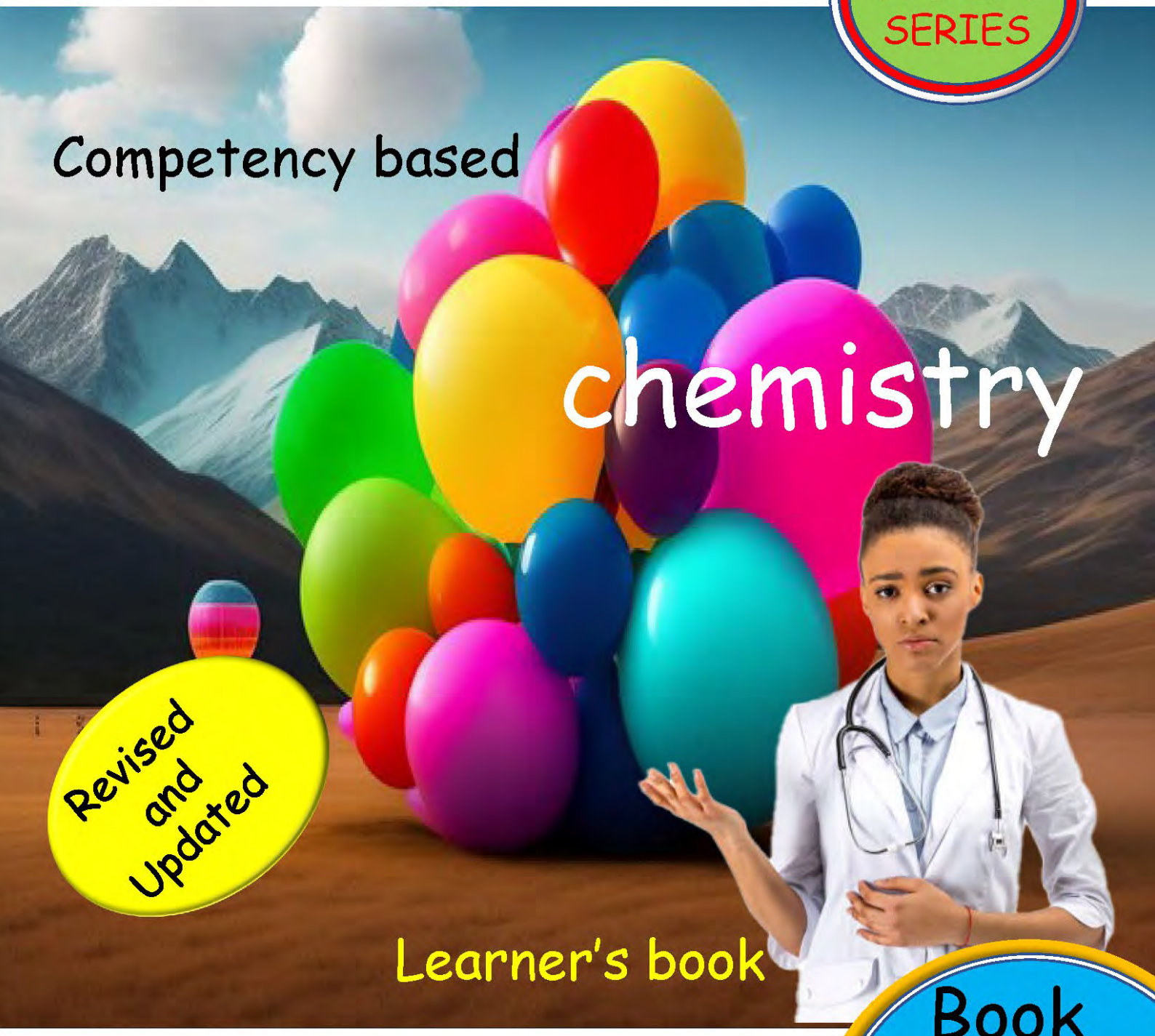
UTTERMOST

Harroan Uttermost

2024 SERIES



Competency based

chemistry

Revised and Updated

Learner's book

Book 3

Unlock your full competency potential

HARROAN-UTTERMOST

2024 Series

Chemistry

New curriculum learner's book for s.3

Student's information.

This book belongs to:

Name .....

School .....

Class .....

Stream.....

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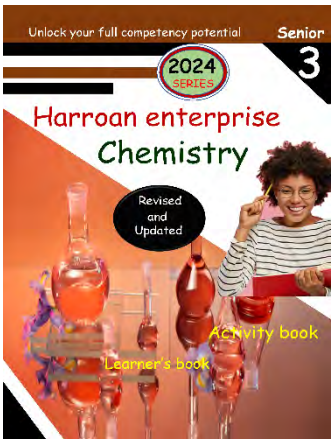
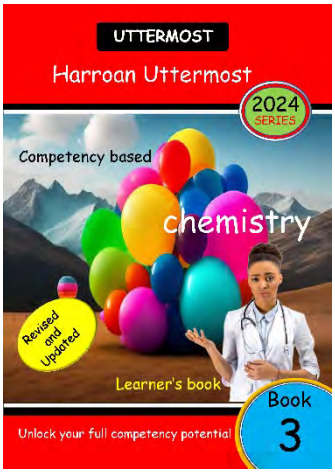
Changes in 2024 versions

1. Two versions have been released for each book. That's Harroan uttermost and the Harroan enterprise.





Harroan enterprise versions are first editions of our new book full of scenario & practical based questions which will unlock the learners competence potential.

Harroan uttermost versions are our third editions improved from our 2023 versions with new features like use your brain power, answer sheet template, improved guide notes & others

2. Full teaching guide books for all the versions have been made though each book has a different structure. A sample of the uttermost teaching guide appears in this sample. The ones for enterprise also appear in the enterprise sample versions. For uttermost versions: learning objectives, learning outcomes & sample activities of integration have been pushed to teaching guides

3. key question has been introduced in uttermost versions. The key question in learner's books provide a focus for the lesson period.

4. Use your brain power has been introduced in uttermost books with critical thinking and problem-based questions meant to unlock the learner's competency potential. The answers to these questions appear in the teaching guides.

5. an answer sheet template has been introduced to provide enough space for learners to answer the questions & write other important notes

5. Guide notes in the uttermost series have been improved. The guide notes introduce learners to a lesson period but they don't answer the lesson key question. This makes learner's to research and brainstorm on the question to get the desired solutions. The answers for all the activities appear in the teaching guide.

