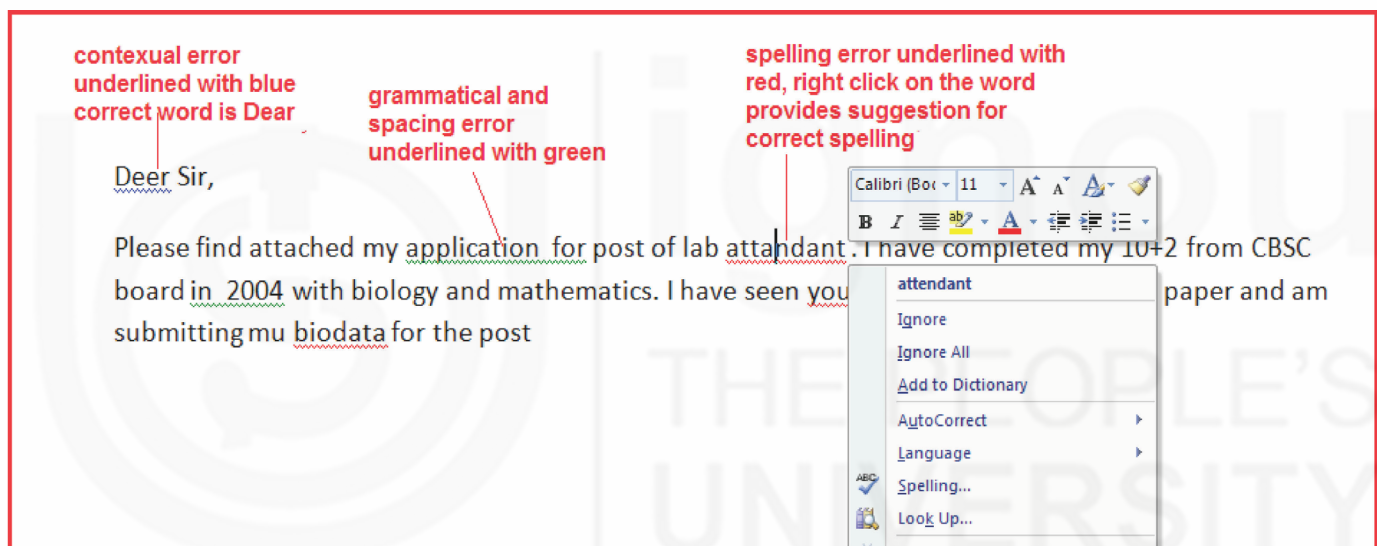


Fig.14.5: Proof reading text

Formatting the Text

To create effective documents you also need to learn how to format your text

Font Style Size and Colour

- To change the font style and size, select the text you want to modify.
- Left click the drop down box of **Font styles** in the Home tab and pick whatever style you want and left click it. Your text will appear in that style (Fig.14.6).
- Similarly move the cursor on the **Font size** dropdown box and select the size. Most documents use size 11 or 12.
- To format font colour go to the dropdown box of **Font colour** in the font group in the Home Tab and pick whatever colour you want, your text will be typed in that colour.

- Select the text you want to change and click on the font colour icon. For a live preview of the colour move the cursor on the different colour options, your text will be changed to that colour. Click to choose the colour you want.

Bold, Italics Underline and Case Change

- To use bold, italics and underline your text , select the text you want to change
- Click on the **B**, *I* or U commands in the font group in Home Tab, the text will be changed suitably.
- To change **case** of the text, select the text.
- Click on **Change Case (Aa)** command in the font group and choose the case option you want and the text will change accordingly.

Text alignment

- To change text alignment, select the text you want to modify
- Select one of the commands from the paragraph group in the Home Tab (see Fig.14.6)
 - (1) align to Left= all text aligned to the left margin ;
 - (2) centre= all text aligned with equal distance to right and left margins
 - (3) align to right= all text aligned to the right margin
 - (4) justify= text aligned with equal right and left margins.

