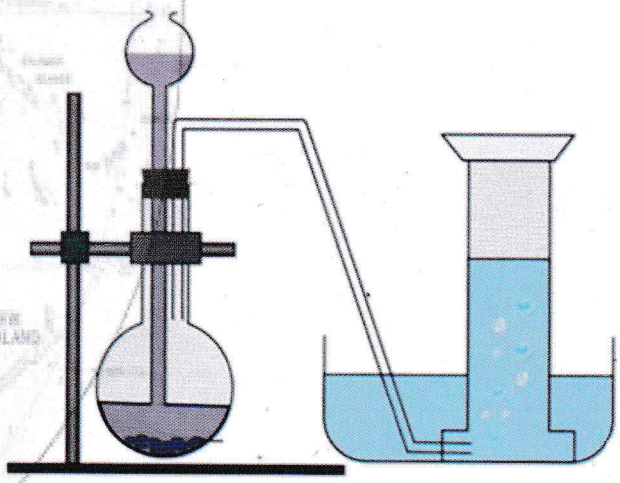
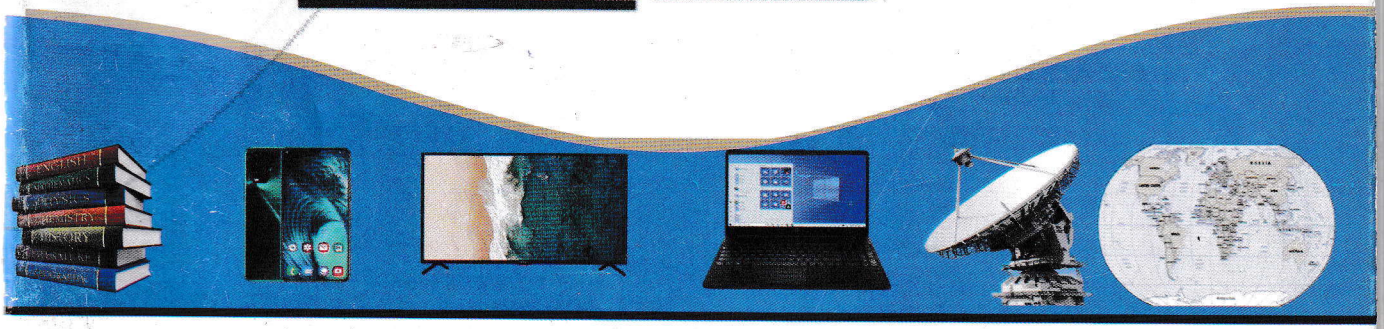
Module 1

CHEMISTRY

Stage I

Applying Chemistry Concepts and Techniques in Daily Life





Institute of Adult Education
Alternative Secondary Education Pathway

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Stage I

Applying Chemistry Concepts and Techniques in Daily Life

Institute of Adult Education
Alternative Secondary Education Pathway

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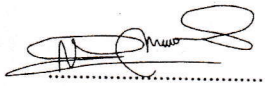

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About this module

This module has been produced by the Institute of Adult Education. All modules produced by the Institute of Adult Education are structured in the same way as outlined below.

How this module is structured

The module overview

The module overview gives you a general introduction to the module. Information contained in the module overview will help you determine:

- If the module is suitable for you;
- What you already know;
- What you can expect from the module; and
- How much time you will need to invest to complete the module.

The overview also provides guidance on:

- Study skills;
- Where to get help;
- Module assignments and assessments;
- Activity icons; and
- Units.

We strongly recommend that you read the overview *carefully* before starting your study.

The module content

The module is broken down into units. Each unit comprises:

- An introduction to the unit content;
- Unit outcomes;
- Core content of the unit with a variety of learning activities,
- A unit reflection;
- Assignments and/or assessments, as applicable; and
- Answers to Assignment and/or assessment, as applicable.

Resources

For those interested in learning more on this subject, we provide you with a list of additional resources at the end of this module 1; the resources are books, articles or web sites.

Your comments

After completing this module, we would appreciate if you would take a few moments to give us your feedback on any aspect of this module. Your feedback can include comments on:

- Module content and structure;
- Module reading materials and resources;
- Module assignments;
- Module assessments; and
- Module support (assigned tutors, technical help, etc.)

Your constructive feedback will help us to improve and enhance this module.

Module overview

Welcome to this module

Dear learner, welcome to study Module One of Chemistry This module introduces you to key chemistry concepts, the importance of chemistry in life and the application of chemistry.

This module has three units. In unit one, you will learn about the general concept of chemistry which include the meaning of chemistry, list of materials made by the application of chemistry as well as areas where chemistry is applied and the importance of chemistry in life. In unit two, you will learn about laboratory techniques and safety while in unit three you will learn to apply scientific procedure in carryingout various investigations in chemistry.

Please read the whole module. In the text, there are questions and activities to guide your reading and reflections as you continue learning.

After completing every unit, make sure you do the activities and unit reflection. Keep your answers and other difficulties or interesting things in your portifolio. This will help you to check whether you have understood the unit or not. Do them on your own or by discussing with your fellow students.

I hope you will enjoy reading this module

General Competence

Upon completion of this module, you should be able to apply chemistry knowledge, skills and principles in daily life.

Study skills

As an adult learner, your approach to learning will be different from the approach you used during your formal schooling. Now you will choose what you want to study, you will have professional and/or personal motivation for doing so and you will most likely be fitting your study activities around other professional or domestic **responsibilities.**

Essentially, you will be taking control of your learning environment. As a consequence, you will need to consider performance issues related to time management, goal setting, stress management, etc. Perhaps you will also need to acquaint yourself in areas such as essay planning, coping with exams and using the web as a learning resource.

Your most significant considerations will be *time* and *space* i.e. the time you dedicate to your learning and the environment in which you engage in that learning.

We recommend that you take time now—before starting your self-study—to familiarize yourself with these issues. There are a number of excellent resources on the web. A few suggested links are:

- http://www.how-to-study.com/

The "How to study" web site is dedicated to study skills resources. You will find links to study preparation (a list of nine essentials for a good study place), taking notes, strategies for reading text books, using reference sources, test anxiety.