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Chapter one

Carbon in life

By the end of this chapter, you should be able to;

- Classify carbon compounds into groups
- Understand that the environment contains a variety of carbon compounds
- Show practically that a material contains carbon
- Explain the importance of organic compounds in daily life
- Name hydrocarbons using the IUPAC nomenclature system.
- Draw and name structures of organic compounds
- Understand the process of making soapy detergents
- Understand how ethanol is made

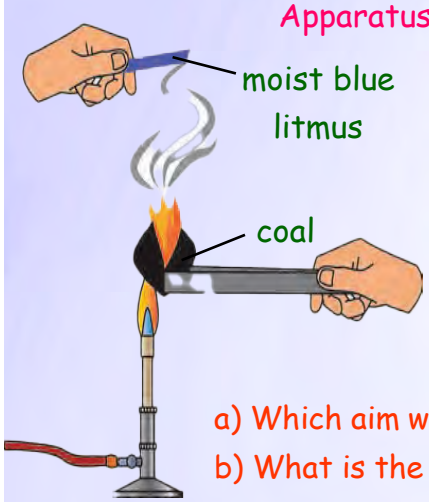
1.1 Diversity of carbon compounds

The environment consists of several carbon compounds which include plants, animals, textiles, plastics, drugs. Etc. The element carbon is available abundantly in nature and occurs in free as well as in combined state.

Can you recall

In s.2 you learnt about carbon in the environment. Can you use the knowledge you acquired to try this

Apparatus; coal, match box, moist blue litmus



Procedure

- Ignite the coal
- Hold the moist blue litmus paper over the gas released
- Note your observations.

questions

a) Which aim would you give the experiment?
b) What is the substance formed?
c) What changes take place in the litmus paper? Explain your observations. Write your answers in the answer template.

Key question: How can you show that a material contains carbon?

Guide notes

The name carbon is derived from the Latin word "carbo" meaning coal. Carbon is found in nature in free state as well as compound state. Carbon in free state is found as graphite and diamond and in combined state as;

- carbon dioxide
- carbonates such as calcium carbonate
- fossil fuels such as coal, petroleum, natural gas
- natural fibers such as cotton, wool, silk
- carbonaceous nutrients such as carbohydrates


Diamond


Graphite rod


Carbohydrates


Cotton

Did you Know

In the earth's crust, carbon is present to the extent of approximately 0.27% in the form of carbonate, coal, petroleum. In the atmosphere, the proportion of carbon in the form of carbon dioxide is approximately 0.03%. some types of plants which grow on the ocean floor convert carbon in marine water into calcium carbonate

Group activity: showing that materials we use in everyday life contain carbon.

What you need: Heat source, plastic bottles, sugar, cotton wool, dry leaves, seeds, maize flour, test tubes, spatula and test tube holders

Caution; Be careful when using the heat source such that you don't burn yourself.

What to do?

- Put part of each of the materials in separate test tubes.
- Heat each test tube and observe the changes in the substances. Use a test tube holder to hold the test tube when heating. For a piece of a plastic bottle, you can heat directly without placing it in a test tube. Use a pair of tongs when holding the plastic.
- Observe what happens when heating each of the substance

TASK;

a) Draw a table on the answer space provided showing the name of materials and observations. Fill in the observations for each material.

b) Outline the similarity from burning different materials

c) What conclusion can you make from your observations.

d) compile a report for the activity and present

Note; a report template is provided on starting pages

Use your brain power!

Two of your siblings are having an argument about the composition of milk. One says milk contains carbon and another says milk doesn't contain carbon.

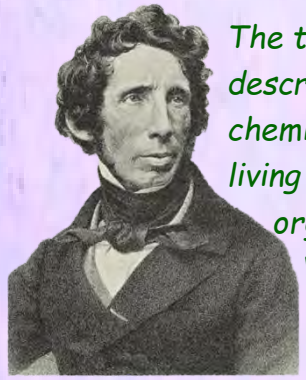
By using a practical scientific approach, how would you end their argument?

Hint: use the scientific method (come up with a hypothesis and test it). Write your report in the answer space provided.

Note; all answers and other notes can be written in the notes template provided.

1.2 Classifying carbon-based compounds

A huge number of chemical compounds are known. Just as biologists group plants and animals to show their fundamental similarities, Chemists group carbon-based compounds to show patterns and trends in the physical and chemical properties of substances. Until the 19th century, chemists classified compounds basing on their sources as organic and inorganic. They classified compounds obtained from living organisms as organic compounds and compounds obtained from constituents of the earth (minerals) as inorganic compounds



Friedrich Wohler

The term "organic" was originally used by chemists of the 18th century to describe compounds obtained from living sources (plants and animals). These chemists believed that nature possessed a certain force which occurs only in living things. According to their thought, only living things could produce organic compounds. This believe was disproved in 1828 by Friedrich Wohler, a German Chemist who prepared urea, an organic compound from the reaction between solutions of inorganic compounds ammonium chloride and silver cyanate.

Today, organic chemistry is defined as the study of carbon containing compounds except oxides of carbon, metal carbides, carbonates, and cyanides. Nearly almost all compounds found in living organisms are organic. Besides this, the vast majority of compounds encountered in our daily lives are organic. Inorganic chemistry is the study of non – carbon containing compounds and oxides of carbon, carbonates, hydro carbonates, metal carbides and cyanides

Challenger

1. Put yourself in the shoes of Friedrich Wöhler. Describe the challenges and skepticism you faced from fellow scientists who firmly believed in the vitalistic theory, which suggested that organic compounds could only be produced by living organisms.
2. Can you name some examples of common organic compounds? And how do they differ from inorganic compounds in terms of their behavior and functions?"

Key question: How is organic chemistry important in daily life?

Guide notes

Concept of organic chemistry

Many organic compounds are found in the environment where they were formed as a result of various chemical reactions. The study of organic chemistry involves preparation methods, structures, properties, composition and reactions of organic compounds. More than three quarters of the global compounds contain carbon. Carbon is unique in its chemical properties as it can form many compounds due to its ability to catenate and form multiple bonds which are single, double and triple bonds. Catenation is the bonding of atoms of the same element to form a chain. Carbon forms stable bonds with itself and other elements. It can make straight chain and branched chains. Carbon can form simple and complex molecules that contain many numbers of carbon atoms.

Substances made from organic compounds.

Organic compounds include different types of substances such as oils, dyes, pharmaceuticals, papers, inks, plastic, fuels, rubbers and textiles.

