THE REPUBLIC OF UGANDA

Ministry of Education and Sports

HOME-STUDY LEARNING

SENIOR 1

CHEMISTRY

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NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

UGANDA NATIONAL EXAMINATIONS BOARD



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This material has been developed as a home-study intervention for schools during the lockdown caused by the COVID-19 pandemic to support continuity of learning.

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FOREWORD

Following the outbreak of the COVID-19 pandemic, government of Uganda closed all schools and other educational institutions to minimize the spread of the coronavirus. This has affected more than 36,314 primary schools, 3129 secondary schools, 430,778 teachers and 12,777,390 learners.

The COVID-19 outbreak and subsequent closure of all has had drastically impacted on learning especially curriculum coverage, loss of interest in education and learner readiness in case schools open. This could result in massive rates of learner dropouts due to unwanted pregnancies and lack of school fees among others.

To mitigate the impact of the pandemic on the education system in Uganda, the Ministry of Education and Sports (MoES) constituted a Sector Response Taskforce (SRT) to strengthen the sector's preparedness and response measures. The SRT and National Curriculum Development Centre developed print home-study materials, radio and television scripts for some selected subjects for all learners from Pre-Primary to Advanced Level. The materials will enhance continued learning and learning for progression during this period of the lockdown, and will still be relevant when schools resume.

The materials focused on critical competences in all subjects in the curricula to enable the learners to achieve without the teachers' guidance. Therefore effort should be made for all learners to access and use these materials during the lockdown. Similarly, teachers are advised to get these materials in order to plan appropriately for further learning when schools resume, while parents/guardians need to ensure that their children access copies of these materials and use them appropriately.
I recognise the effort of National Curriculum Development Centre in responding to this emergency through appropriate guidance and the timely development of these home study materials. I recommend them for use by all learners during the lockdown.

Alex Kakooza
Permanent Secretary
Ministry of Education and Sports

ACKNOWLEDGEMENTS

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of home–study materials for Pre-Primary, Primary and Secondary Levels of Education during the COVID-19 lockdown in Uganda.

The Centre appreciates the contribution from all those who guided the development of these materials to make sure they are of quality; Development partners - SESIL, Save the Children and UNICEF; all the Panel members of the various subjects; sister institutions - UNEB and DES for their valuable contributions.

NCDC takes the responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for improvement. The comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or by visiting our website at http://ncdc.go.ug/node/13.



Grace K. Baguma
Director,
National Curriculum Development Centre

ABOUT THIS BOOKLET

Dear learner, you are welcome to this home-study package. This content focuses on critical competences in the syllabus.

The content is organised into lesson units. Each unit has lesson activities, summary notes and assessment activities. Some lessons have projects that you need to carry out at home during this period. You are free to use other reference materials to get more information for specific topics.

Seek guidance from people at home who are knowledgeable to clarify in case of a challenge. The knowledge you can acquire from this content can be supplemented with other learning options that may be offered on radio, television, newspaper learning programmes. More learning materials can also be accessed by visiting our website at www.ncdc.go.ug or ncdc-go-ug.digital/. You can access the website using an internet enabled computer or mobile phone.

We encourage you to present your work to your class teacher when schools resume so that your teacher is able to know what you learned during the time you have been away from school. This will form part of your assessment. Your teacher will also assess the assignments you will have done and do corrections where you might not have done it right.

The content has been developed with full awareness of the home learning environment without direct supervision of the teacher. The methods, examples and activities used in the materials have been carefully selected to facilitate continuity of learning.

You are therefore in charge of your own learning. You need to give yourself favourable time for learning. This material can as well be used beyond the home-study situation. Keep it for reference anytime.

Develop your learning timetable to ca ter for continuity of learning and other responsibilities given to you at home.

Enjoy learning

Theme: Introduction to Chemistry and Experimental Techniques

Topic One: Chemistry and Society

After going through the activities in this topic, you should be able to:

i) know the appropriate activities to explain the distinct nature of chemistry.
ii) understand why chemistry is studied and how it overlaps other subjects such as biology, physics, mathematics and geology.
iii) understand the importance of chemistry and relate knowledge of chemistry to relevant careers.
iv) know the contribution of chemistry to the Ugandan economy.

Instruction

You are expected to have the following materials for every lesson: a chemistry notebook, a pen, a pencil, a ruler and a chemistry textbook.

Lesson One: The Nature of Chemistry

By the end of this lesson, you should be able to explain the distinct nature of chemistry.

Introduction

In Primary Seven, you learnt about integrated science. What you learnt in integrated science is going to be helpful in chemistry. In secondary school, integrated science is separated mainly into three branches namely:

- **Biology**: this deals with the study of living things.
- **Physics:** this deals with the relationship between energy and matter.
- **Chemistry** (you will find out about this in a while).

In this lesson, you will find out what chemistry deals with and also the common things we use in everyday life that are made with the knowledge of chemistry, by carrying out the given activities.

Activity 1.1: Finding out things we use in everyday life

1. Identify the common things we use in everyday life that you think are made of chemicals.
2. Write your findings in your chemistry notebook.

Activity 1.2: Finding out how products used in everyday life are made
Instructions

a) Look for the following products or items and assemble them in one place.
Bar soap, Vim, toilet paper, Jik, soda, tooth paste, pens, detergent (such as OMO, Nomi, Sunlight), Mineral water bottle, a piece of cloth, a comb, shoe polish, a book, tomato sauce, Blue Band.

b) Critically observe the products or items and answer the given questions. Write your answers in the chemistry notebook.

Questions

1. Give at least one use of each of the products or items.
2. What knowledge do you think is used to make these products?
3. Name any other products produced using the knowledge of chemistry.

Summary

Chemistry is all around us. The common products or items in pharmaceuticals, cosmetics, plastics, foods and beverages, soaps and detergents, water treatment, alcohol preparation at home, all require the knowledge of chemistry.

Lesson Two: The Meaning of Chemistry

Introduction

Chemistry deals with the study of materials that make up our world. Carryout the following activities to explore the meaning of chemistry further.

Activity 2.1: Exploring the meaning of chemistry
Instruction

a) Burn a piece of paper using a lighted matchstick. Observe and write the changes that happen to the paper during the burning.

b) Now consider the following processes that take place in everyday life and answer the questions that follow.

- the rusting of a machete (*panga*)
- the boiling of water
- the rotting of fruits

Questions

i) What changes take place in each of the given processes above?
ii) What are the necessary conditions for each of the above changes to take place?
iii) Name any other processes in which substances change from one form to another.

Summary

The changes you have just observed and many others show what the study of chemistry is about. Therefore, *chemistry is the study of matter and the changes that occur to substances under different conditions*.

Task



1. What careers require the study and knowledge of chemistry?
2. Write the answers in your chemistry notebook.

Lesson Three: Why is Chemistry Studied and how it Overlaps other Subjects?

Activity



Using relevant chemistry textbooks and the Internet, give more reasons why chemistry should be studied and how it relates with other subjects. Write your findings in your chemistry notebook.

Chemistry helps us to:

- understand what different materials or substances are made of and their properties: some are poisonous, corrosive, toxic and many others.
- explain the effects of chemicals on the environment, hence it helps us learn how to conserve and protect our environment.
- get knowledge to advance in science and technology for better and quality human life.
- acquire knowledge relevant in making new materials or products which are relevant and useful in our everyday life, such as making food supplements, plastics, cosmetics, dental creams, insecticides and herbicides, and distillation of crude oil, manufacture of soaps and detergents, etc.
- get knowledge and skills of how to extract and use materials from the earth such as gold, copper, oil and gas etc.
- tell how all the other science related subjects require some knowledge of chemistry.

Lesson Four: Importance of Chemistry in Everyday Life

Introduction

There are many examples of chemistry in everyday life, which show how important chemistry is.