- http://www.ucc.vt.edu/stdysk/stdyhlp.html

This is the web site of the Virginia Tech, Division of Student Affairs. You will find links to time scheduling (including a "where does time go?" link), a study skill checklist, basic concentration techniques, control of the study environment, note taking, how to read essays for analysis, memory skills ("remembering").

- http://www.howtostudy.org/resources.php

Another "How to study" web site with useful links to time management, efficient reading, questioning/listening/observing skills, getting the most out of doing ("hands-on" learning), memory building, tips for staying motivated, developing a learning plan.

The above links are our suggestions to start you on your way. At the time of writing the web links were active. If you want to look for more go to www.google.com and type "self-study basics", "self-study tips", "self-study skills" or similar.

Need help?

Dear learner, in the course of your study, you may need help in various issues such as the location and how to get support from resource centres, clarification of various issues pertaining to your study materials (modules) and so on. If this happens, you are advised to ask for the help from your centre coordinator or facilitator. You can also visit the website of the Institute of Adult Education which is www.iae.ac.tz. And, you can call Tel +255 22 2150838 and ask for help.

Module Assessment

After each unit, you will be required to attempt one unit assignment. The assigments are not meant for submission rather for reflection on what you have learned in the whole module. You will also be given tests and assignments for submission as you will be guided by your module facilitator. You will also sit for mock examinations to accomplish your continuous assessment

Getting around this module

Margin icons

While working through this module you will notice the frequent use of margin icons. These icons serve to "signpost" a particular piece of text, a new task or change in activity. They have been included to help you to find your way around this module.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meaning before starting your study.

 Activity	 Assessment	 Unit assignment	 Case Study
 Discussion	 Group activity	 Help	 Note it!
 Outcomes	 Reading	 Reflection	 Study skills
 Reflection	 Terminology	 Time	 Tip
 Computer-Based Learning	 Audio	 Video	 Feedback
 Objectives	 Basic Competence	 Answers to Assessments	

Unit 1

Explaining the Concepts of Chemistry

Introduction

Dear learner, welcome to the first unit of Module One of Chemistry. This unit is very interesting as it helps you to be familiar with what is going on in this world related to chemistry. It is important to note that, chemistry as a science subject has many applications in our daily life. Stay relaxed and tuned to start our lesson.

Dear learner, at primary school level, I hope among the subjects you learnt was science subject. The science you learnt in primary school was too general. However, as you move to secondary education level, the science subject is divided into three subjects namely; chemistry, biology and physics.

This unit intends to familiarize you with the concepts of chemistry as a science subject. You will learn what chemistry is, products made by application of chemistry in daily life and areas where chemistry is applied. I hope that you will enjoy learning it.

Learning Outcomes

Upon completion of this unit you will be able to:

- Develop an understanding about the concept of chemistry;
- Describe the materials made by application of chemistry;
- Identify the areas where chemistry is applied; and
- State the importance of chemistry in life.

The Concept of Chemistry

Dear learner, welcome to chemistry, the science concerned with the study of matter. Can you explain the meaning of chemistry? If not do not worry, this section will enable you to get familiar with chemistry concept.

Chemistry is branch of science that deals with the study of composition, structure and properties of matter. In other words, it deals with the study of nature, properties and composition of matter. Probably, you can ask youself, what is matter. How does matter look like?

Dear learner, the term *matter can be defined as anything that has weight or mass and can occupy space*. Therefore, in chemistry we study

materials that make up the earth and universe. These range from living to non-living materials. We apply the knowledge of chemistry to study the composition, behaviour and nature of materials around us. This study enables us to make the best use of these materials to improve our welfare. Those people who are specialized in chemistry we call them *Chemists*.

Generally, we can say, Chemists are people who transform the everyday materials around us into amazing things. Would you like to be a chemist? If yes, why? Dear learner, from the above explanation, you may find out that anything that can be touched, tasted, smelled, seen or felt is matter. So far, after being familiar with concepts of chemistry, now let us discuss materials and objects made by application of chemistry.

Application of Chemistry in Daily Life

We have learnt in the previous introductory part that, chemistry has many applications in our daily life. Now it is time to investigate how chemistry knowledge is applied in different fields. In this section, we are going to identify materials and objects made by application of chemistry and we use them daily. Finally, we will identify areas where chemistry is applied.

Materials and objects made by application of chemistry

Dear learner, chemistry as we said ealier is an important subject as it touches almost every aspect of our life and applied in other fields such as agriculture, manufacturing, medicine, processing and food industries, education, cosmetics and home care industries. All these industries are responsible for the production of materials that we need to support and hence, improve our lives. Can you list down any five materials or objects made by application of chemistry that are found in your area? If you can, it is very nice. Let us now share together.

Dear learner, materials made by the application of chemistry include soap, sugar, common salt, chalk, toothpaste, detergents, perfumes, shoes, clothes, petrol, diesel, cement, alcoholic and non-alcoholic beverages, cosmetics (like lotion, body creams), medical drugs and many others. All these materials, among others, are made by applying chemical processes. They are needed for better living. I hope you see how chemistry is fantastic, as many products are made by the application of chemistry in industries around us. Can you mention other materials made by the application of chemistry?

We can conclude that chemistry is applied in different fields, such as agriculture, medicine, home care and cosmetics, manufacturing industries, transport, textile and food/beverage industries.

Areas where chemistry is applied

Dear learner, more discussion about areas or fields where chemistry is applied and materials made by application of chemistry is presented below. Please join in our discussion.

i) Agriculture

Most people in our society are involved in agricultural activities. The agricultural activities involve farm cultivation and livestock keeping. The agricultural activities help us to get food, and other materials needed for industrial activities. The materials made by the application of chemistry and are used in agricultural activities include fertilizers (as seen in Figure 1.1), insecticides, pesticides and weed killers. In the same case, products made by the application of chemistry and used in animal husbandry include, animal vaccines and drugs, animal feeds, and food supplements.