Substances made from organic compounds

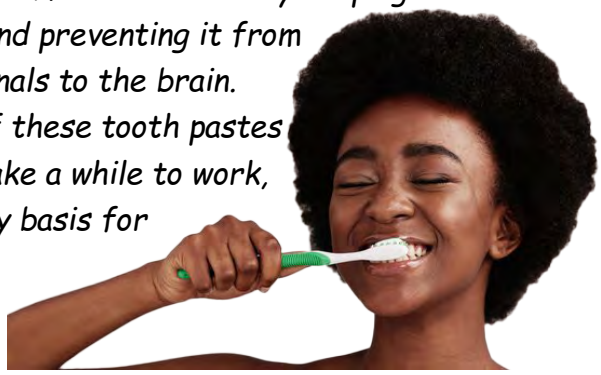
Organic compounds can also be categorized as natural and synthetic. Natural organic compounds are those which occur naturally such as carbohydrates, essential oils and coal. Synthetic organic compounds are man-made organic compounds such as plastics and dyes

Group activity:

Explaining the importance of organic chemistry in daily life.

Several careers such as doctors, dentists, engineers, pharmacologists, chemists, agriculturalists etc. apply the knowledge of organic chemistry in their technical innovations

In medicine and drugs, dentists use potassium citrate an organic salt to combat sensitive toothaches. Dentists also recommend tooth pastes with potassium citrate in treating teeth pain and sensitivity. Potassium citrate work by seeping into the nerve of teeth and preventing it from transmitting signals to the brain. The downside of these tooth pastes is that they take a while to work, so expect to have used them on a twice daily basis for two weeks before they start to work



Questions;

a) Research using internet and textbooks and describe other ways organic chemistry is important in medicine and drugs. Give as many as you can.

b) Describe other ways organic chemistry is used in daily life

c) How are organic compounds harmful?

Use your brain power!

1. Sarah loves cooking and experimenting with different flavors in her dishes. She wants to understand how different spices and herbs contribute to the taste and aroma of her dishes. How can an understanding of organic chemistry help Sarah in enhancing the flavors in her cooking?

2. Lisa is concerned about the pollution caused by plastic waste and wants to find alternative packaging materials. How can an understanding of organic chemistry help Lisa in identifying and designing sustainable packaging solutions using biodegradable materials?

My notes

Answer template

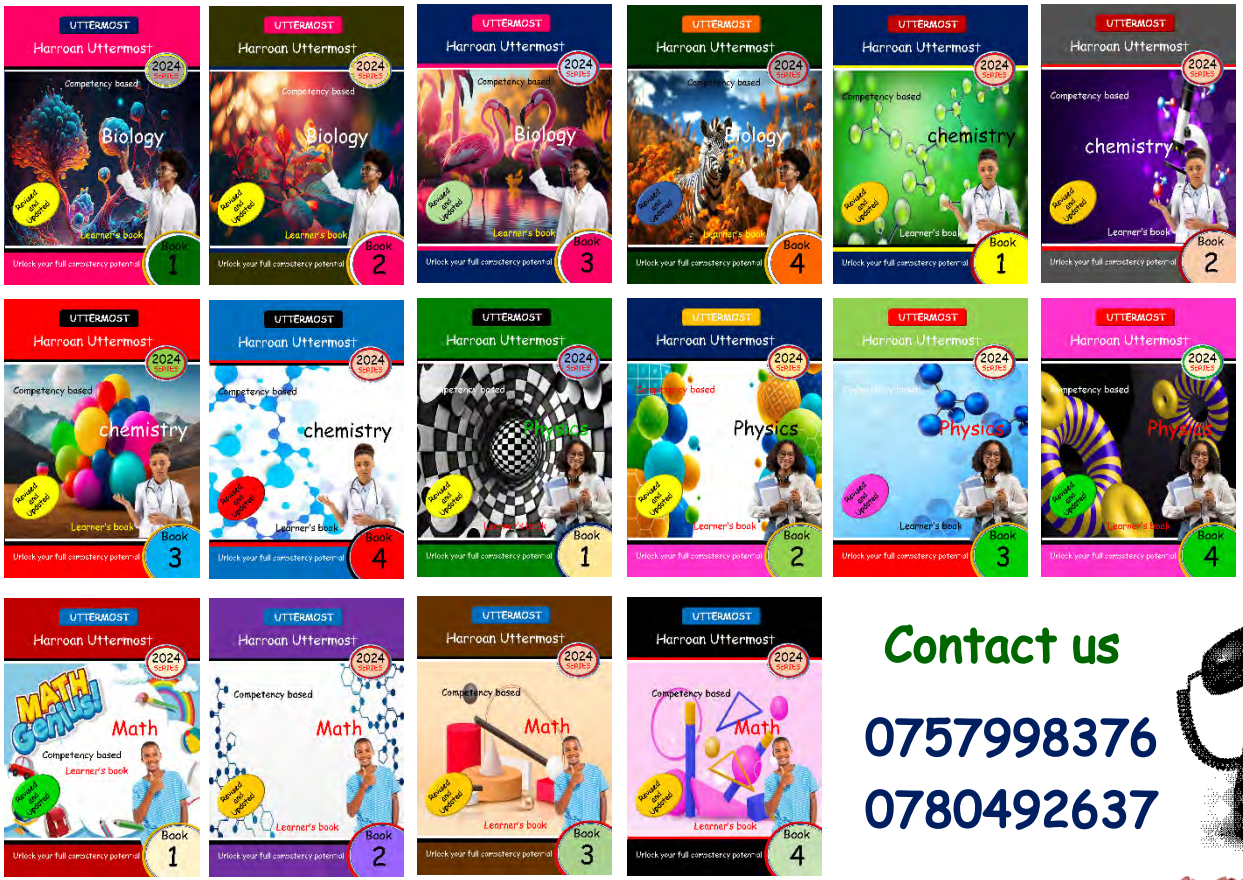
Why a new version each year?

Harroan releases new versions of learner's books each year in order to align the content with evolving education needs and standards. Producing new versions ensures that the content remains current & up to date. This allows learners to learn most relevant and accurate information. Education methodologies & pedagogical approaches evolve over time, incorporating new insights & strategies to enhance student learning.

2024 books on market

1. Uttermost series – 2024 series

Harroan uttermost versions are our third editions improved from our 2023 versions with new features like use your brain power, answer sheet template, improved guide notes & others. This sample contains a few pages of the Harroan Uttermost books. All other Harroan Uttermost books have the same structure.