Activity 4.1

Use the given words to complete the following statements by filling in the blank spaces. Write in your chemistry notebook.
(digestible, our bodies, nutrients, detergents, food, dishes, useful, dirt, microorganism, absorb, chemical)

1. Digestion relies on chemical reactions between……. and enzymes to breakdown large food substances into……that the body can……...
2. Soaps and …….. are chemical substances that dissolve …….. when we wash our clothes,…….. and……..
3. Drugs are a product of chemistry knowledge and are …….. in the treatment of diseases.
4. Cooking is a …….. change that alters food to make it more palatable, kills dangerous…….. and makes food more ……

Follow-up Activity



Using relevant chemistry textbooks and the Internet, give more ways of how chemistry is important in everyday life and write your findings in your chemistry notebook.

Lesson Five: Contribution of Chemistry to the Economy of Uganda

Introduction

Currently, there are many industries in Uganda that are contributing greatly to her economy. In the following activity, you will find out the different ways in which knowledge of chemistry contributes to the economy of Uganda.

Activity 5.1

Using the knowledge of common industrial products in our country and their uses, ask older people around you, or use chemistry textbooks, magazines, newspapers and the Internet to find out how chemistry contributes to the economy of Uganda. Base your research on the fields of medicine, industries, transport and agriculture. Write a short report in your chemistry notebook.

Topic Two: Experimental Chemistry

After going through the activities in this topic, you will be able to:

i) know laboratory rules and regulations and the action required in the event of an accident.
ii) name and use laboratory equipment.
iii) explain the scientific method used to carryout investigations and the importance of risk assessment to keep self and others.
iv) know how to purify a mixture given the information about the substances involved.
v) identify substances and their purity by using their melting and boiling points.

Lesson One: Laboratory Rules and Regulations

Introduction

At home, we carry out different activities in special places, for example:

- Meals are prepared in a special place called a……
- Bathing is done in a special place called ……..
- Urinating and defecating are done in a special place called atoilet.

Chemistry is a laboratory science which is studied by carrying out experiments. The experiments are carried out in a special room called a **laboratory.**

In the kitchen, there are regulations and guidelines we follow to avoid danger and accidents. Also, in the laboratory, there are rules and regulations which should be followed when carrying out experiments. Do you think there are toilet rules? What happens when you break them?

Activity 1.1

Instruction

Read the passage below about the experience of a Senior One student of X College and attempt the questions that follow.

Mukasa, a Senior One student, was required to prepare a salt solution from the laboratory. He wrapped his sweater around his waist, picked up his books and ran to the laboratory. On entering, he knocked a table with glassware, spilling a colourless liquid. His books fell down into the pool of the colourless liquid. The glassware fell on the floor and broke. Mukasa tried to collect the broken pieces of glass. The broken pieces cut his fingers while his books were burnt by the colourless liquid. In pain, he rushed to wash his fingers using water.In the process, the sweater that was around his waist pulled down a beaker of hot water from another table and itpoured on his leg. Mukasa was rushed to a clinic and never carried out his experiment.

Questions

i) From the above passage, what errors were committed by Mukasa?
ii) How could Mukasa have avoided the accident?
iii) Using the above story, suggest some rules that should be enforced to ensure safety in the laboratory?

Lesson Two: Safety in the Laboratory

Introduction

The common dangers or accidents in the laboratory include: fire, acid burns and scalds, falls etc. Therefore, there is need for safety measures or precautions.

Activity 2.1
Observe the pictures below carefully and answer the questions that follow.



Questions

i) What do you see in each of the pictures above?
ii) Of what use is the equipment in pictures B, D, E and G?
iii) Which activity is taking place in pictures A, C and F?



Follow-up Activity



1. Explain how you would deal with a fire outbreak:
a) at home.
b) in the school laboratory.
2. Produce a set of guidelines to be followed.

Summary

When in the laboratory, we should follow the given rules and regulations to avoid accidents. The following rules and regulations are important to note amongst the many:

1) Do not run or play when in the laboratory.
2) Do not wear loose attire in the laboratory.
3) Not all colourless liquids found in the laboratory are water.
4) Never perform any experiments without the guidance and supervision of a teacher or laboratory assistant.
5) Any flames not in use should be put off.
6) The laboratory tables should not be crowded with chemicals and books. Keep them clean.
7) If any chemical spills on the skin, wash it off immediately with a lot of water.
8) Do not take any food or drinks in the laboratory.
9) Read container labels carefully to avoid mixing wrong chemicals.
10) Report all injuries and accidents to the teacher or the laboratory attendant.

Task



Safety symbols are signs found on the labels of containers or bottles containing dangerous chemicals.

Observe the given safety symbols and identify them, or give their meaning. Write the answers in your chemistry notebook.





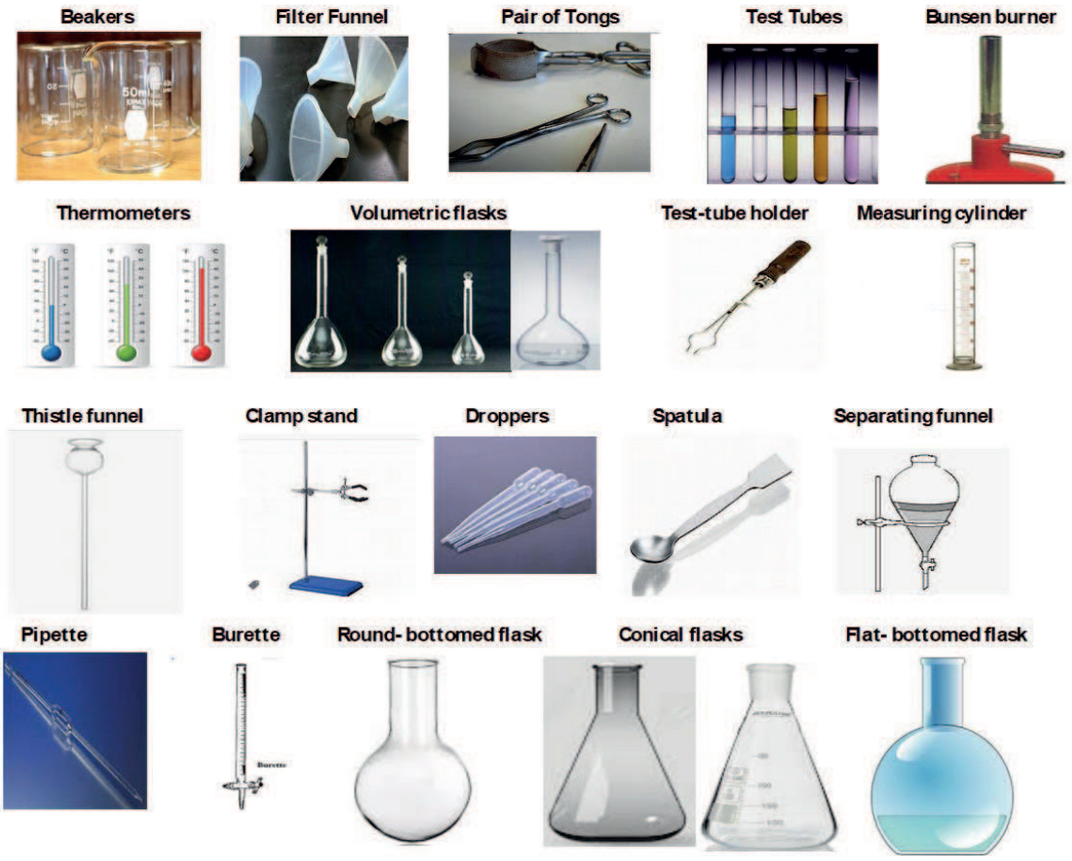


Lesson Three: Laboratory Apparatus and their Uses

Activity 3.1: Identifying apparatus and their uses

Observe the given laboratory apparatus and their uses.

Apparatus:



Use of the apparatus

1. Used in preparation of gases when heating is involved.
2. Used in mixing reagents.
3. Used in measuring volumes of liquids.
4. Used for holding test tubes and boiling tubes during hearting.
5. Used for separating immiscible liquids.
6. Used for scooping small amounts of substances.
7. Used during filtration (separating liquids from solids) and directing liquids into containers.
8. Used for heating substances.
9. Used for mixing small volumes of reagents and heating small volumes of liquids.
10. Used for holding small volumes of substance and heating small quantities of substances.
11. Used for measuring exact volumes of liquids during titration.
12. Used for measuring a fixed volume of a liquid.
13. Used for holding reagents, mixing solutions and sometimes heating.
14. Used for gas preparation at room temperature, holding liquids and mixing solutions.