Figure 1.1: Fertilizer

ii) Medicine

Hospitals and dispensaries are made specifically for medical treatments. In addition to that, the pharmacy is special room where different medicines are kept. Man uses medicines extracted from plants and animals for treatment. The medical treatment ensures the humam well being through the prevention of illness and diseases, also treatment when they get sick. The products made by application of chemistry which are used in this field include drugs, vaccines and nutritional/food supplements.

iii) Home care and cosmetic industry

Different materials that we use at home are made in home care and cosmetic industries. These materials are very important in our daily life as they help in activities like bathing, washing clothes and house, softening the skin, smoothing the hair and so on. These materials include

detergents, cosmetics, soaps, disinfectants, shampoo, insecticides, shoe polish and toothpaste as seen in Figure 1.2.

Figure 1.2: Detergents

iv) Food and beverage industries

Some foods and drinks we buy from shops or supermarkets are made by food and beverage industries. These foods and drinks are preserved with chemicals to prolong their shelf life. Examples of foods and drinks made in these industries include soft drinks like juice and soda, alcoholic drinks, baked food, spices, cooking oil, biscuits, canned food and common salt. Figure 1.3 shows how the soft drinks are made in food and beverage industries.

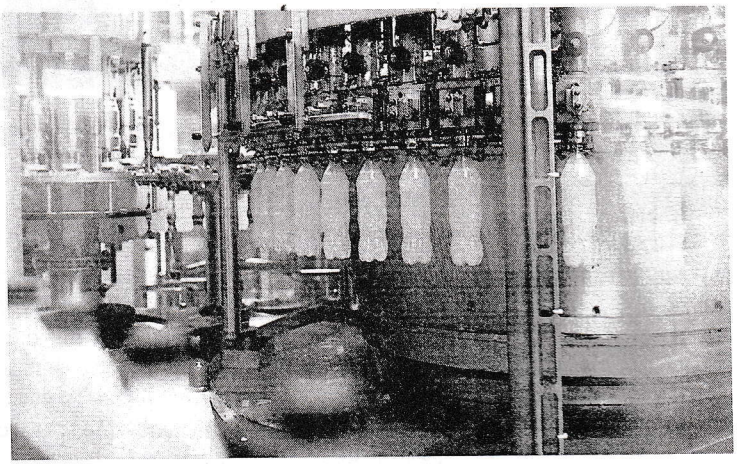


Figure 1.3: Soft drinks production

v) Manufacturing industry

Manufacturing industries use materials made from chemical processes.The products made in these industries include vehicles, cements, plastics, containers, textiles, handbags, paints, iron sheet, vanishes, chemicals and rubbers

Figure 1.4: Bags of cements

vi) Transport and communication

When you look at transport sector, you might find that we use different means of transport including cars, motor vehicles, buses, trains, ships and planes to move from one place to another. The fuels, lubricants, oil, grease, coolants and tyres that are used by these vehicles or means of transports are produced by applying chemical processes.

Similary in communication sector, we use different devices include phones, computers, letters and newspaper as means of communication which are also made by chemical processes.

Before we proceed further, do the following activity.

Dear learners, visit a nearby industry to observe some of the products which are made through the application of chemistry knowledge. List them. Investigate how chemistry is applied there. Write a report about your visit.

Let us wind up this unit by describing the importance of studying chemistry.

Importance of Studying Chemistry

Dear learner please share with your nearby friend on how studying chemistry is important to daily life. Thereafter, relate your answers to what we are discussing in the section that follows.

Dear learner, there are a number of reasons for studying chemistry. If you ask someone to tell you the reason for studying chemistry, probably he/she will give reasons based on how the subject touches him/her.

However, there are many reasons as to why we study chemistry. Here below are some of the reasons:

i) Chemistry helps to get different professionals in different carriers or disciplines such as pharmacy, engineering, medical and natural science professions. The skills you obtained from chemistry helps you to work in different professions, for example, doctors, nurses, teachers, laboratory technician, pharmacists and industrial workers.

ii) Chemistry helps to ensure human well being. Different medicines including drugs and syrups are used to treat human when sick. In addition to that, vaccines are used to prevent people from getting different infections and diseases. All these medicines and vaccines are made through chemical processes.

iii) Chemistry helps to ensure human being is safe. The insecticides used by human being to kill different dangerous insects like cockroaches, mosquitos are made through chemical processes. Also different chemicals like aqua guard and chlorine are used to treat water which helps to kill dangerous bacteria that cause illness to human.

iv) Chemistry is essential for understanding the effects of chemicals on the environment. This information can be used when providing the best nutrients to plants, which help them grow, at the same time making a proper decision on how we can preserve our environment.

v) Chemistry concepts are important in other disciplines like biology, physics, cooking and astronomy.

vi) Chemistry helps us to understandhow to extract and use materials from the earth to improve our welfare.

Unit Reflection

After the completion of this unit, reflect on the following:

1. Did this unit make you amazed? If yes, explain how and what made you amazed?
2. Which part (s) in this unit you preferred most, and why?
3. What challenge did you encounter when learning the contents of this unit? How did you overcome those challenges?
4. Do the activities inserted in this unit help you in your study?

Unit Assignment

Do the following questions; remember to put your work in your portfolio:

1. What do you understand by the following terms:
   a) Chemistry.
   b) Chemist.
   c) Matter.
2. Briefly explain the application of chemistry in your daily life.
3. Describe the areas where chemistry is mostly applied in our daily life.

Unit 2

Applying Labolatory Techniques and Safety

Introduction

Dear learner, welcome to unit two of module one of chemistry. This unit covers all issues related to chemistry laboratory as well as first aid. Specifically, you will learn about rules and safety precautions in chemistry laboratory, first aid and first aid kit, basic chemistry laboratory apparatus and their uses as well as chemical warning signs.

Learning Outcomes

Upon completion of this unit, you should be able to:-

- State the laboratory rules;
- Explain the safety measures for a chemistry laboratory;
- Identify the possible causes of accident in a chemistry laboratory;
- Name the items found in first aid kit and explain their uses;
- Elaborate the correct use of different laboratory apparatus; and
- Interprete different chemical warning signs and symbols.