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Selling structure

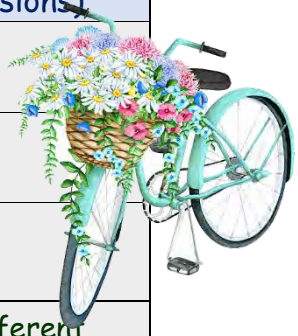
The 2024 versions have two printing formats;

1. The standard clear format print- the one used in 2023 versions
2. The best quality hd print- the newly introduced one

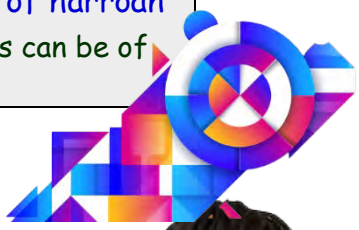
Advert break **Book pages 210**

This page is not part of the book. It shows Harroan books on market **Color printing**

Book(s) price	Price	Additional benefits (Tp costs, free teaching guide, free other versions)
1 learner's book	25,000	None
1 teaching guide	30,000	None
Learner's book + teaching guide	50,000	None
5 to 9 learners' Books	20,000 each	None. The books can be of different classes or subjects
10 to 19 learners' Books	18,000 each	None. Still the books can be of different subjects or classes
20 to 29 learners' Books	17,000 each	Free transportation costs, books can be of different subjects or classes
30 to 39 learners' Books	16,000 each	Free transportation costs, books can be of different subjects or classes
40 to 49 learners' Books	15,500 each	Free transportation, books can be of different subjects or classes
50 to 69 learners' Books	15,000 each	Free transportation costs, free teaching guide, books can be of different subjects or classes.
70 to 99 learners' Books	15,000 each	Free transportation costs, free teaching guide, 1 free book of Harroan enterprise, books can be of different subjects or classes
100 or more learners' Books	15,000 each	Free transportation costs, free teaching guide, 1 free book of harroan enterprise & its guide, books can be of different subjects or classes



2. Enterprise series – 2024 series



Harroan enterprise versions are first editions of our new books full of scenario & practical based questions which will unlock the learners' competence potential. The books are not practical books though they contain a practical view section with competence based practical questions. They are different from Harroan Enterprise plus that they concentrate on a particular class. They contain a full separate teaching guide.

Book pages 210

Order starts from 10

For enterprise

Color printing

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Selling structure for standard clear print out. Order starts from 10

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Book(s) price	Price	Additional benefits (Tp costs, free teaching guide, free other versions)
10 to 19 learners' Books	18,000 each	None. Still the books can be of different subjects or classes
20 to 29 learners' Books	17,000 each	Free transportation costs, books can be of different subjects or classes
30 to 39 learners' Books	16,000 each	Free transportation costs, books can be of different subjects or classes
40 to 49 learners' Books	15,500 each	Free transportation, books can be of different subjects or classes
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70 to 99 learners' Books	15,000 each	Free transportation costs, free teaching guide, 1 free book of Harroan Uttermost, books can be of different subjects or classes
100 or more learners' Books	15,000 each	Free transportation costs, free teaching guide, 1 free book of harroan Uttermost & its guide, books can be of different subjects or classes

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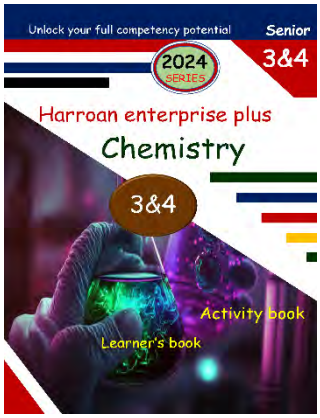
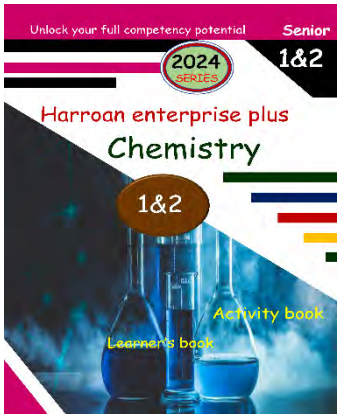
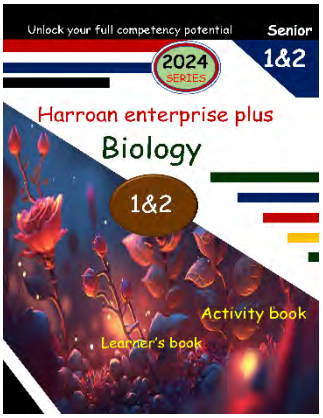
Book pages 300

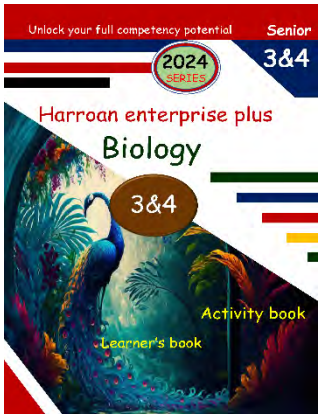
2. Enterprise plus series – 2024 series

It's of 2 classes









These are Harroan enterprise but of combined classes. Each book is on 300 pages with the same structure as Harroan enterprise. They contain scenario questions from combined classes though on comparing with single class Harroan Enterprise, they have less questions but all topics covered.

Order starts from 10 For enterprise series

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10 to 19 learners' Books	25,500 each	None. Still the books can be of different subjects or classes
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3. 2023 & 2022 series

2023 & 2022 versions still available for sale. 1 book for 20,000. 15,000 for 10 or more copies

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1.3 Classifying organic compounds.

Organic compounds can be classified into several groups namely; Hydrocarbons (alkanes, alkenes, alkynes), Alcohols, Esters, Carboxylic acids, Amines, Ketones, Ethers.

These groups are differentiated from each other by functional groups. **A functional group** is a group of atoms or bonds with a characteristic chemical reactivity. Examples of functional groups include; C=C, C≡C, –OH, and –COOH.

Functional groups are common to a given homologous series

Homologous series is a series of organic compounds with the same functional group and similar chemical properties in which members differ from each other by CH_2 group. The following are the characteristics of homologous series;

- All members of a particular homologous series can be represented by the same general formula
- All members of a homologous series can be prepared using the same general methods.
- Members of the same homologous series have the same chemical properties
- The physical properties of members change gradually with increase in molecular mass e.g melting points, boiling points and density increase with increase in molecular mass.
- All members in each homologous series differ from another by a methylene (CH_2) group

Key question: How do we name Hydrocarbons?

Guide notes

Hydro carbons are organic compounds consisting of only hydrogen and carbon atoms. They are classified into three groups namely alkanes, alkenes and alkynes.