Task:



Match the given laboratory apparatus above with their correct uses and write in yourchemistry notebook.

Lesson Four: Scientific Method of Investigation

Introduction

In science,the steps used to collect information or facts and drawing conclusions is referred to as ***thescientific method*** or the ***scienceprocess.*** In the following activity you will learn about the scientific method used in the study of chemistry**.**

Activity 4.1 Preparation of a fruit juice

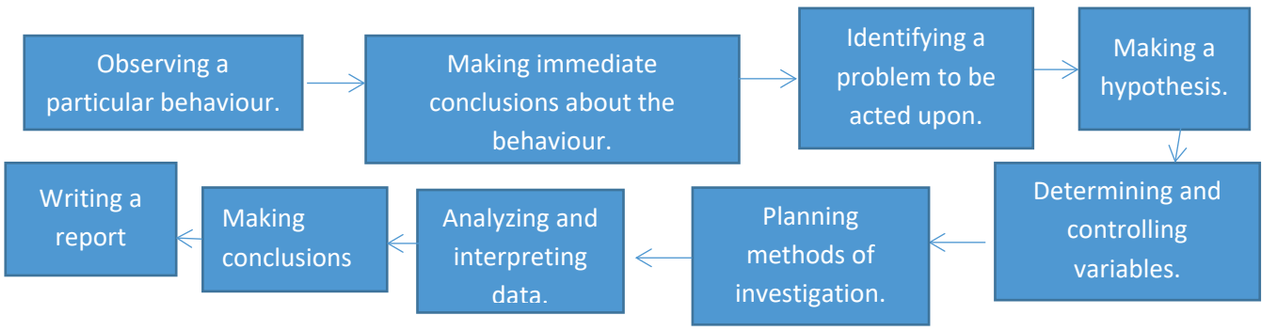
Look for one of these fruits and prepare juice: oranges, mangoes, passion fruits, lemons, pineapple.

Questions

1. State the aim of the activity.
2. List the materials required for the activity.
3. Mention the steps you have followed when preparing the juice.
4. What safety measures did you put in place when preparing the juice?
5. What are the possible risks faced when preparing the juice?

Summary

What you have just carried out is called ***the scientific method*** and it involves the following steps



Project work:



Identify a suitable activity where scientific process can be applied and write in your chemistry notebook the steps involved in the chosen activity.

Lesson Five: How to Purify a Mixture

Introduction

In everyday life, the substances we use are usually in mixture or impure form. Many mixtures contain useful substances mixed with unwanted substances.

Chemists have developed methods of separating pure compounds from complex mixtures.

Separation of mixtures depends on the substances in the mixture, the properties of the substances present and whether the substances are solids, liquids or gases.

A pure substance is one which contains particles of only one substance, whereas ***a mixture*** contains two or more substances that are physically combined.

Activity 5.1

Study the given table and fill it correctly.

No.	Name of substance	Pure substance or mixture	Components of the mixture
1	Distilled water	Pure substance	-
2	Rice cooking in a pot	mixture	Rice, water and salt
3	Salty water		
4	White sugar		
5	Sweet tea		
6	Muddy water		
7	Black coffee		

There are many techniques that can be used to separate mixtures and obtain pure substances, and these include:filration, evaporation, simple distillation, fractional distillation, using a separating funnel and chromatography.

1.Filtration technique

Activity 5.2

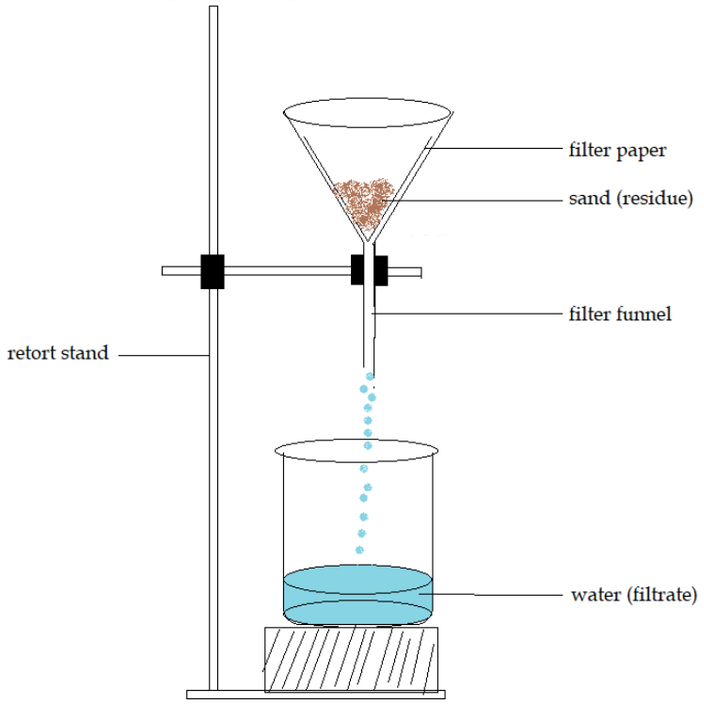
Instructions

1. Get two cups, tea leaves, sugar, spoon and a strainer or sieve.
2. Make a cup of tea.
3. Pour the tea into another cup or container through a strainer or sieve.

Questions

i) Name the process that you have just carried out in step (3).
ii) What other mixtures can be separated using this method or process?

In the laboratory, filtration can be carried out to separate mixtures.
Observe the given diagram carefuly and answer the questions that follow.



Questions

1. What do you observe in the above diagram?
2. Identify and name the apparatus used in the diagram.
3. Which mixture is being separated in the above experiment?
4. Give examples of other mixtures that can be separated by filtration technique.

Summary

The **filter paper** contains holes which are large enough to allow the molecules of water to pass through but not the sand particles.Therefore,it acts as a sieve. The sand is trapped on the filter paper.The trapped sand iscalled the **residue** and the water that has passed through the filter paper as the **filtrate**.

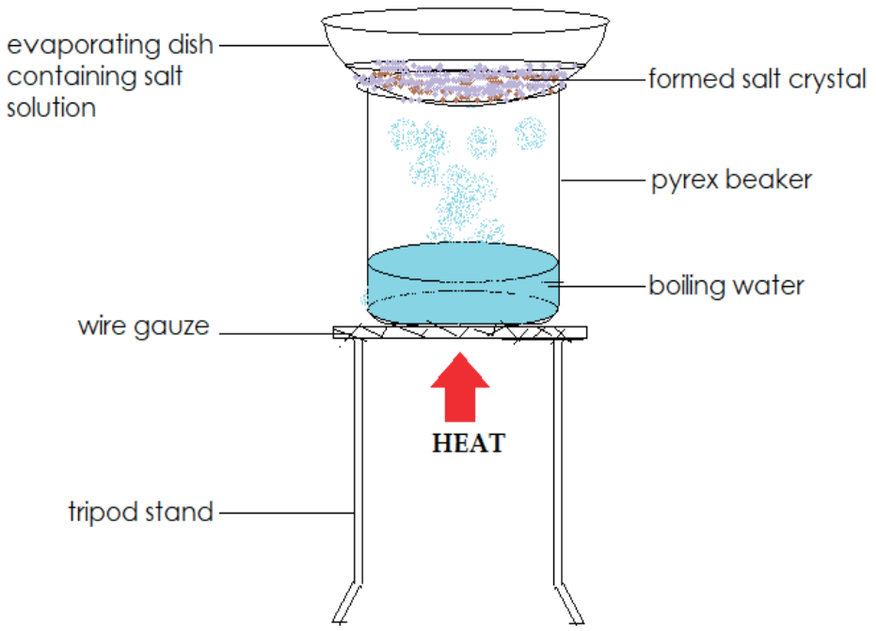
2. Evaporation technique

Introduction

Evaporation is a technique used to separate soluble salts from their solutions.

Activity 5.3Obtaining salt from salty solution

Observe the diagram given and attempt the questions that follow.



Questions

1. Name the process taking place in the diagram shown above.
2. Name the components in the mixture/solution.
3. Identify and name the laboratory apparatus used in the experiment.
4. Which equipment can you use at home to carry out the same experiment?