General Concept of a Laboratory

Dear learner, think of special rooms like library, dispensary or hospital laboratory or school laboratory that you have come across. Is there any common feature found in all these rooms? How can you differentiate other laboratories from a chemistry laboratory?

When we talk about laboratory, we mean "A *special room or building specially designed for conducting various scientific experiments*".

What is a chemistry laboratory?

A chemistry laboratory is a special room or building equipped with chemicals and apparatus for conducting various chemistry experiments.

Special Features of a Chemistry Laboratory

Dear learner, make a visit to any nearby chemistry laboratory. Observe all features you find inside the laboratory. List down all the features you have observed. Then, compare the observed features with that discussed below.

Dear learner, an appropriate chemistry laboratory should have the following features:

- A room with enough space for carrying out scientific experiments;
- A store for keeping laboratory apparatus, chemicals and reagents;
- An office for laboratory technician to sit in and design scientific experiments;
- Wide doors opening outwards;
- A wide table in front of the laboratory room, fitted with sinks for experiment demonstrations;
- Fume chamber for preparation of poisonous gases;
- Enough chemicals, reagents and apparatus;
- Big windows for enough ventilation to let in fresh air and light;
- Cupboard, storage carbinets and drawers with locks;
- Good supply of water and electricity; and
- Equiped with *working* fire extinguishers.

We hope you are aware about features that chemistry laboratory should have. It is time now, to discuss laboratrory rules and safety measures.

Rules and safety precautions in the chemistry laboratory

Dear learner, working in chemistry laboratory is very dangerous especially if safety measures are not taken accordingly, because it is equipped with different dangerous chemicals and delicate apparatus. Based on the situations in the chemistry laboratory, there are special rules and safety measures to be observed by everyone working in the laboratory.

Activity

Can you list down any five-laboratory rules you know? If not, do not worry because the next section will pinpoint some of those rules.

Dear learner, as we said in the previous section, whenever you need to use chemistry laboratory you need to adhere to rules and safety measures that will be discussed in this section. Join in our discussion.

Laboratory Rules

i) Do not enter in the laboratory without permission of your teacher or laboratory technician;

ii) Dress properly for the laboratory activities;

iii) Master all location for entry and exit;

iv) Read and follow instructions carefully during experiment;

v) Do not eat, drink or smoke in the laboratory;

vi) Do not play or run in the laboratory;

vii) Read the label on reagent bottle careful before taking anything from the reagent bottle;

viii) Use fume chamber when carrying out experiment with harmful gases;

ix) Do not touch an electrical equipment with wet hand;

x) Keep inflammable substances away from fire;

xi) Do not use cracked or broken apparatus;

xii) Clean up the equipment and store it safely;

xiii) Always wash your hands with soap and running water after experiments;

xiv) Don't taste anything in the laboratory; and

xv) Report any accident happened in laboratory to the teacher or laboratory technician.

Laboratory safety measures

Dear learner, after being familiar with chemistry laboratory rules and precautions, it is important to note that chemistry laboratory can be a place of discovery and learning. However, by the nature of laboaratory work, it can be a place of danger if proper precautions are not taken. The following are some important laboratory safety measures to be observed when you are in a chemistry laboratory.

i) The laboratory should be supplied with working fire extinguishers;

ii) All cupboards, storage cabinets and drawers should be well labelled and locked;

iii) Chemistry laboratory should be supplied with first aid kit for the

purpose of attending any emergency which might occur in the laboratory;

iv) Containers for chemicals should be checked regularly to ensure they do not leak;

v) All chemicals should be well labelled to prevent accident in the laboratory;

vi) The fume chambers should be labelled;

vii) The gas cylinders should be labelled and be maintained in a good working condition at all time;

viii) Stored chemicals should be checked regularly;

ix) Equipments for monitoring contamination should be installed to give alerts;

x) Chemicals that easily react with each other should never be stored together; and

xi) Keep all chemicals in properly labelled containers. This will prevent accidental use of the wrong chemical for a particular experiment.

First Aid and First Aid Kit

Dear learner, this section deals with first aid and first aid kit. The section is very important to us because it opens up our mind on how we can help a victim who suddenly becomes sick or gets accident immediately before getting medical assistance.

What is first aid?

First aid is the immediate help or assistance given to an accident or sick person until professional medical help is available. When someone helps an injured or a sick person before the arrival of full medical assistance is what we call first aid. This help can be given by any person regardless of his/her knowledge in a medical profession.

Whenever an accident occurs, something must be done immediately to help and save life of the victim. You must always be ready to give a first aid to a victim whenever an accident occurs close to you. First aid helps to:

- Reduce the fear of death;
- Shorten recovery time;
- Reduce pain and further damage;
- Prevent permanent disability; and
- Bring hope to the victim.

Possible Causes of Accidents in a Chemistry Laboratory

Dear learner, it is dangerous to work in a chemistry laboratory because accidents may occur in a laboratory, if greatest care is not taken into account. Common accidents in the laboratory are shock, burns,

suffocation, vomiting, bleeding, electric shock, fainting, bruises, cuts and poisoning. Below are some possible causes of accidents in the chemistry laboratory.

i) Failure to follow the right procedures/instructions during experiments.

ii) Chemical and liquid spills left on the floor may cause falls and burns.

iii) Wrong use of equipment and apparatus when conducting experiments may lead to breakage, which in turn cause cuts, bruises, grazes, burns and so on.

iv) Wrong use of reagents may cause burns, poisoning or damage.

v) Poor ventilation in the laboratory may cause suffocation (due to inadequate oxygen supply) and poisoning (by inhaling poisonous gases produced when experimenting).

vi) Gas leaking from taps or cylinder may lead to fire or explosion.

Generally, we can conclude that most laboratory accidents are a result of carelessness and negligence of the users. It is also due to failure to follow the laboratory rules and safety measures.

With your neighbour, discuss other possible causes of accidents that can happen in a chemistry laboratory.

Let us continue discussing about first aid kit

First Aid Kit

Dear learner, we hope you are aware now about concepts related to first aid. Now let us discuss about first aid kit.

First aid kit is a box in which first aid chemicals, tools and instruments are kept. I believe first aid kit is not new to you. Can you mention places you have come across a first aid kit? Why do you think first aid kit is important to be available in a chemistry laboratory?