General formula; is a general rule used to calculate the number of atoms of each element e.g

- C_nH_{2n+2} for alkanes
- C_nH_{2n} for alkenes
- C_nH_{2n-2} for alkynes
- $C_nH_{2n+1}OH$ for alcohols
- $C_nH_{2n+1}COOH$ for carboxylic acid

Where n is the number of carbon atoms in a molecule.

Naming hydrocarbons.

The naming of organic compounds is according to the International Union and Applied Chemistry (IUPAC) nomenclature system which gives systematic names to organic compounds. The names given using this system have two parts i.e the parent name/root name/ prefix and the primary suffix.

The prefix indicates the nature of the basic carbon chain making up the hydrocarbon. Chains with 1 to 4 carbon atoms are known by special root words. Chains with 5 or more carbon atoms are known by their respective Greek numbers.

Parent names/prefix name of hydrocarbons

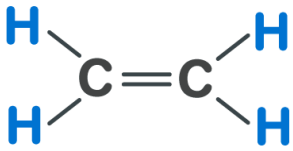
Number of carbon atoms	Prefix names
1	Meth-
2	Eth-
3	Prop-
4	But-
5	Pent-
6	Hex-
7	Hept-
8	Oct-
9	Non-
10	Dec-

Primary suffixes are added to show whether the hydrocarbon is saturated or not

Primary suffixes for hydrocarbons

family	Type of bonds	Suffix
Alkanes	Single C-C	-ane
Alkenes	Double C=C	-ene
alkynes	Triple C≡C	-yne

When naming a hydrocarbon like



It has two carbon atoms therefore its prefix is eth-

It has double bonds between carbon atoms therefore its suffix is -ene

The name of the hydrocarbon is ethene. Its molecular formula is C_2H_4

Group activity:

Group activity:

1. Consider the compound C_5H_{12}. What are the steps involved in naming this hydrocarbon, and what is the significance of each step?

2. Why is it important to have a standardized system for naming hydrocarbons?

b) How does the systematic naming system (IUPAC) help in accurately identifying and communicating information about the structure of hydrocarbons?

3. Complete the table below

Number of carbon atoms (n)	Formula of alkane (C_nH_{2n+2})	Name of alkane	Formula of alkene (C_nH_{2n})	Name of alkene	Formula of alkyne (C_nH_{2n-2})	Name of alkyne
1	CH_4	methane	-	-	-	-
2						
3						
4						
5						
6						
7						
8						
9						
10						

Use your brain power!

1. Consider a hydrocarbon C_7H_{16}. How would you determine its systematic name using the IUPAC rules? Show how you have arrived to your answer

2. Imagine you encounter a hydrocarbon with multiple double bonds and functional groups. Discuss the challenges and considerations in naming this complex molecule using the IUPAC nomenclature system.

3.Consider the role of functional groups in hydrocarbon naming. How do different functional groups affect the naming process? Discuss any additional considerations or complexities that arise when naming hydrocarbons with functional groups present.

My notes

Answer template

Advert break

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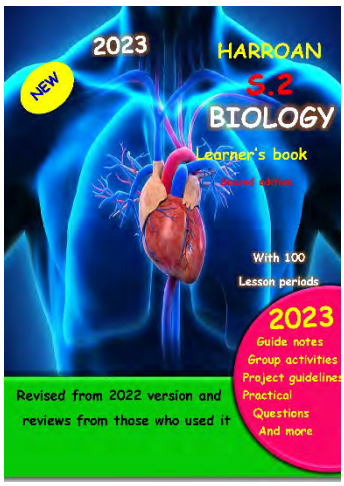

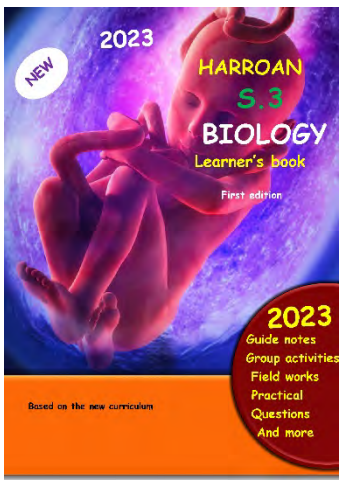

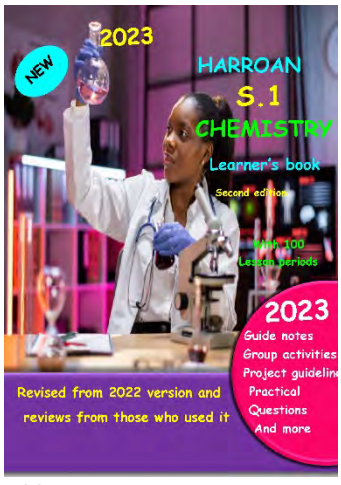

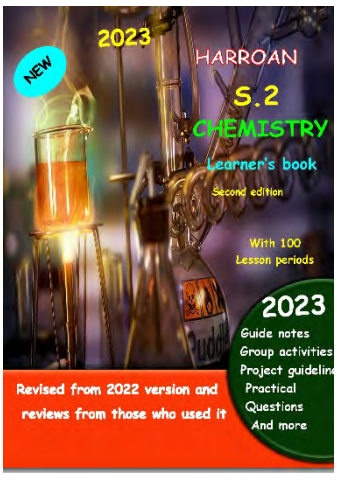

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1.8. Constructing a biogas digester.