Summary

The salty solution is heated slowly so that the water evaporates completly and leaves the salt behind.



Follow-up Activity

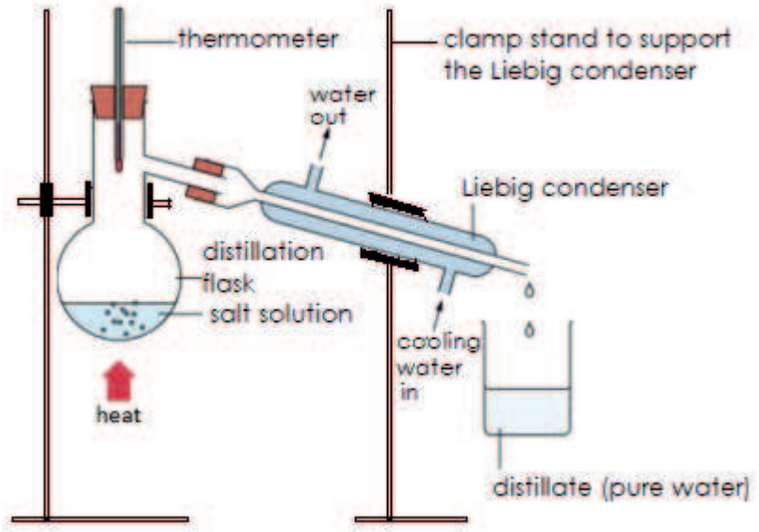
Common salt, chemicaly known as sodium chloride, is an essential raw material for the chemical industry, especially in the manufacture of plastics, margarine, soap, detergents and dye-stuffs. Use relevant chemistry textbooks orsearch the Internet for information on how salt is obtained from lake Katwe in western Uganda.

Lesson Six: **Simple distillation technique**

This technique is used to obtain a solvent from a solution. For example, water can be obtained from salty water by simple distillation.

Activity 6.1

Observe the diagram of the apparatus given and attempt the questions that follow.



Questions

1. Name the components of the mixture.
2. Identify and name the laboratory apparatus used in the experiment.
3. What is the role of the thermometer in the experiment?
4. State the function of the condenser in the experiment.
5. Where is the salt (solute) and water (solvent) at the end of the experiment?
6. Which other mixtures can be separated by the same method?

Follow-up Activity

Use the words given in the circle to fill in the missing words. Some words may be used more than once.

Mixture, salt, water, solvent, crystallisation, distillation, evaporation

A salty solution is a …….. containing salt dissolved in ……

Water is known as the …… and ……is known as the solute.

In both …… and crystallisationmethods, it is only the salt that is separated.

If larger and better shaped crystals of salt are required, then the method …..must be used.

If both salt and water are to be obtained, then the …… method must be used.

Summary

During a simple distillation, asolution in aflask is heated until it boils. The steam rises to the condenser where it condenses to water. The salt is left in the flask and water is collected in the beaker or conical flask.

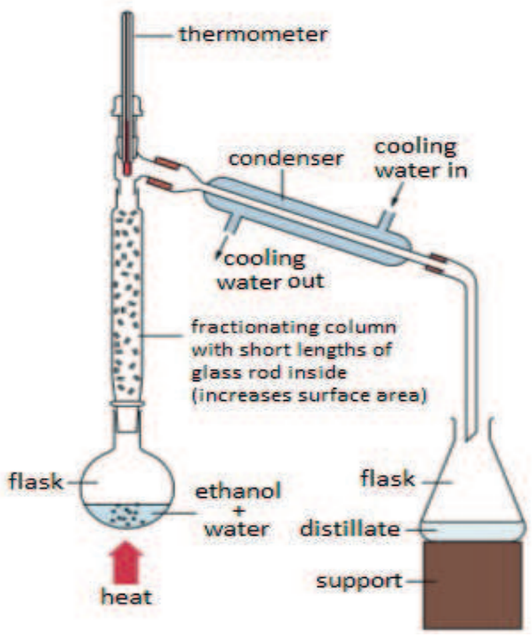
Lesson Seven: **Fractional distillation technique**

Introduction

This method is used to separate miscible liquids; for example, water and ethanol.*Miscible liquids* are liquids which dissolve in each other in all proportions to form a uniform mixture.

Activity 8.1

Observe the diagram of apparatus below and attempt the given questions.



Questions

1. Identify and name the laboratory apparatus used in the experiment.
2. What is the role of the fractionating column in the experiment?
3. Where is the ethanol and the water at the end of the experiment?
4. On which principle does fractional distillation work?
5. Name any other mixture that can be separated by fractional distillation technique?

Follow-up Activity



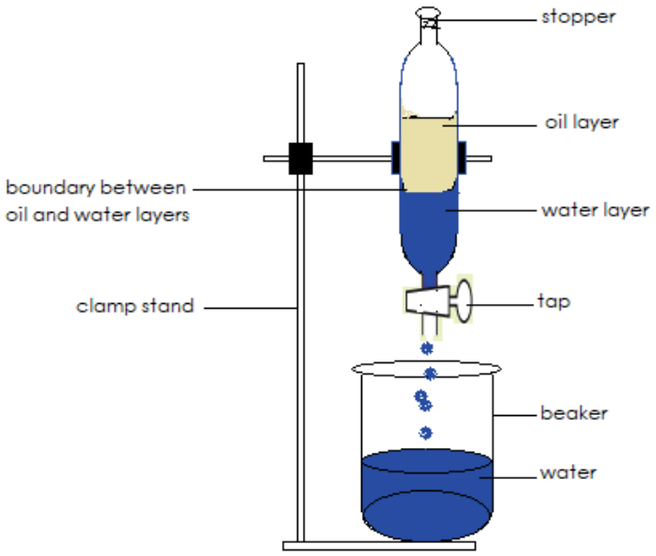
Using the Internet and relevant chemistry textbooks, look out for the industrial application of fractional distillation or visit crdible cities nearby. Write your findings in the chemistry notebook.

Lesson Eight: **Using a separating funnel**

Introduction

This technique is used to separate immiscible liquids; for example,oil and water; water and paraffin.*Immiscible liquids* are liquids which when mixed, in whatever proportions, form distinct layers.

Activity 9.1
Study the diagram of the apparatus for the separation of a mixture of oil and water. Attempt the questions that follow.



Questions

1. Name the components of the mixture.
2. Identify and name the laboratory apparatus used in the experiment.
3. Name any other mixtures that can be separated by this method.

Summary

The use of a separating funnel technique works on the principle that the liquids to be separated are immiscible and have different densities.

Lesson Nine: **Chromatography technique**

Introduction

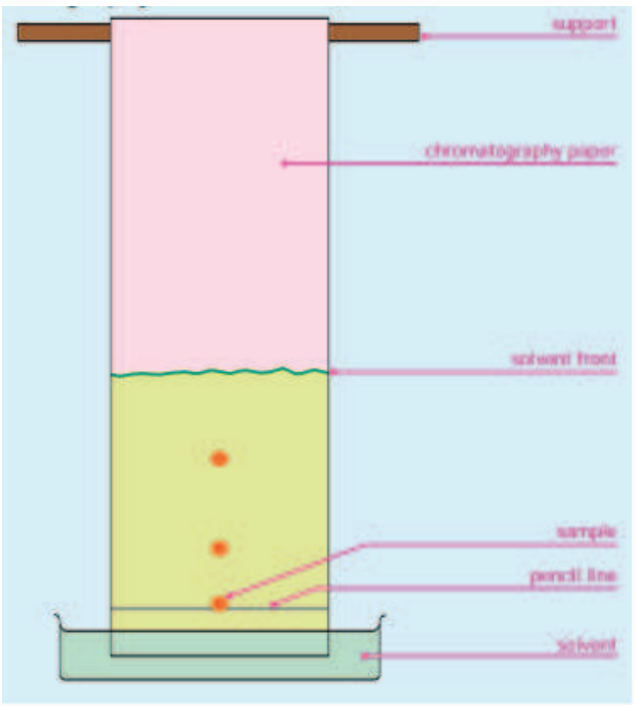
Chromatography technique is used to separate and identify two or more solids that are soluble and coloured. It operates on the principle of substances having different rates of movement over a stationary phase i.e. usually a paper