Dear learner, almost everyone will need to use a first aid kit at some time. First aid kit is supposed to be available at home, in cars and at different work places. First aid kit comes in all types and the list of content vary depending on their uses and place. Take the time to prepare a first kit and make it available for home and travel. Try to keep your first aid kit small and simple. Probably you can ask a question, where should this kit be placed? Usually, you need to keep first aid kit in an accessible place where it will be seen and reached easily by everyone.

For instance, in the laboratory the box can be kept in a place where it can easily be reached in case of an accident, preferably on the wall. You,

as a student, must be familiar with the tools and chemicals kept in the kit and learn how to use them to provide first aid to a victim.

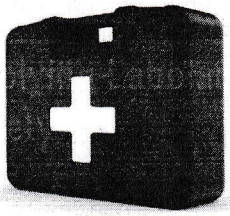
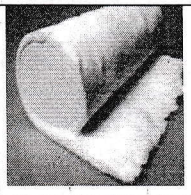
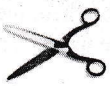


Figure 2.1: First aid kit

Components of the First Aid Kit and their Uses

Dear learner, it is very important that every body should be familiar with the instruments and chemicals found in the first aid kit. The following are some of the components found in the first aid kit with their uses.

Table 2.1: Components of the First Aid Kit

S/N	Item	Diagram	Use
1.	First aid manual		Contains guidelines on how to use the items on the first aid kit
2.	Bandage		Keeping dressing materials in place and immobilizing injured limbs
3.	Cotton wool		Cleaning and drying wounds
4.	Safety pin		Securing bandages
5.	Pair of scissors or razor blade		Cutting dressing materials and flaps in a wound

6.	Plaster or adhesive bandage		Covering small cuts or wounds
7.	Disposable sterile gloves		Covering the hands to avoid infecting wound or prevention of direct contacts of hands with a victim body
8.	Antiseptic		Cleaning wounds to kill germs
9.	Petroleum jelly		Smoothening and soothing chapped skin
10.	Soap		Washing hands, wounds and equipments
11.	Gentian violet (G.V)		For fungal infection of the skin and mouth
12.	Pain killers		For relieving pain
13.	Liniment		For reducing muscle pain

Dear learner take a time to prepare your own first aid kit for home purpose. Then, mention all materials you have used to prepare and state the uses of each item.

First Aid Procedures

Dear learner, as we said earlier, whenever an accident occurs, one must be ready and prepared to assist. The following are some of the health problems that may require first aid and the procedures to follow when providing help.

i) Providing first aid for burns

Dear learner, have you experienced cases related to burns in your life? If yes, how did you manage to help that case? If not, do not worry because this discussion is all about rendering first aid to person who is suffering from burns.

Burns are injuries resulting from a body being exposed to heat or harmful chemicals. This situation causes pains and may result into infection.

Procedures

The following are procedures which you can use to render first aid to a burn victim:

a. Lay down the victim to protect burnt area from coming into contact with ground;
b. Gently pour cold water on the burnt area to cool it and reduce pain as seen in Figure 2.2. If the burn is severe, immediately call for medical help;
c. Gently remove any jewellery, shoes or burnt clothing from the injured areas. Loosen any tight clothing;
d. Cover the burns with sterile gauze and wrap it loosely to avoid pressure on the skin; and
e. Give the victim pain killer, and then seek medical help immediately.

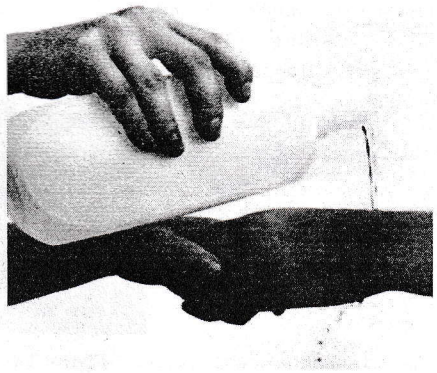


Figure 2.2: Burn rendering fisrt aid

ii) Rendering first aid to suffocated person

Suffocation is the condition in which the lungs are not getting enough oxygen and hence, causing difficulty in breathing.

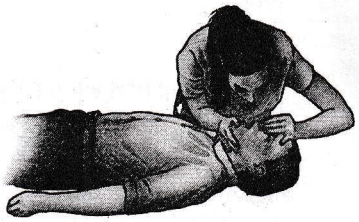


Figure 2.3: Suffocated person assistance

Procedures

The following are procedures that you can use to render first aid to a victim:

i) Remove the causes, if possible, or remove the victim from the causes of suffocation;

ii) Ensure the victim's air way is open for air to reach the lungs;

iii) Administer cardio pulmonary resuscitation (CPR); this involves blowing air into the victim's mouth;

iv) Keep the victims warm using a light blanket; and

v) Seek medical help, immediately.

iii) Rendering first aid to a person with bruises

A bruise is an injury beneath the skin. It can easily be identified by pain, swelling or mark under the skin. It may be caused by blow (hard hit) that damages or breaks blood vessels near the skin surface. This allows a small amount of blood to leak into the tissues under the skin. The trapped blood appears as a blue-black mark.

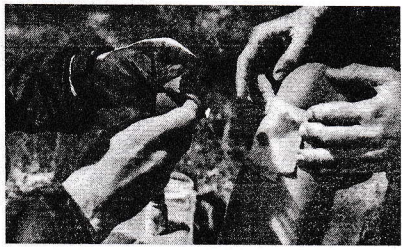


Figure 2.4: Attending bruises case

Procedures

The followings are procedures that you can use to render first aid to a bruise victim:

i) Wash the bruised part of the body.

ii) Apply a cold compress such as a cloth dipped in cold water or ice to the injury. This helps reduce pain, swelling and speed up recovery.

iii) If the bruise is on the limb such as arm or leg and it covers a large area, keep the leg or arm elevated as much as possible.

iv) Apply a cloth dipped in warm water to the bruise for 5-10 minutes. This will help to increase blood flow to the affected area and speed up healing.

i) Providing first aid for electric shock

An electric shock occurs when a person comes into direct contact with electricity. Exposure to electricity may result in injury or even death.