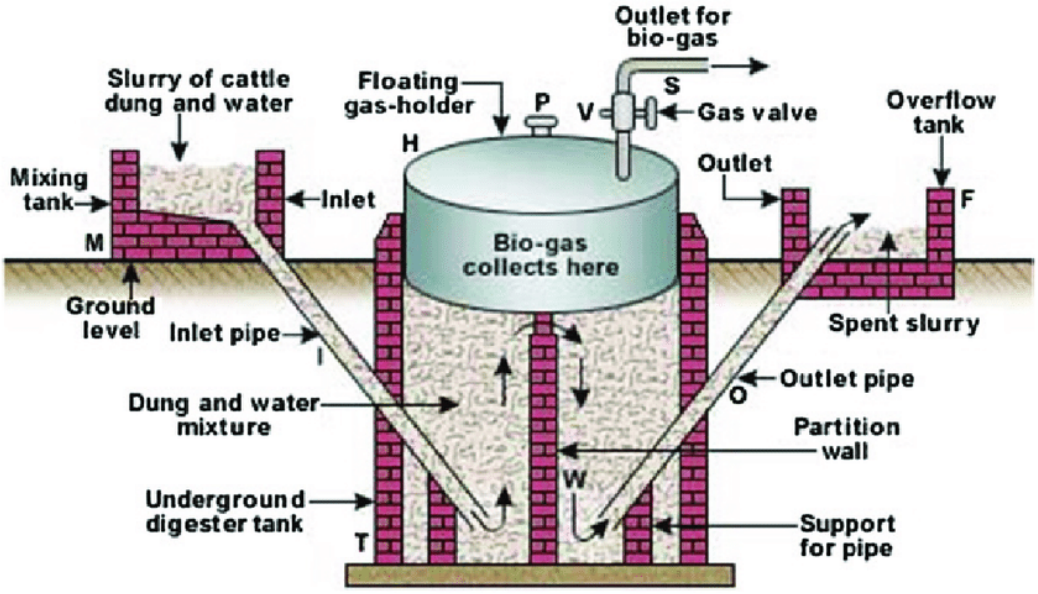
Key question: How would you construct a biodigester using locally available materials?

Biogas

Biogas is a renewable energy source produced by the breakdown of organic matter by certain bacteria under anaerobic conditions. It is a mixture of methane, hydrogen, and carbon dioxide. It can be produced by agricultural waste, animal dung, manure and sewage. The process of biogas production is also known as anaerobic digestion. Biogas recycles waste products naturally and converts them into useful energy, thereby preventing pollution. Biogas converts harmful methane gas produced during decomposition into less harmful carbon dioxide.

Bio gas digester.

Biogas production is carried out in anaerobic digesters known as biogas plant. These have 5 components; An inlet to feed the slurry, Fermentation chamber where biogas is produced with activity of microorganisms, The gas storage tank to store the gas produced, The outlet fc



Bio digester illustration diagram

Making a simple plastic bio digester

Hi there, my name is Catherine. Below is my cheap homemade and easy to build mini plastic Biogas plant. It burns for approximately 20-30 minutes on a Bunsen burner. You can add anything from your kitchen waste (except onion peels and egg shells). In 12 hours the Gas is ready for use. It is very easy and cost effective to build (only around shs. 30,000) and gives many useful products.

The end products of this system are:

1) Methane: (can be used as a fuel)
2) Slurry: (the spent slurry is excellent manure)

The main components of this system are;

1. In let pipe 2. Digester tank 3. Gas holder tank 4. Slurry outlet pipe 5. Gas outlet pipe

Step 1: Choose the correct container

You will have to choose correct size container which will act as a digester tank. My one is 50 litres tank. I got it from scrap

Step 2: Make holes

Marking where to put holes. Up & down on opposite sides

Heating an iron rod

Inserting holes using a hot iron rod

Step 3: Fix the inlet and outlet pipes

Make holes in the tank for inlet and outlet. For this I took an old iron rod and heated it to make holes. CAUTION: rod is really very hot.

Glue the Inlet pipe and Outlet pipe with any water proof adhesive

Step 4: Making the Gas

I took a paint bucket of 20 litres, for making a gas holder tank. This tank holds the gas produced. The tank is overturned and fixed with a valve used for plumbing purposes.

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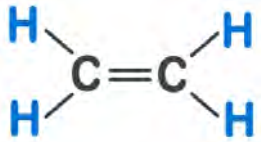
1.9 Naming of alkenes

Alkenes

Alkenes are hydrocarbons which contain at least one double bond(-C=C-) between two carbon atoms. Alkenes contain two hydrogen atoms less than in corresponding alkanes. Alkenes are very reactive compared to alkanes due to presence of double bonds that have more electron density. Alkenes are unsaturated hydrocarbons with a general formula C_nH_{2n} where n>1. If an alkene has seven carbon atoms, the molecular formula of the alkene will be $C_7H_{(2X7)}$ which is the same as C_7H_{14}. Since there must be at least one double bond between two carbon atoms, the first number of the homologous series is ethene, which contains two carbon atoms with one double bond. The molecular formula of ethene is C_2H_4. Its structural formula is



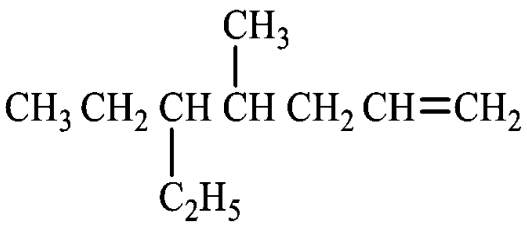
Key question: How do you name alkenes?

The rules used in naming alkanes are also applied in naming alkenes. The 'prefix' of an alkene is the same as that of a corresponding alkane. A number that indicates the position of the double bond is added to the prefix followed by suffix -ene. a hyphen is inserted on either sides of the number showing the position of the double bond. The carbon chain is numbered in such a way that the carbon atom with the double bond is given the lowest possible number.

Consider the alkene $CH_3CH_2CH=CH_2$

Numbering the carbon atom from left to right, the double bond is on the third carbon atom. Since there are carbon atoms in the chain the name of the alkene would be 'but-3-ene'. On the other hand, starting from the right-hand side, the double bond is on the first carbon atom. The correct name of the alkene is therefore but-1-ene because the first carbon carrying the double bond has the lowest number. But-1-ene is also named as 1-butene. For branched alkenes, the longest carbon chain having the double bond is taken to be the parent chain. All other rules used in naming branched alkanes also apply when naming alkenes.

Let's try this!!! Write the name of the alkene



Step 1; find out the position of the double bond on the lowest number of carbon atom. *It is on carbon atom number 1 from right to left so the position is -1-*

Step 2. Find out the prefix name of the longest carbon chain having the double bond. *It has seven carbon atoms therefore, its prefix is hept-*

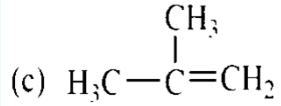
Step 3 identify the position of the substituent groups starting from the side whose carbon atom with the double bond is the lowest.

The side is right, the substituents are methyl on carbon atom 4 and ethyl on carbon atom 5 remember the order of naming substituents must be alphabetical. The name of the alkane is 5-ethyl-4-methylhept-1-ene or 5-ethyl-4-methyl-1-heptene.