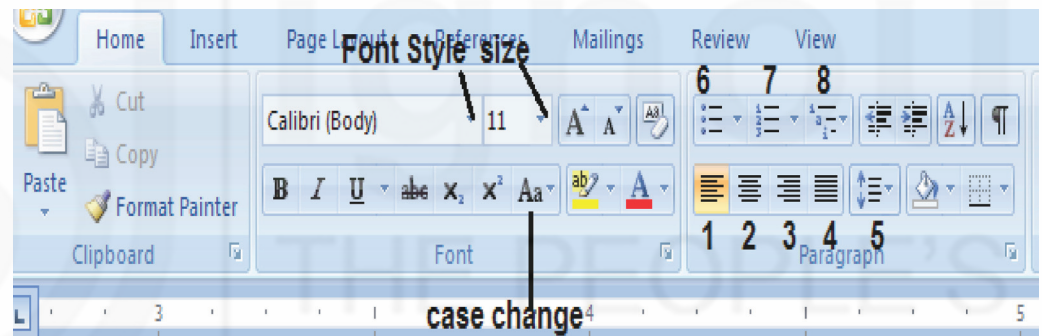


Fig.14.6

Line and Paragraph Spacing

- For modifying line spacing select text that you want to modify (See Fig14.6)
- Click on Modify Line Spacing (number 5 in Fig.14.6) command in paragraph group in Home Tab.
- Select the Line Spacing option you want OR select line spacing option in the dropdown box
- Another dialogue box opens, modify the before and after points to adjust the spacing
- Finally click on OK to apply the changes
- If you want to change the paragraph spacing then choose the **Space Before or After the Paragraph** option in the drop down box.

Bullets and Numbered Lists

- Select the text you want to organize into lists or points
- Click on the **Bullet** (6) or Numbering commands (7 and 8 in Fig.14.6) in the Paragraph group in the Home Tab

- ➔ Click on the style you want, it will appear in your text
- ➔ To remove the bullet or number select the bulleted or numbered list and click on the corresponding command again, the bullets or numbers will be removed.
- ➔ To change the style of the bullets or numbers, select the corresponding command and click on the desired style.

Indent and Margin Settings

- ➔ To modify the default indent settings, select the text.
- ➔ Click on **Page Layout Tab** and go to **Indent** in the **Paragraph** group and change the numbers to the desired level
- ➔ To change the default margins of the text select the text and click on **Margins** in Page Layout Tab. A new dialogue box will open and you will see many options. Click on the desired option.

Practice Exercise 4

- Create a blank document
- Insert text in the document
- Change font style, size and colour
- Select a paragraph and change the line and paragraph spacing
- Change the case in a part of the text
- Try all the four text alignment options
- Choose a part of the text and arrange it into bulleted text
- Make listed text numbered 1-5.

Inserting and Modifying Tables

- ➔ To insert a blank table, click on the **Insert Tab** on the Ribbon
- ➔ Click the **Tables** command, an **Insert Table** dialogue box will open showing a grid of rows and columns
- ➔ Hover over the grid to select the required number of rows and columns for the table and a table template will be seen in your document. You can fill the data or text into the table.
- ➔ To convert text into a table select the text you want to convert
- ➔ Repeat the first two steps, click on **Convert Text to Table option**
- ➔ Choose the section on **Separate text at** and click on the appropriate command. Word will know how to arrange the text in the table.
- ➔ Along with this, Table Tools will open different options for table designs. Select the desired option.
- ➔ To add more rows to the table bring the insertion point on the row above which you want to insert another row.
- ➔ Right click the option of **Insert: Insert Row Above** and a new row will appear.
- ➔ Similarly for inserting the row below or for adding columns left and right of an existing column right click the option of **Insert;** and choose the appropriate options from the box that appears.

- To delete a row or a column, select the row or column
- Right click your mouse and select the **Delete Rows or Delete Columns** from the menu that appears.

Practice Exercise 5

- Open a blank document insert a table with 5 rows and 3 columns.
- Delete a row and a column from the table.
- Convert a given text into table form.

There are many more functions that you can perform using the Ribbon tabs in MSWord. We have explained only the key functions. You need to explore and practice using the other commands that are available under each of Ribbon Tabs so that you are able to create suitable word documents according to your need in the laboratory

Printing and Closing your Document

- Click on Office button
- go to the option of Print, click on it and three options appear **Print, Quick Print and Print Preview**.
- **Print Preview** allows you to see what the document will look like on a printed page before you give the print command.
- **Print** allows you to print the document if your computer is connected to a printer. You can also print quickly by using Quick Print Option. or by pressing Ctrl+P
- The **Send** option under the Microsoft Office button allows you to send your document either to another computer via email or to a fax machine. Your computer has to be set up for this.

The last command listed in the box says **Close**. If you click on it you will exit from the document. You can also shut down MSWord by clicking on the bottom of the box which says **Exit Word**. If you have forgotten to save any documents the computer will ask you if you want to Save. Click on Yes or No. You can also exit or close down MSWord by clicking on the X in the last square on the top right hand side of the screen.

Shortcut Mouse Commands

In addition to the ribbon commands that we have explained you can use your mouse for shortcuts to some of the commands that are available through the Ribbon. For this you have to use the right click button on the mouse and you see a new box (Fig.14.7) with some of the frequently used commands

Setting up your filing system

With your knowledge of using the computer you can set up a complete filing system similar to your paper filing system. The same way as you would name your paper files of all the documents in the laboratory, you can name your documents and save them in folders giving each folder an appropriate name so that it is easy to find them.

List out on paper the number and names of files that you would want to make in your work place. For example, Student names, class section; equipment and glassware; chemicals; stationary, day to day expenses etc. Wherever possible your computer files should be the same as the paper files.