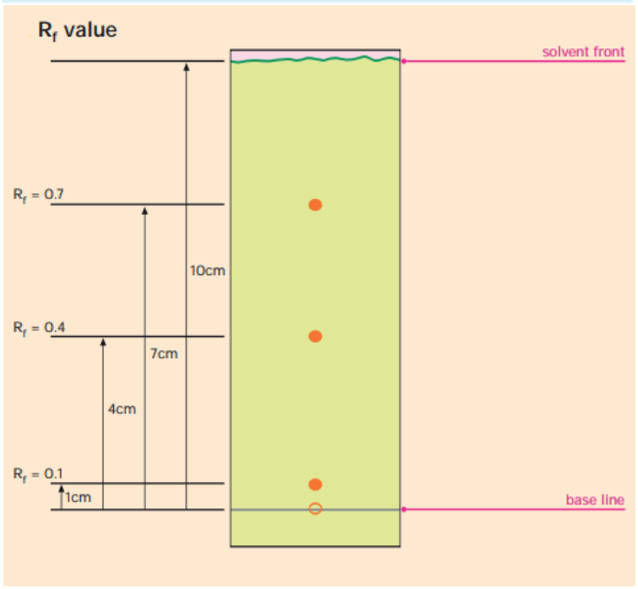
Activity 10.1

Study the diagrams given, showing the separation of different components in a sample of black ink.

Procedure for the experiment

A spot of black ink is put onto a piece of chromatography paper or filter paper and left to dry. This paper is then put in a suitable solvent such as ethanol.





Questions

1. Identify and name the laboratory apparatus used in the experiment.
2. State the principle on which separation by chromatography operates.
3. Name any other mixtures that can be separated by chromatography technique.

Follow-up Activity

1. Using the internet and relevant chemistry text books, complete the table below.

No.	Name of technique	Principle of operation	Examples of mixtures	Industrial application
1	Crystallisation			
2	Fractional crystallisation			
3	Magnetic separation			

2. a) Define the following terms:
   i) A suspension
   ii) An alloy

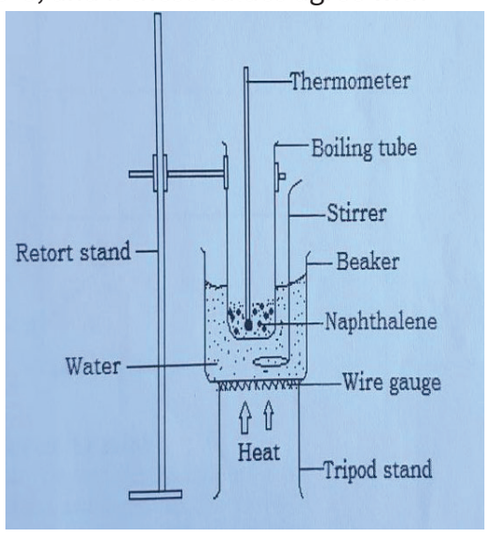
b) State the components of the given alloys.

No.	Name of alloy	Components
1	Brine	Common salt and water
2	Brass	
3	Solder	
4	Bronze	
5	Duralumin	
6	Steel	

Lesson Ten: Identifying Purity of Substances by Using their Melting Points and Boiling Points

Introduction

Pure substances can be identified by using their physical properties,such as melting point, freezing point, refractive index and density. These physical properties determine the degree of purity to a very high accuracy. The *experimental results* of these properties are compared with the *standard values e.g. 1 atmosphere, 25°C*, and if these values agree with the experimental ones, then the substance being investigated is said to be *pure*.



Activity 11.1 Determination of melting point

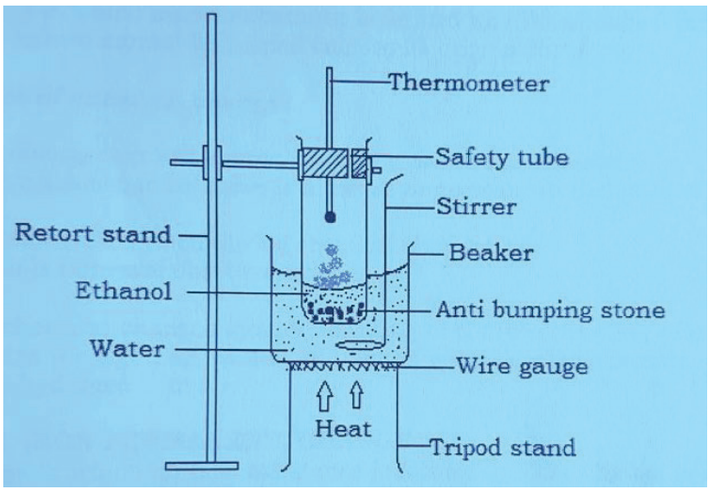
In the experimental diagram below, the **melting point** of a solid is being determined. The solid is placed at the bottom of a melting point tube and the tube is placed in a beaker containing glycerol. The beaker containing glycerol is gently heated with continuous stirring and the melting point tube is carefully watched. After sometime, the solid begins to melt and the corresponding temperature is read off as the melting point of the solid.

Questions

1. Identify and name the laboratory apparatus used in the experiment.
2. What is the role of the thermometer in the experiment?
3. What can you say about the solid if the temperature obtained is:
   i) higher than the standard melting point?
   ii) lower than the standard melting point?
   iii) same as the standard melting point?
4. Define melting point.

Activity 12.2 Determination of boiling point

The liquid whose boiling point is to be determined is placed in the boiling tube. The liquid is heated gently to its boiling point using glycerol. The highest constant temperature of the boiling liquid is read on the thermometer and this is the boiling point of the liquid.



Questions

1. Identify and name the laboratory apparatus used in the experiment.
2. What can yousay about the liquids if the temperature obtained is:
   i) higher than the standard boiling point
   ii) lower than the standard boiling point
   iii) same as the standard boiling point.
3. Define boiling point.

Theme: Particle of Matter

Topic Three: States and Changes of States Of Matter

After going through the activities in this topic, you willbe able to:

i) state that matter is any thing which ocupies space and has mass and can exist in solid, liquid, gas and plasma forms.
ii) tell that solids, liquids and gases have different properties including shape, pouring and compressing.
iii) define the kinetic theory of matter and use it to explain particle arrangement, interparticle forces, movement of particles and the properties of solids, liquids and gases.
iv) explainthat a change from one state to another involves either heat gain or heat loss.

Note:

For every lesson have a chemistry notebook,a pen, a ruler, a pencil and a chemistry textbook.

Lesson One: Matter and its Properties

Introduction

In your primary integrated science class, matter was defined as anything which occupies space and has mass. In chemistry, we shall delve deeper into what matter is and how it behaves in different conditions. Matter is the word used to cover all the substances and materials from which the whole universe is made.

There are many millions of different substances known and these are classified as solids, liquids or gases. These are *the three states ofmatter*.

Activity 1.1 Identifying the states of matter

Look around your home.Identify and name the substances that are solids, liquids and gases. Use a table to write in your answers.

Solids	Liquids	Gases

Task



Use the Internet to research a state of matter called **plasma**.

The kinetic theory helps us to explain the behaviour of matter. It states that matter is made up of tiny invisible particles which are in constant motion and have different sizes. The three states of matter have different properties and their particles are arranged differently. In the following activity, you will understand the properties of each state of matter.

Activity 1.2 Properties of the states of matter

Copy the table given below in your chemistry notebook.

Solids e.g salt, sand, metal	Liquids e.g. water, paraffin	Gases e.g. air, oxygen, carbon dioxide

Statements (i) to (iii) below describe the properties of a solid, a liquid and a gas. Put each statement into the appropriate column in the table you have copied in your notebook.

i) Has a fixed shape and volume, particles are closely packed, vibrate about a fixed position and cannot be compressed.

ii) Has no fixed shape or volume, particles are far apart from each other, move randomly speed out and occupy the whole space of its container. It can be compressed into a smaller volume.

iii) Has no fixed shape, takes up the shape of the container in which it is placed. The particles are relatively packed. It has a fixed volume and cannot be compressed.