Figure 2.5: Electric shock assistance

Procedures

The following are procedures that you can use to render first aid to an electric shock victim:

i) Put off the main switch immediately, if possible.

ii) Detach or remove the victim from the source of electricity using a dry wooden stick.

iii) Check whether the victim is breathing. If breathing has stopped, begin resuscitation (artificial respiration), that means, apply mouth-to mouth respiration (CPR), immediately.

iv) If the victim is breathing but unconscious, put him or her in recovery position

v) Take the person to the hospital immediately for further medical treatment.

Caution: Do not touch the victim with your bare hands if he/she is still in contact with the electric current.

i) Providing first aid for poisoning

Poison is any substance that can harm the body if swallowed, inhaled or absorbed into the body. Poisons include laboratory chemicals and even drugs and medicines.

Figure 2.6: Poisoning case

Procedures

The followings are procedures that you can use to render first aid to a victim:

i) Find out what caused the poisoning

ii) If poison is in the eyes

- Wash the eye with a lot of clean water,
- Ask the victim to blink as much as possible, and
- Do not rub the eye.

iii) If poison is on the skin

- Remove any clothing from the affected part
- Wash the affected area thoroughly with water

iv) If the poison has been swallowed induce vomiting if the poison is non-corrosive but if the poison is corrosive do not induce vomiting

v) If the poison has been inhaled, move the person to place with plenty of fresh air.

vi) Call for medical assistance immediately.

Discuss the procedures of rendering first aid for choking, fainting, muscle cramp, vomiting and bleeding.

Basic chemistry laboratory apparatus and their uses

Dear learner, as you have learnt in the previous lesson about the features of a chemistry laboratory you will remember that one of essential features of a chemistry laboratory is the presence of apparatus. Therefore, this section describes these apparatuses. Welcome and enjoy the lesson.

Visit a nearby school chemistry laboratory and make observations of the apparatus found in that laboratory. List down any apparatus you have observed and state their uses. Probably you might find out that most of the laboratory apparatus is made of glass, while some is made of plastics and metals. Do you know why most of them are made of glass?

After your visit, let us share together the chemistry apparatus.

Dear learner, as said in the previous section most standard apparatus in a school chemistry laboratory is made up of glass because of the following reasons:

i) Glass is transparent and thus reactions/interactions inside are clearly visible from outside;

ii) Glass is comparatively cheaper, which reduces cost of equipping the school chemistry laboratory;

iii) Glass is comparatively easy to clean/wash after use; and

iv) Glass is comparatively unreactive to many chemicals.

Chemistry apparatus is special tools and equipments that are used in performing scientific experiments in the chemistry laboratory. These are designed for the purpose they are intended in a chemistry laboratory as seen examples below:

a. Apparatus for measuring volume: examples measuring cylinder, pippete, burette, volumetric flask and dropper;
b. Apparatus for measuring mass: examples beam balance and electric balance;
c. Apparatus for measuring temperature: example thermometer;
d. Apparatus for measuring time: examples stop watch, clock;
e. Apparatus for scooping: example spatula and Deflagrating spoon;
f. Apparatus for putting liquids/solid for heating: examples test tube, beaker, conical flask, round bottomed flask and flat-bottomed flask;

g. Apparatus for holding unstable apparatus (during heating): examples wire gauze, tripod stand, clamp stand, test tube holder, test tube rack, pair of tong and gas jar;
h. Apparatus for holding/directing liquid solutions: examples filter funnel, thistle funnel, dropping funnel and separating funnel;
i. Apparatus for heating: examples candle, spirit burner, kerosene stove, charcoal burner/jiko and bunsen burner; and
j. Apparatus for safety gears: gloves, satefy goggles/glasses.

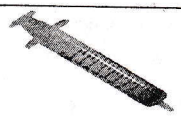
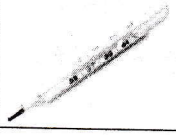
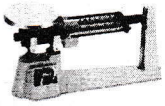
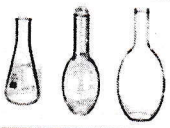
From the above explanation, laboratory apparatus can be classified according to uses as summarized below:

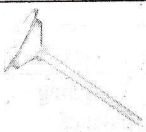
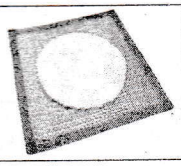
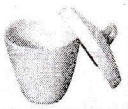
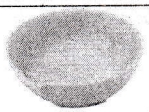
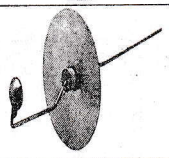
a) Apparatus for holding things, e.g test tube holder, retort stand and clamp, test tube rack, tongs and tweezers;
b) Apparatus for taking measurements, e.g. thermometers, burette, pipette, measuring cylinder, measuring flask, beam balance, electronic balance, common balance, measuring syringe, beaker and stop watch;
c) Apparatus for heating substances, e.g boiling tube, pipeclay triangle, crucible and lid, wire gauze, deflagrating spoon, Bunsen burner, spirit burner, tripod stand, evaporating dish, wire gauze and stove;
d) Apparatus for doing chemical reactions or testing, e.g beaker, test tube, dropper, flask, watch glass, gass jar and thistle funnel;
e) Apparatus for filtering, e.g filter funnel, filter paper and cotton wool;
f) Apparatus for grinding, e.g mortar and pestle;
g) Apparatus for storage, e.g. reagent bottlte and wash bottle;
h) Apparatus for scooping, e.g spatula; and
i) Apparatus for safety, e.g. goggles and hand gloves.

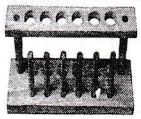
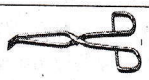
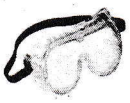
Dear learner, for more details on how the mentioned apparatus above look like, Table 2.1 summarizes some of the common laboratory apparatus and their uses.