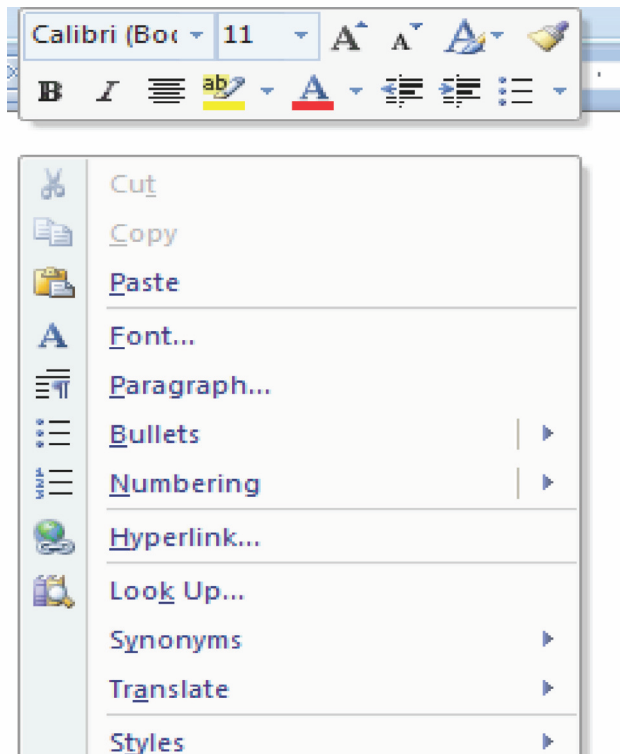


Fig.14.7: Shortcut mouse commands.

- ➔ Open your computer using the start button. Go to **Documents** (Fig.14.8).
- ➔ Click on Documents. A new box will open. Click on **New Folder**. A folder icon will appear in the Document Library. Give a name to the folder.
- ➔ Make more folders repeating the previous step .Each folder can be given a name according to what you want to save in it.

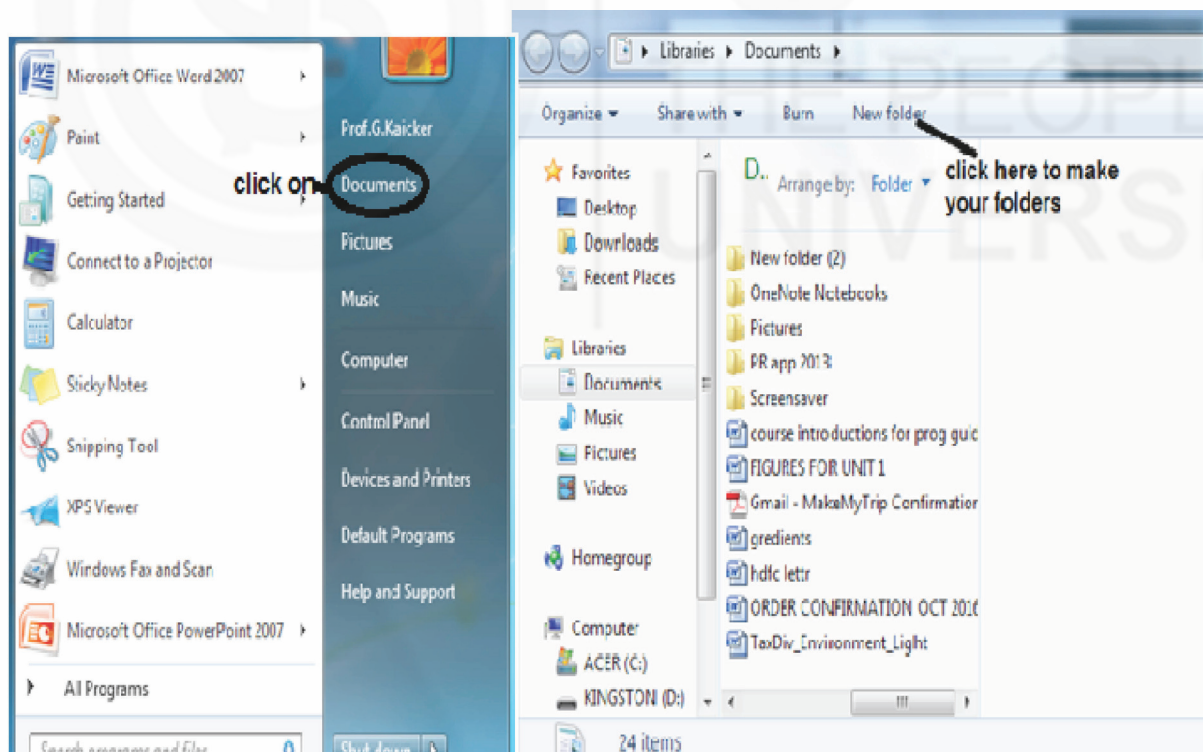


Fig. 14.8: Creating a filing system.