Lesson Two:Arrangement of Particles in the Three States of Matter

Introduction

The three states of matter have their particles arranged differently. After looking at their properties, these can help you understand how particles are arranged.

In the following activity you will find out how the particles of the states of matter are arranged.

Activity 2.1 Study and observe carefully the pictures shown below

A **B** **C**







Questions

1. Which picture best shows the arrangement of particles in:
   i) solid
   ii) gas
   iii) liquid

2. Draw three rectangles and label them as solid, liquid and gas.

Draw small circles within each of the rectangles to represent the particles of the given state of matter. Refer to the properties of each state of matter to draw the particles.

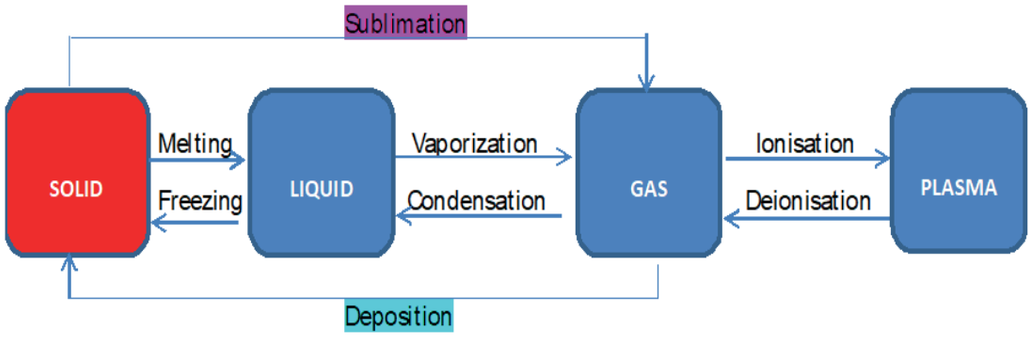
Solid Liquid Gas



3. Solids and liquids can not be compressed as much as gases. Explain why.

Follow–up Activity

Look at the diagram below, study it carefuly and give responses to the questions that follow.



Questions

1. How many states of matter can you identify in the diagram? Name them.
2. Which of the states of matter do you think occurs naturally on earth and which one(s) does not?
3. Give atleast three examples of the states of matter which occur naturally on earth and two which do not occur naturally.

Take note:

Place water in the ice cube tray for use in the next lesson.

Lesson Three: Changes in States of Matter

Introduction

Substances in any of the three states of matter can change from one state to another. A change in state of matter means a change in structure and properties of matter. Heating or cooling subtances brings about change in state.

In the following activity, you will find out more about how states of matter change to other states.

Activity 3.1 Change of state for water

You will need the following: three small containers of different shapes, ice cubes, water, a glass, a small saucepane and a source of heat.

Instructions

1. Place some ice cubes in a glass and observe what happens to them after ten minutes. Write your observation in your chemistry notebook.
2. Get the water from list of what you need, put it in the saucepan and boil it. What do you observe?

Questions

From the activity you have just carried out:

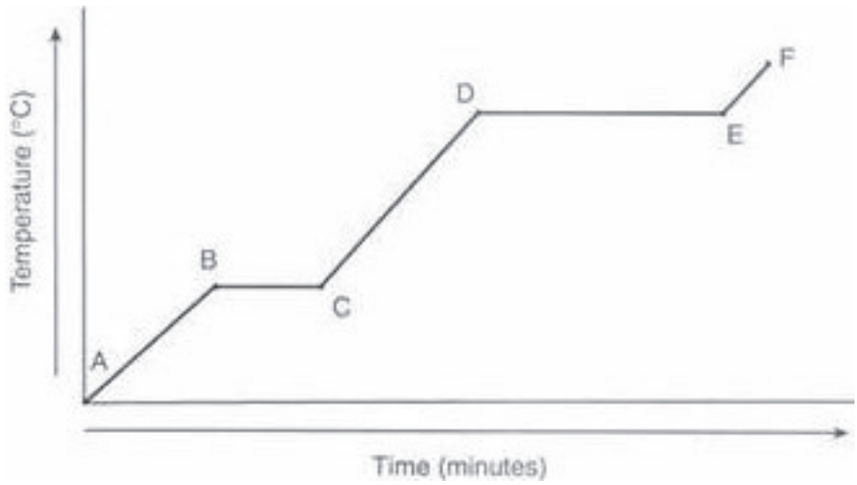
1. is it possible for matter to change from one state to another?
2. when does matter change from one state to another?
3. what causes the ice cubes to change to liquid water?
4. what point has water reached when it turns to ice cubes?
5. what occurs when liquid water turns to gaseous water?
6. what happens when liquid water reaches it’s boiling point?
7. in which state of matter are particles moving fastest?
8. in which state of matter are particles moving lowest?

Summary

Matter changes states through heating or cooling and this occurs when it reaches its boiling point, melting point or freezing point. The kinetic theory of matter helps us to undertstand other properties of matter and to explain particle arrangement of the different states of matter.

Follow-up Activity

1. Study the graph of temperature against time carefuly and describe how the states of matter change.



Questions

1. a) A-B shows solid ice. What do you think is happening to the temperature, energy of particles and movement of the particles?
   b) State what happens between:
      i) B-C
      ii) C-D
      iii) E-F
   c) D-E shows liquid water. What is happening at this stage?

2. Using the knowledge of the properties of solids, liquids and gases, information from the Internet and relevant chemistry textbooks, explain how the following phenomena occur.
   a) Rain formation
   b) Drying of clothes
   c) Making a cup of tea
   d) Cooling effect of evaporation

Lesson Four: Diffusion as Evidence of Movement of Particles

Introduction

Diffusion is one way to explain that matter contains tiny invisible particles that are in constant motion. *Diffusion is the movement* of *particles from a region of their high concentration to a region of their low concentration*. Diffusion occurs in gases and liquids but not in solids except whenthe solid is dissolved in water.This is because the particles in solids are closely held together in a rigid shape.

In liquids, diffusion is much slower than in gases. Heavy gases diffuse much slowly than lighter gases. All this is due to the speed at which the particles move.

Activity 4.1: Diffusion of tea leaves in water

You need the following:Tea leaves, two glasses, hot water, cold water, straws.

Instructions

1. Get two glasses and label them A and B.
2. In glass A, put half a litre of hot water.
3. In glass B put half a litre of cold water.
4. Use a straw to carefuly drop tea leaves to the bottom of each of the glasses A and B and observe carefuly what happens.
5. Leave the experiment to stand for five minutes.

Questions

1. What do youobserve in each of the glasses after five minutes?
   Glass A……
   Glass B……..
2. Name the process that has taken place in the glasses.
3. State the role of the straw in the experiment.
4. State the purpose of the experiment.

Summary

Tea leaves are in solid state but they dissolve in water and the water particles which are in constant random motion make the tea leaves gradually spread upwards and are finally uniformly distributed throughout the solution. The process taking place is called *diffusion*.



Follow-up Activity

1. Ask your parents or guardians to help you with a tin of perfume or air freshner and spray it in one corner of a closed room. Then stand in the other corner and carefuly observe what happens after a few minutes.
2. Explain why diffusion is faster in gases than in liqiuds and solids.
3. Write your observation in your chemistry notebook.

Lesson Five: Brownian Motion as Evidence for Movemnt of Particles

Introduction

Read about Robert Brown whose name bears this reference. Brownian motion refers to the random movement of particles in a liquid or a gas. This is evidence that particles in liquids are in constant motion.

When fine pollen grains are placed on the surface of water, they are observed to be in a state of constant random motion. The random movement of the pollen grains is caused by collisions between the moving invisible water particles and the pollen grains.

Activity 5.1

Instructions

1. Lock yourself inside a dark room, close the door and windows.
2. Flash a torch from one end to another.
3. Observe and try to touch what is in the beam of light.

Question

1. what do youobserve?
2. Write your observation in your chemistry notebook.

Summary

You may have observed in **Activity 5.1** above that there are some dusty particles in rays of light that you cannot touch but you see them moving randomly and in a zigizag manner. This is evidence that air contains invisible particles which collide with the dust particles, causing them to move in a random.