Isomerism in alkenes: Alkenes form different isomers due to changing positions of double bonds as well as the presence and positions of substituents. Ethene and propene do not have any isomers. Butane has the following isomers

(a) $CH_3CH_2CH=CH_2$ (but-1-ene or 1-butene)

(b) $CH_3CH=CHCH_3$ (but-2-ene or 2-butene)

(c) 

(2-methylprop-1-ene or 2-methyl-1-propene)

The above isomers have different structures. Isomers a) and b) are due to the position of the double bonds. They are referred to as positional isomers. Isomer c) is due to the presence of a substituent and it is referred to as a branch isomer.

Group activity:

a) Complete the table

Molecular formula	IUPAC name	Structural formula
C_2H_4	Ethene	$CH_2=CH_2$
C_3H_6		
C_4H_8		
C_5H_{10}		
C_6H_{12}		
C_7H_{14}		
C_8H_{16}		
C_9H_{18}		
$C_{10}H_{20}$		

b) Name and draw open structural formula for all isomers of i) pentene ii) hexene

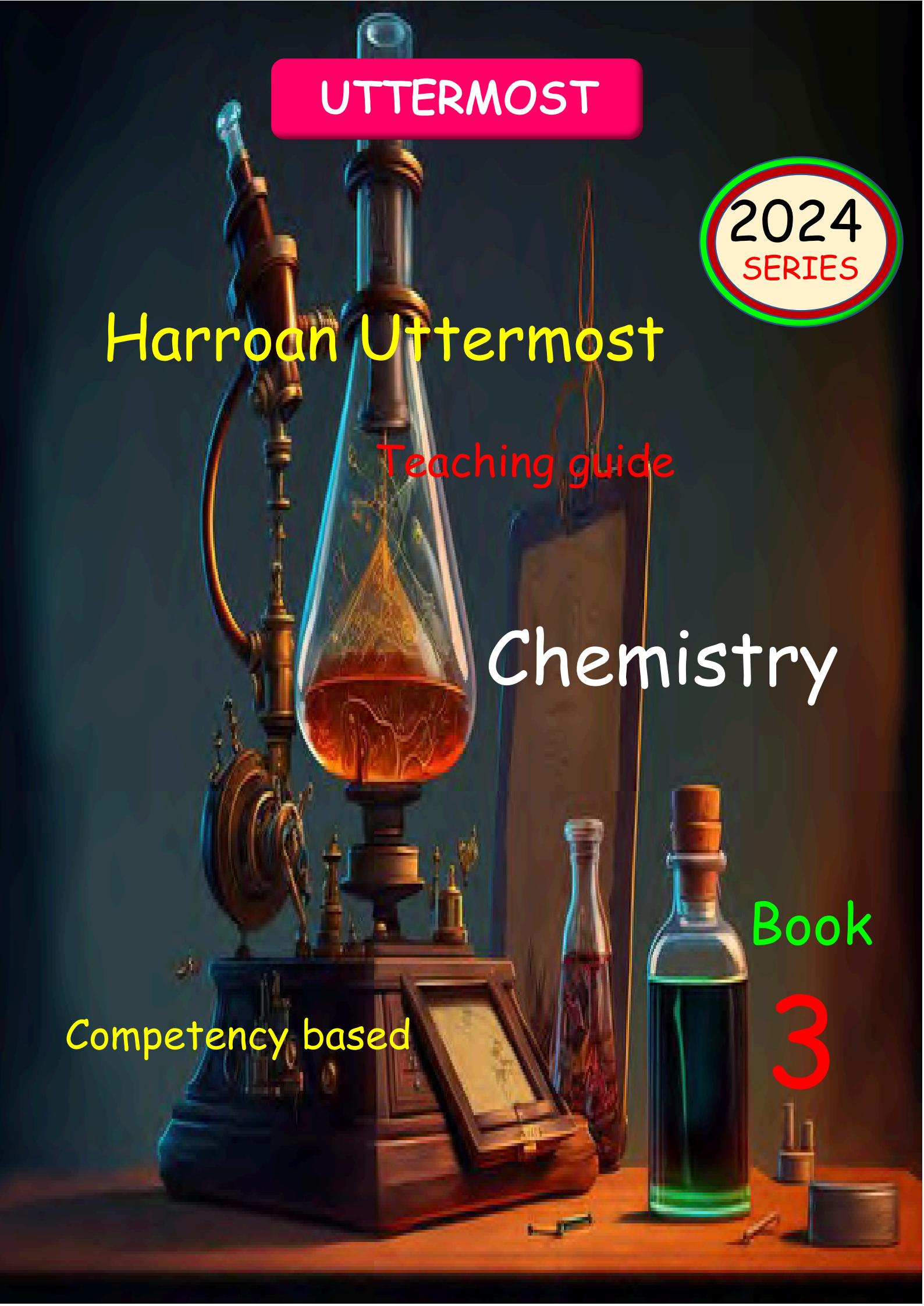
c) You are a chemistry teacher explaining the nomenclature of alkenes to your students. How would you guide them through the process of naming simple and complex alkenes

Use your brain power!

a) You have an alkene with three carbon atoms and a double bond. There is also a methyl group attached to the second carbon atom. How would you systematically name this alkene?

b) You have an alkene with five carbon atoms and a double bond. There is also a chlorine atom attached to the second carbon atom and a propyl group attached to the fourth carbon atom. How would you systematically name this alkene, considering both the substituents and the halogen atom?

A sample of the teaching guide for Harroan uttermost s3 appears on the next page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Teaching guide
Chemistry
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3
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How to use the Teaching guide

Harroan Uttermost teaching guide has been developed for teachers to teach learning contents to their students more effectively with using the harroan uttermost series. As for the features of this Teaching guide, its contents correspond to that in the textbook according to the Senior 3 Syllabus. The NCDC syllabus sets the national standards that are taught by teachers in the classroom that all students should acquire throughout the country, regardless of the context. These standards outlined in the syllabus are reflected in this teaching guide. Therefore, information in this teacher's manual will help teachers to prepare lesson plans and to conduct lessons in line with the syllabus. Firstly, the composition of the textbook is introduced, then, the components in this teacher's manual are introduced in the following section.

Main contents of the Teaching guide

Introduction: In the introduction, teacher makes students review the previous lesson to connect the new lesson through the key question. An example of the introduction is shown in the lesson flow.

Showing a key question: The key question is closely related to the core or main points of the lesson including the new knowledge, new concepts and new skills. The teacher delivers the key question by using the review of the previous lesson or a new phenomenon at the beginning of a new lesson. In this particular lesson, students try to answer the key question by guessing or predicting based on their experiences.