Every time when you open Documents, these folders will appear in the Document Library and you can open any old folder to see the saved files or save new files in any folder or modify any existing files.

Practice Exercise 6

- Make a list of the folders that you want to create on the computer
- Create and name three folders.

14.2.2 Creating an MS Excel Worksheet

The Excel Program is located in the Microsoft office folder. To work with Excel we first start the computer by click on the start button → choose **All Programs** → Click on **Microsoft Office** → choose **Microsoft Excel**. A blank Excel workbook will open on your screen. Note that the title bar is labeled **Workbook 1 Microsoft Excel**.

Before you start creating an MS Excel spreadsheet you must become familiar with the Excel Ribbon menu and its functions. The functions of **Quick Access Tool Bar** and The **Office button** are similar to MS Word. The **Ribbon** has tabs like **Home, Insert, Page Layout, Formulas, Data, Review and View**, each having different command groups under it (see Fig. 14.9).

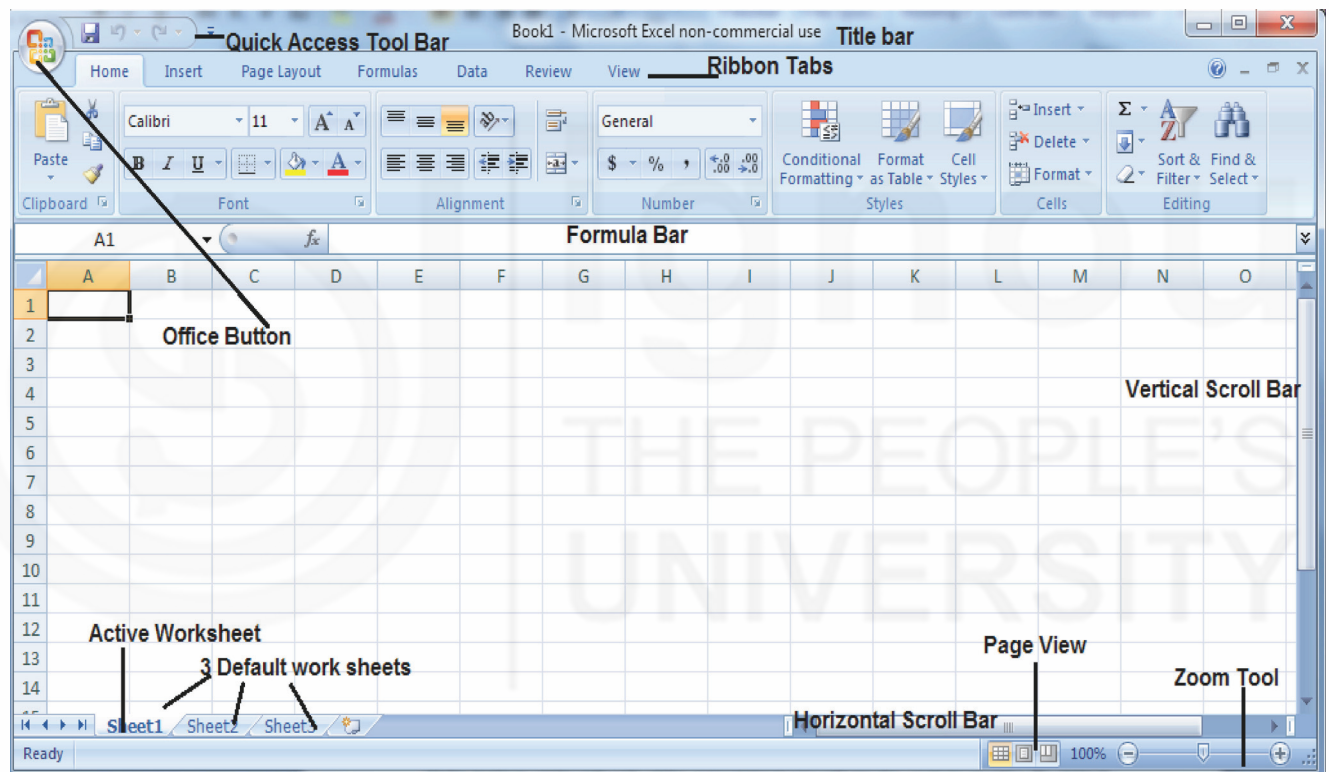


Fig. 14.9: Excel Workbook.

At the bottom of the left side of the spreadsheet you will see the worksheet tabs. By default 3 worksheet tabs appear in each new workbook, however, you can add more tabs as you work. Clicking the worksheet tab displays its content. The worksheet that you are working on is known as **Active sheet**. On the right side is the **Horizontal Scroll Bar** that is used to move the sheet right or left. You can see the **Zoom Slider** on the right corner and the **Page View Options- Normal, Page layout and Page Break** next to it. The default is the Normal view. You can change the width of the cells and the columns, add more cells and columns. You can minimize or restore/maximize the screen by clicking on the buttons on the top right hand corner of the workbook (the options are the same as in Word).