Table 2.1: Some Chemistry Laboratory Apparatus and their Uses

S/n	Apparatus name	Diagram	Uses
1.	Pipette		Used for measuring specific volume of a liquid
2.	Measuring cylinder		Graduated container used to measure volume of a liquid

S/n	Apparatus name	Diagram	Uses
3.	Burette		Used to accurately measure volume of liquids
4.	Measuring syringe		Used in sucking in and measuring specific volume of liquid or gases
5.	Thermometer		Used for indicating/measuring the temperature of a substance
6.	Weighing balance		It is a weighing instrument used to measure the mass of a substance
7.	Stop watch		A special watch used to measure the time
8.	Beaker		Container used for holding, heating and mixing liquids.
9.	Test-tube		Used for holding and heating substance for a short time
10.	Dropper		Used for adding liquid during an experiment drop by drop
11.	Flasks		They are used in holding liquids during experiments

S/n	Apparatus name	Diagram	Uses
12.	Watch glass		Circular glass container used for evaporation of liquid substances.
13.	Gas jar		For collection of gas during experiments.
14.	Thistle funnel		used to add reagents into flasks during experiments
15.	Bunsen burner and spirit lamp		Used for heating substance in a laboratory
16.	Tripod stand		Used to support heating container during experiments.
17.	Wire gauze		Placed on tripod stand to support container. It also helps to spread out the flames and heat
18.	Crucible		It is used for heating substance at a very high temperature
19.	Evaporating dish		It is used for heating to evaporation of liquids.
20.	Deflagrating spoon		It is a long-handled spoon used to heat small amount of substance inside the gas jar.

S/n	Apparatus name	Diagram	Uses
21.	Filter funnel		It is used to separate solids from liquids. It is used for filtering.
22.	Filter paper		It is placed in a filter funnel used to separate solids from liquids.
23.	Mortar and pestle		A mortar is a small hard bowl and a pestle is small heavy tool. They are used for grinding substances
24.	Test tube rack		It is a structure that is, specially designed for placing test tubes so that can not break
25.	Test tube holder		It is an instmment that is used for holding a test tube during heating
26.	Retort stand and clamp		Used to hold apparatus such as burettes during experiments
27.	Tongs		Used to hold hot substances and apparatus
28.	Reagent bottles		Used to store different chemicals
29.	Plastic wash bottle		Used to store distilled water
30.	Spatula		Used for scooping/picking up small quantities of powder or crystalline chemicals.
31.	Safety goggles/ glasses		Used to protect the eyes from chemical spills and strong light.

S/n	Apparatus name	Diagram	Uses
32.	Gloves		For protecting the hands from touching corrosive chemical

Please mention other apparatus apart from the above mentioned. State their uses and draw their diagrams.

Chemical Warning Signs

Dear learner, the next section is about chemical warning signs. If you go to the petrol station or you come across with motor vehicles, carrying petroleum products such as diesel or petrol you might find warning signs there. Similarly, if you observe carefully the gas cookers and gas containers, we use at home you may also find warning signs. Can you tell me what those warning signs mean?

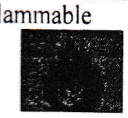
It is okay, if you have come across different warning signs in your daily life. Dear learner, warning signs either found in petrol stations or elsewhere are also found on some chemical bottles in the chemistry laboratory. These signs are called *chemical warning signs.*

What are chemical warning signs?

Chemical warning signs are safety symbols found on chemical containers, especially those used in the laboratory. The aim is for ensuring safety use and handling of that particular chemical. The list of different chemical warning signs and their implications in our daily life is provided in Table 2.2. The symbols are also found on tanks or containers that are used to carry, store or transport certain chemicals. Continers holding flammable fuels such as diesel, petrol and natural gas as well as those containing toxic chemicals normally bear warning symbols. These symbols indicate the danger (hazard) likely to be caused by the chemicals they contain if great care is not observed.

Dear learner, when performing experiments in the laboratory it is important to read the satefy signs on the chemical containers. You have to be aware whether the chemical you want to use is toxic, corrosive, flammable, oxidant, explosive or harmful. This will reduce the chance of causing accidents in the laboratory.

Table 2.2: Some of Chemical Warning Signs and their Meaning

Symbol	Meaning
Harmful or irritant 	Substances that can impair or harm your health. They are poisonous substances that do not kill immediately but have detrimental effects on the body. Substances that can irritate the body. They cause pains when in contact with the body. They are dangerours to health
Toxic 	Toxic substances include those that can poison you. These substances are dangerous and can cause death
Oxidant 	Substance which reacts easily with oxygen to cause fire
Radio active 	Substance which emits harmful radiation
Corrosive 	Substances that corrode or burn the skin surfaces. Example concentrated alkalis and acids like sodium hydroxide and slphuric acid respectively.
Flammable 	Substance that can catch fire easily eg. Petrol, methylated spirit.
Explosive 	Substances which explode rapid and emit particles at high-speed example atomic bombs

Unit Reflection

I hope you have successfully learnt from this unit. Before proceeding to the next unit, assess yourself by answering the following reflective questions.

1. What did you learn from this unit?
2. Which parts in this unit are you mostly interested? Why?
3. Does this unit help you to be safe when dealing with chemicals? Explain.
4. Which part (s) was most difficult to you? How did you overcome that difficulty?

Unit Assignment

Attempt the following questions and put your work in your portfolio.

1. Differentiate chemistry laboratory from other school facilities.
2. Explain what will happen if people working in laboratory do not adhere to laboratory rules?
3. During an experiment conducted by form one chemistry students, one of the students accidentally got burnt on his hand by spilling chemical bottle. Using the knowledge you have learnt from this unit explain the procedures you would use to give first aid to this student.
4. Identify the chemical substances found on the chemical containers with the following warning signs.
   i) Flammable
   ii) Corrosive
   iii) Explosive

Unit 3

Describing Scientific Procedures in Chemistry

Introduction

Dear learner, let us continue with our third unit of module one of chemistry that deals with scientific procedures. In studying chemistry as a science, it involves the use of systematic guidelines in order to do investigation. These guidelines are termed as scientific procedures.
In this unit, you will learn about significance of these scientific procedures, the main steps in the scientific procedures and application of the scientific procedures.