Topic Four: Using Materials

After going through the activites in this topic, you willbe able to:

i) classify materials used in everyday life into natural and synthetic groups, and how this affects their use.
ii) relate the physical properties of polymers to their uses in everyday life such as in building , fabrics and fabricating utensils used in homes.
iii) identify the molecular structures of materials and relate this to their use.
iv) explain that polymers are useful long chain molecules made by both natural and sythetic processes.
v) explore how common materials can pollute the environment and which materials can be recycled.
vi) explain how heating changes the structure and properties of some materials.

Note

Prepare the following materials for every lesson:a chemistry notebook, a pen, a pencil, a chemistry textbook.

Lesson One: Classifying Materials

Introduction

When we take a look around our surroundings, all the items around us are made of a particular material. These different materials are either obtained from **natural substances** or they have been created artificially using sciencehence called **synthetic materials.** The wayswe use these different materials depends on the properties of the materials.

Activity 1.1Classifying substances as natural and synthetic materials.

Instructions

1. Collect the following items: a piece of wood, a piece of paper, sisal fibres, polythene, plastics, glass, clay, rubber, concrete, pottery, metal and different pieces of cloth made from fabrics such as wool, silk, polystyrene, nylon, cotton, polyster.
2. Carefuly observe the materials that youhave collected.
3. Classify the materials into natural and synthetic materials.
4. Record your observations in the table as shown bellow.

No.	Natural material	Synthetic material
1		
2		

Summary

You mighthave observedand noticed that the materials we use in everyday life occur naturally butsome are human-made. *Natural materials are those which occur naturally* and those *that are made by humankindare classified as artificial or synthetic or human-made.*

Lesson Two: Investigating what Happens to Materials on hammering or heating

Introduction

You are going to hammer or heat the different materials and observe what happens to them. Different materials behave differently on hammering or heating.

Activity 2.1Heating and hammering different materials

Instructions

1. Collect the following items: wood, concrete, glass, paper, plastics, a piece of cloth, pottery, rubber, metal, a hammer (stone), a brick and a source of heat.
2. Carry out the following activity outside your house.
3. Take each item and hammer or hit it (wrapping items to be hammered with a piece of cloth prevents pieces from jumping into your eyes) and observe what happens. Record your observation in a table.
4. Heat a small piece of each item using the source of heat.
5. Record your results in a table.

Table of results

No.	Material	Observation when hit with a hammer	Observation when heated

Summary

When materials are hit with a hammer, some of them, such as concrete and glass, crumble or break into small pieces. Others like wood are flattened into long fibres, and yet others like rubber are not affected. When the materials are subjected to heat, some like paper, fibre and wood burn, others like plastic melt, while others like concrete are not affected by heat.

Lesson Three: Physical Properties of Materials

Introduction

The difference in how materials behave when subjected to great force or heat is detemined by the structure of the particles making them. We learnt that matter is made up of very tiny particles and between these particles are attractive forces. The particles that makeup matter could be atoms or molecules. When atoms join together they form different kinds of bonds.

Observe and study the given table below showing examples of bonds and properties of materials with these bonds.

No.	Bond	Properties of material with this bonds
1	Ionic	Crystalline solids that are easily broken
2	Covalent	Gases, liquids or solids with a low melting point
3	Covalent giant structure	Very hard solids with high melting points such as sand
4	Metallic	Ductile, malleable solids that are good conductors of heat and electricity

Materials that break easily (brittle)

Examples of materials that break easily include concrete, glass and ceramic.

a) Concrete

This is one of the useful materials made by humankind. Its made out of sand, gravel and cement.





Cement has crystals which start forming when water is added to it and they become stronger if the concrete is allowed to dry out slowly. This is why it's a good idea to wet concrete with water for several days after it has been used to make a structure. Because concrete is made out of crystals, it is quite easily broken with a hammer.Crystalline substances are easily broken.

Questions

1. How is concrete made?
2. Suggest any three properties of concrete.
3. State any four uses of concrete.

b) Glass

Glasses are usually hard, brittle, transparent materials. Glass is a non-crystalline solid and the molecules in it are not arranged in any particular pattern.



Glass has a structure like that of a liquid but the molecules are too large to move around, hence glasses are liquids that behave like solids. The most common type of glass is made *by heating limestone (calcium carbonate) with sodium carbonate and sand (silicondioxide) in a furnace*. The three substances melt together and run out from the furnace as a clear liquid which is then allowed to cool as a flat sheet of glass. This can be moulded into any shape before it cools and turns solid. Other substances, particularly metal oxides, can be added to make different kinds of glass.

Questions

1. What are the componets of the most common type of glass?
2. Explain how glass is manufactured.
3. Is glass a liquid or a solid? Give a reason for your answer.
4. Mention any three properties of glass.
5. What type of glass do presidents' cars have?

c) Ceramics

These are objects made out of soft clay and then hardened by heat. Clay contains a mixture of compounds mainly aluminium oxide and silicon dioxide.





Clay pots

Question

1. Name any two compounds that clay is composed of.
2. State any three properties of clay.
3. Mention any three uses of clay.
4. Does making pots require the knowledge of chemistry?

Lesson Four: Materials that don't Break Easily

Introduction

Materials that don't break easily include: plastics, natural polymers, naturals fibres and metals.

a) Plastics

Plastic are snythetic materials. They are human-made and not found in nature. Plastics are very important in our daily lives because they are cheap to make and can easily be moulded into different shapes.

Observe the different plastic objects that we use in our everyday life.



Activity 4.1

Identify and name any other plastic objects not shown in the picture but are useful in everyday life.

The properties of plastics

- They vary from transparent to opaque.
- Vary from soft to hard.
- Vary from weak to very strong.
- Vary from heat resistant to easy to melt.
- Don't conduct electricity hence are used as electrical insulators.

Note:
The structure of plastics is very different from the structure of concrete and ceramics.

What are plastics made of?

Plastics are made of carbon and hydrogyen atoms that are joined together. The long chain molecules obtained from the joined atoms are called **polymers**. **"Poly"** means many hence polymers are compounds madeup of many small molecules joined together to form one long molecule. Examples of polymers; polythene, nylon, melamine, polyurethane.



Coloured Polythene bags

Plastics differ in their physical properties and these can be explained by the structure of their molecules.

Activity 4.2

Study the table below.

No.	Types of plastic	strength
1	Polythene	Not very stong.
2	Nylon	Very strong, flexible, streches without breaking.
3	Melamine	Rigid, hard and cant be stretched.It burns without melting.
4	Polyurethane	Not strong and can be squashed/stretched without permanently changing itsshape.

Task



Using chemistry textbooks and sources from the Internet, give atleast two uses of each of the plastics given in the table. Write in your chemistry notebook.

Lesson Five: **Natural Polymers**

Introduction

These are polymers that occur naturally. They are made by living things as they grow. Even right now you are making one polymer called ***keratin,*** a fibrous material made of proteins**.** Our hair, fingernails, the feathers, hooves, claws, horns, the outer part of the skin are all made of keratin.

Question

Research using textbooks or internet and give three uses of keratin polymer to animals.

Another well-known natural polymer is *cellulose.* This is the polymer that wood is made of. Cellulose has a complex structure made up of carbon, hydrogen and oxgyen. Because wood has covalent bonds and strong forces holding the molecules together, it has great strength and it is a very useful material.

Activity 5.1

Finding out the direction of fibres in a newspaper.

Note:
When wood is crushed, it forms long thin pieces of cellulose called cellulose fibres, which can be made into paper.

Study materials required: two sheets of newspapers.

Instructions

1. Tear the newspaper sheet down the page.
2. Now try tearing the newspaper sheet across the page.
3. Is it easier to tear the newspaper down or across the page? Write down your observation in the chemistry notebook.
4. Roll up a page of a newspaper and try pulling at one end while your sisteror brother or friend pulls at the other end. What happens? Are youable to tear it up? Write your answer in your chemistry notebook.

Question

What conclusions can you make about the fibres in the newspaper?