Practice Exercise 7

- Practice using the zoom tool to enlarge or decrease the size
 - Left click the horizontal tool bar to slide it left to right
 - Click on all the three page views options.
- Go to the top of the worksheet The columns are named A,B, C, D etc., and the rows are numbered 1,2,3,4,.....
- Above the column head is the **Name Box** and next to it the **Formula Bar**.
- Left click on any cell in a column to select it the selected cell address will appear in the Name Box. If a cell from column B and row 3 is selected then B3 will appear in the name box (Figure 14.10).
- Enter text in the cell, the same text will also appear in the Formula Bar.

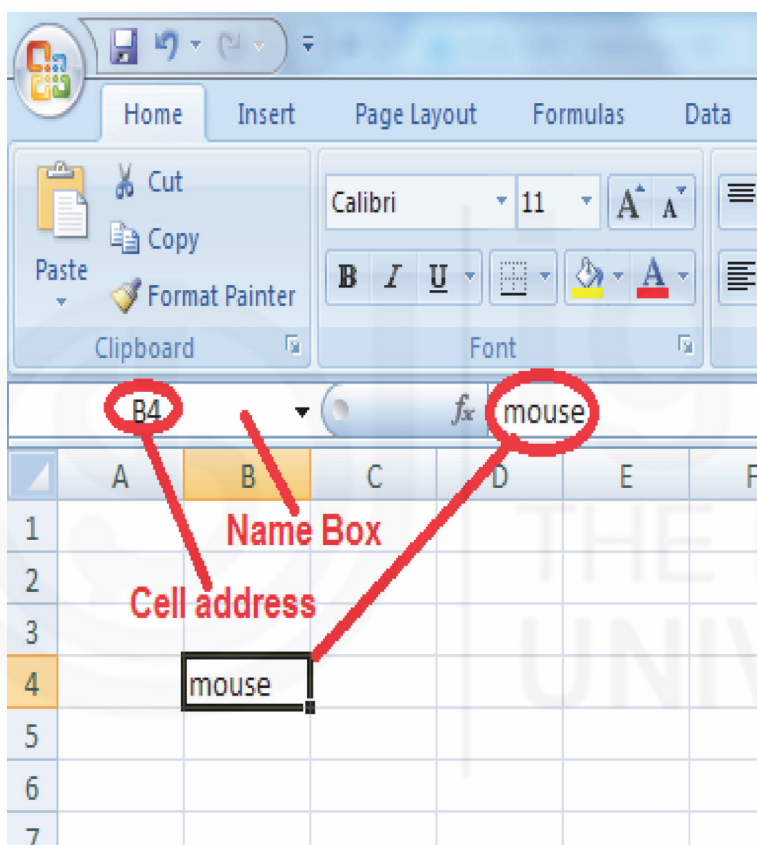


Fig. 14.10: Working with cells.

- Delete text by selecting the cell and using backspace or delete key on the key board OR
- Select the cell and place your cursor on the formula bar and use backspace key to delete or change the text.

To Open an Existing File

If you want to continue working on an existing workbook that was created earlier:

- Click on Office button and then click on Open button, a new dialogue box opens (Figure 14.11)