Learning Outcomes

Upon completion of this unit you should be able to:-

- Explain the concept of scientific procedure;
- Explain the importance of scientific procedure;
- Describe the steps of the scientific procedure; and
- Use the scientific procedure to carry out investigation in chemistry.

General Concept of Scientific Procedures

Dear learner, I hope you have experienced problems in your day-to-day life. For example, when you are sick you normally go to the hospital whereby a doctor asks you some questions to know what your problem is. The doctor examines you and at the same time, you are asked to go for the laboratory tests according to your explantions before the doctor prescribes medicine for you. The doctor has to be sure of what you are exactly suffering from in order to get the proper medical treatment. As you can see here, doctor follows certain steps in order to make right diagnosis and therefore, gives you the right medication.

In chemistry, we also use certain steps or guidelines to answer questions or solve problems around us. This organised set of guidelines is referred as the scientific procedure. We carry out experiments to find answers to scientific questions. *Scientific procedure is a process that scientists use to ask questions and conduct investigations to find answers to these problems.*

Scientific method is a systematic way of learning about the world around us and answering questions.

Dear learner, what is the importance of the scientific procedure? Share with your nearby friends.

Steps of Scientific Procedure

Dear learner it is important to be aware that when studying chemistry, we need some skills like problem identification, formulation of hypothesis, experimentation and observation, data collection and analysis, data interpretation and drawing conclusion. How are these skills used in studying chemistry? For more clarifications about scientific procedures join in our discussions below.

Problem identification

The first step of the scientific procedure is to identify a problem. A problem is an obstacle that makes it difficult to achieve a desired goal or objective. Identification of problem involves observation of a phenomenon. This may include observing the colour, smell, texture of a substance and so on. Observing involves the use of five senses to obtain information namely taste, touch, smell, vision and hearing. Once you identify a problem, it becomes easy to state it scientifically.

For example, you can observe how temperature affects the solubility of common salt in water. This phenomenon can be investigated scientifically.

Formulation of hypothesis

After identifying and stating the problem, you can formulate a testable hypothesis for the problem. Hypothesis is a statement. It is a prediction or proposed solution to a problem based on prior information about a chemical phenomenon. It is a logical guess about the outcome of the experiment. A hypothesis must be able to be tested. Therefore, a hypothesis is a tentative or possible explanation for an observation, phenomenon or scientific problem that need to be tested. It can be accepted, rejected or modified only after conducting an experiment to prove or disprove it.

Experimentation and observation

After making a hypothesis, the next step is to plan and conduct an experiment to test your hypothesis. To design the suitable experiment, you must find out the factors that affect the problem you want to investigate. You have to make sure that you change only one factor at a time while keeping all other conditions the same (constant). These factors we call them *variables*. Such factors include temperutre, volume, speed, light, concetration and so on. There are three types of variables.

a) Dependent variable

This is the factor that changes its value when the values of the other variables change. It is the value being measured. Eg. Solubility depends on temperature.

b) Independent variable

This is the factor that is manipulated in order to obtain different values for comparison, e.g. temperature.

c) Controlled variable (constant variable)

This is the factor that does not change or is kept constant all the time. It does not affect the result of the experiment, e.g. amount of water.

Data collection and observation

This involves collecting and recording what you have observed during the experiment.

Data analysis and interpretation

Once your experiment is complete and you have already collected data, the next step is to anaylse and interpret the collected data to see if the hypothesis is ture or false. In this step, we look at trend or patterns and explain why they occur that way. This trend will help you to make your conclusion. For example, according to the results obtained, we can say when temperature increases also solubility increases. Analysis involves comparing the results obtained at different stages of experiment and representing them in a diagram or graphs.

Drawing conclusion

This is the last step of the scientific procedure. This step concludes whether to accept or reject your hypothesis. It is important to note that accepting hypothesis does not necessarily mean it is correct. Sometimes repeating the experiment may give a different result. In other cases, a hypothesis may predict an outcome, yet you might draw an incorrect conclusion. If the results are not related to the hypothesis the experiment may be carried out again to make sure that the results obtained are reliable.

Application of the scientific procedure

The scientific procedures are used in many areas. The followings are the common areas:

i) *When carrying out experiments* –an experiment is a scientific test that is done in order to study what happens and to gain new knowledge;

ii) *In project work* – this is a planned piece of work that involves careful study of a subject or problem over a period of time so as to find information on the subject or problem; and

iii) *In a field study* – this involves doing practical work in order to find answers to problems and to test hypotheses.

Discuss any other three areas where scientific procedure is applied.

Unit Reflection

I hope you have successfully learnt a lot from this unit. Now you can assess yourself by answering the following reflective questions.

1. Do you think this unit can help you in solving your daily problems easily? How?
2. How are scientific procedures useful in studying chemistry?

Unit Assignment

Attempt the following questions and put your work in your portfolio.

1. Mention three applications of scientific processes.
2. Arrange chronologically the steps used in a scientific study.
3. List down three factors affecting experiments during scientific processes.

References

Atkinson A. (1974), *Certificate Chemisty*, Longman Publisher. Norwich, Uk.

Holderness A. & Lambert J. (1987). *A New Certificate Chemistry*, Heinemann Education. London, England.

Mahumbwe N. & Magasi S. (2008). *Comprehensive Chemistry for Secondary School Book Two*, Nyambari Nyangwine, Dar es Salaam, Tanzania

McDuell G.R & TIE (2009). *Chemistry Forms 1 & 2 Teacher's Guide*, Longman Publisher, Harlow, UK.

Sander A.J. (2019). *Comprehensive Chemistry for Secondary School Book One*, Nyambari Nyangwine, Dar es Salaam, Tanzania.

SCSU & MoEVT (2010), *Chemistry for Secondary School Book 1 & 2*, Oxford University Press (T) ltd

TIE (1995), *Secondary School Chemistry Book One*, Longman (T) ltd, Dar es Salaam, Tanzania.

TIE (1995), *Secondary School Chemistry Book Two*, Longman (T) ltd, Dar es Salaam, Tanzania.

TIE (2009). *Chemistry Forms 1 & 2 Student's Book*, Pearson Ed. Ltd, Harlow, UK.

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