Summary

It is difficult to tear the newspaper down the page, but it is easy to do so across the page. This is because the fibres that make up the newspaper are lined up across the page. This means that when one tears the paper down the page, you are tearing it against the direction of the fibres, thus the resistance. When one tears it across the page, he or she is tearing it between the fibres, thus less resistance.

Follow-up Activity



Using chemistry textbooks and information from the Internet, research the properties of cellulose. Write them in your chemistry not book.

Lesson Six: Natural Fibres

c) Fibres

Introduction

Fibres are made from polymers. They are used to make thread that can be made into cloth or ropes. They can be classified into natural and synthetic fibres.

Natural fibres are classified into three groups depending on their sources:

- Animals fibres such as silk, wool and mohair.
- Plant fibres such as cotton, pine, sisal and hemp.
- Mineral fibres such as asbestos.

Synthetic fibres include: nylon, polyester and terylene.

Animal fibre (silk)



Plant fibre (cotton)



Synthetic fibre (nylon)



Questions

1. Give any three uses of natural fibres.
2. Give any two uses of synthetic fibres.
3. State the properties of natural and synthetic fibres.
4. What are regenerated fibres? Give examples.
5. What would be the most suitable fibre for each of these:
   - a set of seat covers for a car?
   - a sweater for cold weather?
   - a baby's nappy?

d) Metals

A metal is a material that conducts electricity and heat relatively well. They are typicaly malleable and ductile.

When hammered, metals can be flattened without shattering because the layers of atoms in the structure slide past each other.

Question

Why are metal good conductors of heat and electricity?

Lesson Seven: Material Used for Building Houses

Introduction

In your home area, there are many different kinds of houses made using different materials.The constitution (what the houses are made of) of the house depends on a number of things; forexample, the availability of building materials, the cost of building materials, the space available for building, the weather condition in the area and the size of the house.

Activity 7.1
Observe the pictures of the different houses carefully.







Identify and name the materials the houses are made of. Write in your chemistry notebook.

Follow-up Activity



a) Move around your home area and observe the houses. Pick one house.

b) Describe the shape and colour of that house.

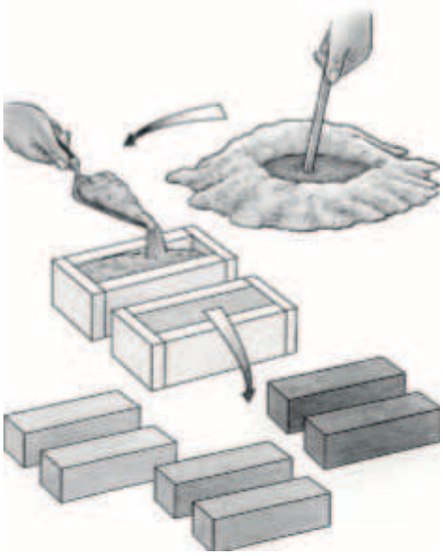
c) List the materials that the different parts of the house are made of.

d) List the advantage and disadvantages of the materials used.

Lesson Eight: Making Bricks

Introduction
In this lesson, we are going to learn how to make bricks that can be used to build houses and can be sold to earn money.

Making of bricks
Materials required:



Mud and clay (used for brick making), cement, water, sand, container for mixing cement of mud, boxes for moulding the bricks forexample long-life milk or juice cartons with a flatside cut out), a bucket, a piece of wood.

Instructions

1. Two parts of cement added to two parts of sand, or add one part of cement to three parts of sand, or add three parts of cement to one part of sand or to mud suitable for brick-making.
2. Add water to the mixture until it's a firm paste.
3. Mould each mixture into a box and label it carefully.
4. Leave the bricks to dry for a week (not in the sun).

Task

1. Research the common roofing materials used in Uganda for roofing houses.
2. Study the tabel below and fill it correctly.

No.	Types of roof	Insulation	Cost	Effect on environment	Is it water proof	How easy is it to build	Appearance
1	Thatched						
2	Corrugated iron						
3	Corrugated iron with ceiling						

Lesson Nine: Enviromental pollution by Materials

Introduction

In Uganda, many tonnes of wastes in terms of garbage, refuse or trash are produced in homes and communities. We can make a difffrence in our homes and our communities by reducing, or reusing,orrecycling materials and also encouraging our neighbours to do the same.

Activity 9.1

1. Using the Internet and relevant chemistry textbooks, newspapers and magazines, research appropriate methods of disposing wastes while guarding against enviromental pollution.
2. Identify materials in your home or communities that can be recycled.

Activity 9.2:Classifying materials into recyclable and non-recyclable

In this activity, you will classify materials used in everyday life as those that can be recyled (recyclable) and those that cannot be recyled (non-recyclable).

Instructions

1. Consider the following materials: wood, paper, natural and synthetic fibres, plastics, cotton, sisal, silk, nylon, polythene, polyester, protein, rubber, starch, wool, polystyrene, glass, polytetrafluoroethene.
2. Sort the materials given in (a) above into those that can be recycled and those that cannot be recycled.
3. Record your results in a table.

No.	Material	Natural or synthentic	Recyclable	Non- recyclable
1	Wood			
2	Paper			
3	Plastics			
4	Cotton			
5	Sisal			

4. From your results, what kind of materials (natural or synthetic) are re-cyclable and which ones are not recyclable?

Summary

Recyclable resources or materials are those substances which can be reused in any form again and again after use; for example, glass, plastics, metals and paper.

Non-recyclable resources or materials are those substances which can not be reused in any form again; for example, photographs, medical waste, hazardous chemicals and chemical containers, wax boxes, ceremics, kitchenware and many others.

Follow-up Activity



Use the Internet and relevant chemistry textbooks to find out:

a) What happens to the following materials when they are heated?

- Polythene
- Rubber
- Glass

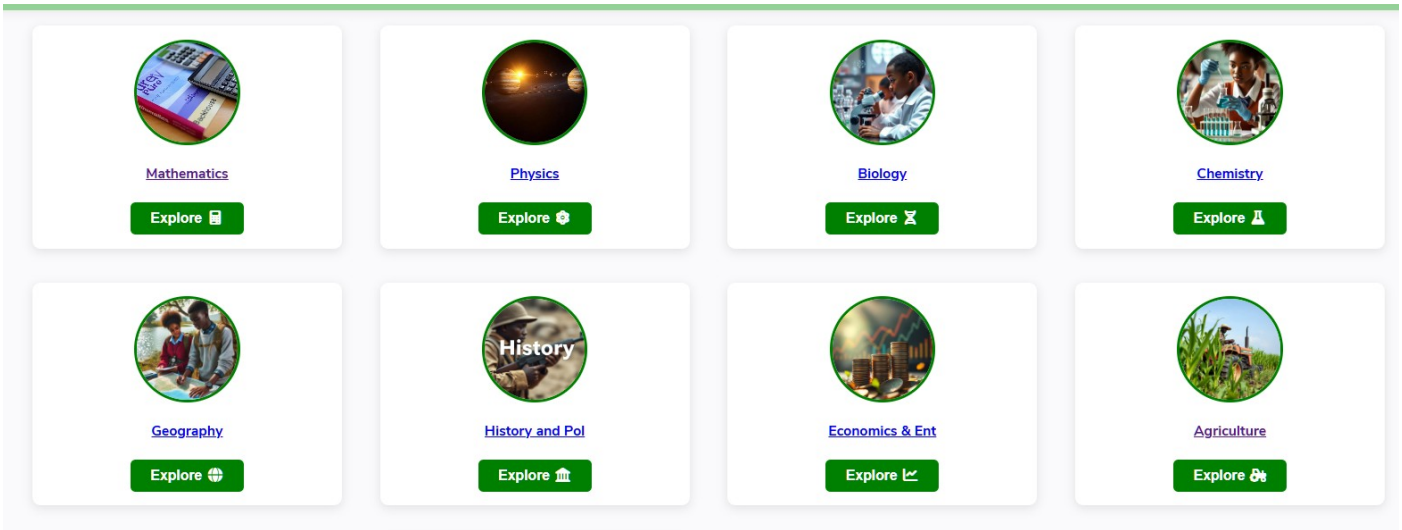
b) Explain the effect of heat to the structure and properties of matter.

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