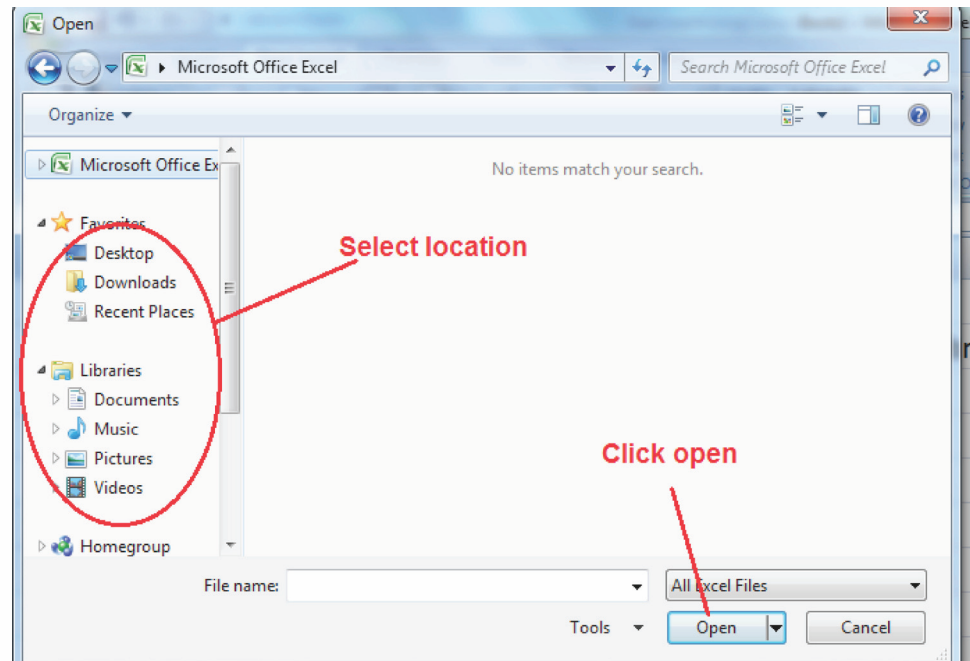


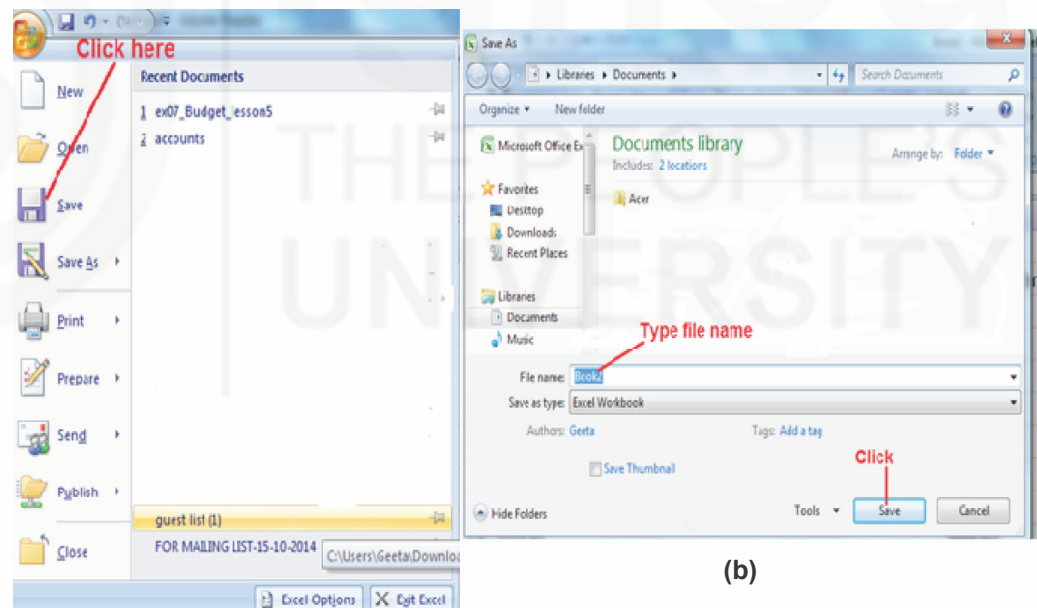
Fig. 14.11: Opening an existing worksheet.

Select where the existing file is eg., in Documents/Desktop/any other drive

→ Select the required file and click Open.

To Save the Worksheet

Click on MS Office button → click save. You can also click on the save icon on the Quick Access Toolbar (Fig 14.12a).



(a)

Fig.14.12: Steps for saving the worksheet

- A dialogue box opens (Fig. 14.12b), type a name for your workbook file in the *File name box* and specify the location which can be any folder on the hard disc. Initially Excel offers Documents folder but you can change by selecting a new drive or folder
- Select **Save As** if saving the file for the first time
- Click on Excel workbook, a dialogue box will open, choose the location (Desk top/ Documents), give file name and click save.

Example Worksheet

- ➔ Open a new Worksheet
- ➔ Go to the cell A1 and type Laboratory Budget 2016, that becomes the title of your spreadsheet
- ➔ Now go to A6 and type Bills in the cell,
- ➔ Go to B6 and type Date
- ➔ Go to C6 and type January; D6 type February ; E6 March and so on till December. These become your headings
- ➔ Under Bills type the various categories of bills like Mouse feed, Cages etc as shown in Fig.14.13
- ➔ Enter the date under date heading and the amount under each month

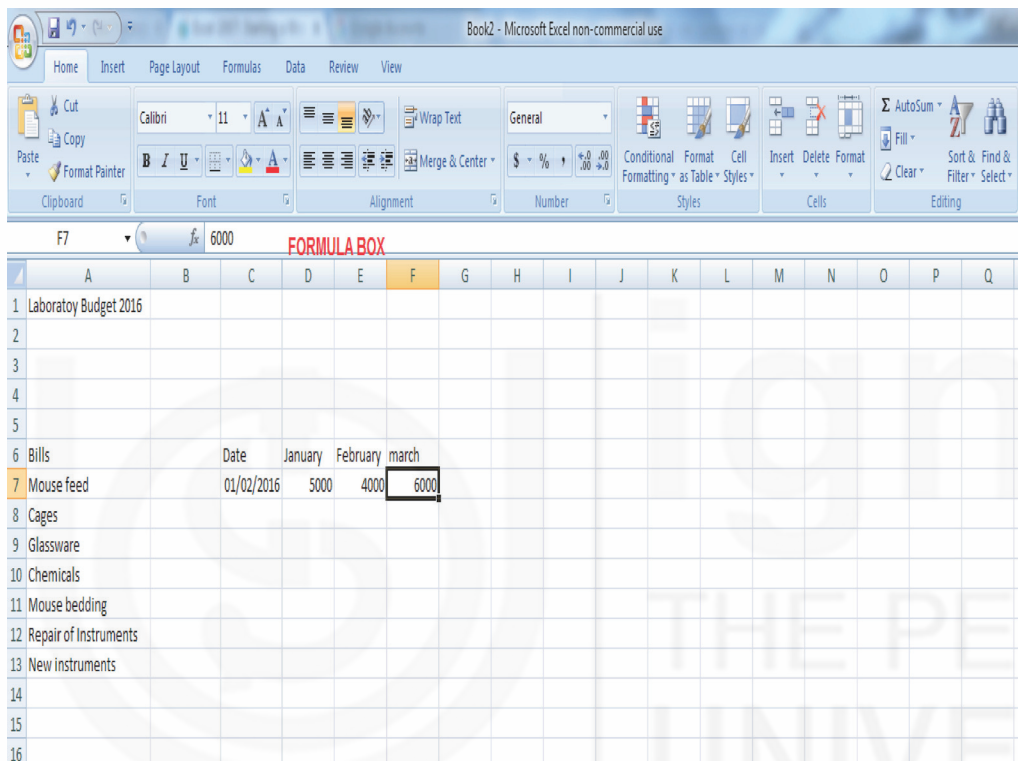


Fig. 14.13: Creating a worksheet.

You can move information from one cell to another in Excel by using cut- copy-paste or drag -drop methods the same way as you can in Word.

- ➔ To drag and drop select the cell or cells you want to move
- ➔ Place your cursor on any edge of the selected cell the cursor will change from a thick white cross to a thin black cross. Drag the cell to the location where you want to place it.

Rename, Delete, Insert worksheet

- ➔ To rename your worksheet click on **Format** command in the **Cells Group** in Home Tab, click on **Rename sheet** and give another name to the worksheet. Alternately double click on the sheet tab and rename it OR right click and the mouse short-cut opens where you can click on rename and give another name (Fig.14.14).
- ➔ To delete a worksheet right click on it and select delete option OR select the sheet tab to be deleted, Click on **Delete** in Cells command group, select **Delete Sheet**.

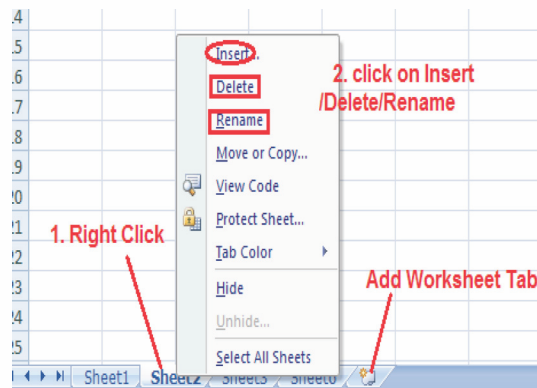


Fig. 14.14

- To insert a new worksheet click on the **Add Worksheet** tab after the last sheet tab. Or right click on the existing sheet tab and select insert option.
- To rearrange the sheets in a different order, right click on the sheet and select the **Move or Copy** option

Excel can be used to present not only numerical data but also to calculate and analyse numerical information. For these functions we create formulas that is, equations that perform calculations by using values in a worksheet. In this exercise we will only do some simple calculations. You can practice and learn more complicated functions once you are more experienced with using Excel.

Creating Simple Formulas

- To add two numbers click on the cell where you want the result of your addition to show.
- Enter the = sign, this lets excel know that a formula is being created
- Enter first number , enter the addition (+) sign, enter the second number
- Click on the Enter sign (✓) on the formula bar to complete the formula.

An alternate way is to use **Cell References**. These are useful as they allow you to modify any value of a data in a spreadsheet without having to write the formula again and the final value will be recalculated automatically.

- Click on the cell where you want the result to appear.
- Enter the equal sign (=) then enter the cell number of the first value (eg.,B4) add the + sign and enter the cell number of the second value(say B5) and click on the enter sign to complete the operation (Fig.14.15).

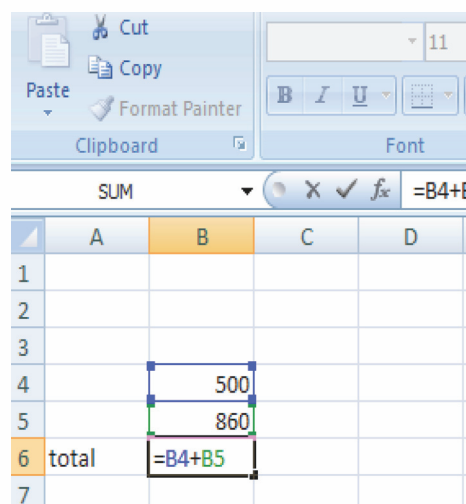


Fig.14.15

- ➔ To subtract 500 from 860 we create the formula as =B5-B4 in the cell and click enter
- ➔ To multiply 500 by 860 we create the formula as=B4*B5 and click enter
- ➔ To divide 860 by 500 we create the formula as =B5/B4 and click enter
- ➔ To do any operation by point and click method enter the = sign and click on the cell with the first figure, the cell reference number will appear in the cell
- ➔ Enter the + sign and then click on the next cell and the cell reference will appear in the cell, click enter
- ➔ To add many numbers in a column select the entire numbers by left clicking and dragging down over the numbers to be added
- ➔ Click on **Auto Sum** command in the **Editing group** of the Home Tab on the Ribbon
- ➔ The sum of the numbers will appear below the last cell of the numbers
- ➔ Cell references automatically change when a formula is pasted to a different cell, this is called **Relative Reference** (see Figure 14.16).

	A	B	C	D	E	F	G	H
1								
2								
3								
4	SPECIMEN	TYPE	UNIT COST	UNIT SIZE	INVENTORY	TOTAL COST		
5	MICROSCOPIC SLIDES	PROTOZOA	50	1	15	=C5*E5		
6	MICROSCOPIC SLIDES	HISTOLOGY	160	1	150			
7	PRESSED FLOWERS	MALVACAE	35	1	135			
8	MODEL LIFE CYCLES	INSECTS	450	1	3			
9								
10								

Fig.14.16

Practice Exercise 8

- Write a simple multiplication formula
- Write a simple addition formula using the point and click method
- Write a formula for Subtracting 450 from 900
- Using cut and paste method transfer text from one cell to another and also copy and paste information from one cell to another.

Preparing a Worksheet for Printing

- ➔ Click MS Office button and select **Print** and then **Print Preview**. From print preview you can select the same commands that are available in the Ribbon.
- ➔ In Print Preview click on **Margins** and black dotted margin lines appear to indicate the margins of your worksheet To change margin, column width etc., bring cursor on the dark lines and drag it to the required location. The change will be seen in the spreadsheet Close print preview to return to normal view
- ➔ Alternately go to the **Page Layout** tab of Ribbon and select **Page Setup** group of commands, select the **Margins** command and select the margin width option you want or enter the numbers you want to customize the margin width.

Under the **Page Layout** group of commands you have different commands for preparing your spreadsheet for printing

- To change orientation of the print select **Page Layout** and click on **Orientation** command to select **Portrait or Landscape**.
- Go to **Page Layout** and locate **Scale to Fit** group and enter specific width and height or percentage field to modify the spreadsheet.

Note: Use the Scale to Fit carefully because if you decrease the percentage too much then you might not be able to read the spreadsheet.

- Left click and select a specific area of cells to be printed.
- Go to **Page Layout**. Click **Print Area** command and select **Set Print Area**. Only the selected area will be printed.
- To insert a page break, go to **Page Layout** and select **Breaks** command under the **Page Setup** group, select **Insert Page Break**.
- Go to **Print Preview** to confirm that page break is at the correct place.
- Click on Print. Only the selected area will be printed.

In this exercise we have explained and given very basic instructions to work with MS Excel. We hope that after following the instructions for making a simple MS Excel worksheet you will realise the various possibilities in this software. You would be able to organise your lab work more efficiently.

To practice and learn more about Microsoft word and Excel you can visit the following websites where you will find written instructions as well as videos showing how to work with the latest versions of Microsoft Office software:

1. <http://www.gcfllearnfree.org/office2007>
2. http://www.teach-ict.net/software/word_2007/word_2007.html

14.4 ACTIVITIES

Activity 1

- 1) Using MS Word, write an application to the head of your laboratory asking for two days leave. Check your document for any spellings or grammatical errors!
- 2) Take a print out and submit to your counsellor in the Lab
- 3) Save the application in a new folder and name it LEAVE

Activity 2

- Open a new workbook.
- Create an inventory worksheet to include 10 items that could be instrument /glassware/chemicals/biological specimens. At the top give the grant that your lab has received. Give the date of purchase, cost per item, number of each item in stock and total cost of that item. Add up the total cost of all ten your items in stock. Calculate how much money is left from your grant.
- Print out your worksheet and submit to your counsellor who will award you marks for the session.