Activity The activity is delivered to examine their guess and prediction to the key question. In some lessons, the teacher may deliver the activity without students' prediction or hypothesis. These two different ways are dependent on the lesson content. Activities are carried out by a group, individually or done by teacher's demonstration, which is dependent on the availability of the materials and contexts of the lesson topics. Teacher allows students to have enough time to do the activity..

Preparation
Materials and apparatuses recommended for use in the lesson are shown.

Lesson Title: Diversity of carbon compounds

Preparations: test tubes, spatula, heat source

Lesson flow

1. Introduction
   - Review s2 knowledge about carbon in the environment by asking: What are allotropes of carbon, what are the properties of each carbon, what are the importance of each allotropes in daily life
   - Introduce can you recall; let learners discuss about the question and expected answers.
   - Introduce the key question to learners. Listen to what they have to say about it. They don't have to be perfect at the start of the period but they should have a right answer for the same question at the end.
   - Let learners go through the given guide notes in form of discussion.
2. Activity
   - Ensure that learners work in pairs
   - Explain the steps of the activity
   - Ensure that each group has materials for the activity
   - Learners researching about the activity should be done before the lesson period.
   - Ask students to do the activity. Students will share ideas with each other. Give students enough time to find new ideas by themselves through the activity.
3. Discussion for findings
   - Ask students to present their findings from the activity.
   - Write their findings on the blackboard.

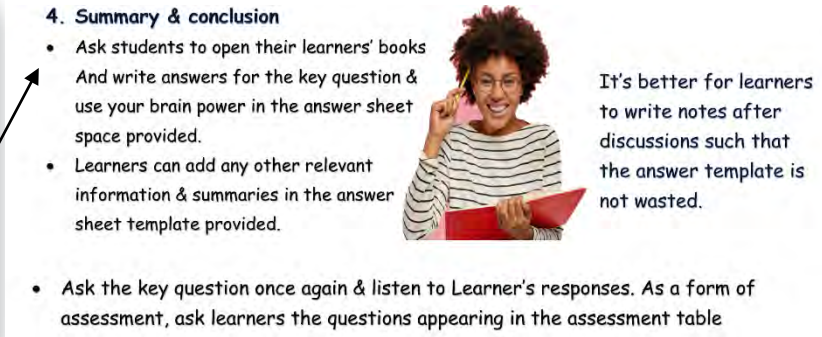
Learners should research about the questions before the lesson period such that more time is given to discussion. Researching

Discussion In the discussion part, the teacher allows students to present their results or findings from the activity and to share with all other students. The teacher allows time to students to think and seek the answers for the key question by using the results or findings in the activity. The teacher must verify the results to the students to avoid misconceptions


themselves.

3. Discussion for findings
- Ask students to present their findings from the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the findings with the students.
- Let other groups ask the discussing groups questions on what they are discussing
- Settle arguments arising within learners

Summary The summary confirms the core points of the lesson. The teacher asks questions shown in the teacher's manuals as summative assessment to students in order to confirm if they have acquired the main knowledge and skills in the lesson. The summary points may be the students' findings or results in the discussion part of the textbook which the teacher would facilitate and direct students


4. Summary & conclusion
- Ask students to open their learners' books And write answers for the key question & use your brain power in the answer sheet space provided.
- Learners can add any other relevant information & summaries in the answer sheet template provided.

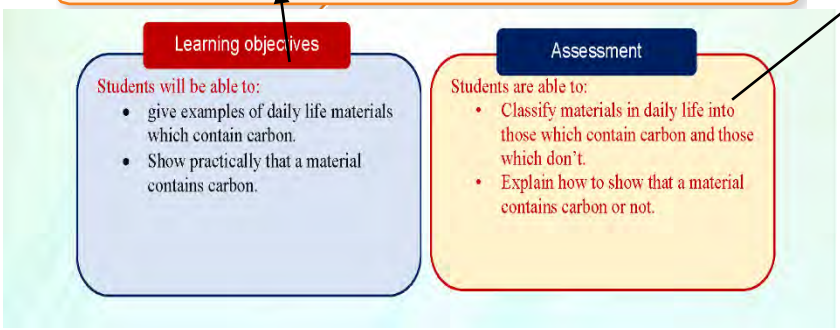
- Ask the key question once again & listen to Learner's responses. As a form of assessment, ask learners the questions appearing in the assessment table

Lesson Flow

A lesson flow includes several teaching points. The main components are:
❶. Introduction,❷. Key question,❸. Activity,❹. Discussion and❺. Summary.
Lesson flow in some lessons contains additional information like "Result" or "Challenge", according to the content of the lesson in the textbook.

Lesson Objectives

Objectives capturing the main knowledge and skills in the lesson are provided in the textbook.



Assessment

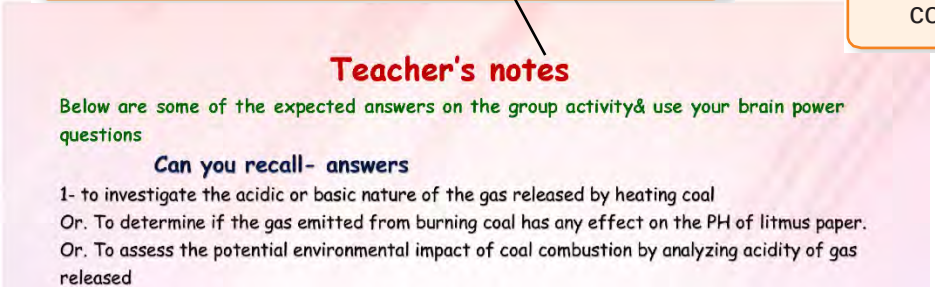
Teacher should reflect own lesson along this criteria through the lesson. The three components of knowledge, thinking skills, attitude & values are also indicated in the teacher's manual.

'Knowledge' means new concepts, new fndings and their relationships.

'Thinking skills' means scientifc process skills, which contain observing, measuring, inferring, classifying, predicting and communicating.

'Attitude and Value' means the interests, curiosities and respect for nature and recognition on the importance and usefulness of the content.

Teacher's Notes contains answers to questions in learner's book & supplementary information useful for teaching, such as background knowledge and more detailed explanations, are introduced. In case of materials or equipment not accessible nationwide, the alternatives are mentioned and instructions on how to improvise are provided.


Teacher's notes

Below are some of the expected answers on the group activity& use your brain power questions

Can you recall- answers

1- to investigate the acidic or basic nature of the gas released by heating coal
Or. To determine if the gas emitted from burning coal has any effect on the PH of litmus paper.
Or. To assess the potential environmental impact of coal combustion by analyzing acidity of gas released

Theme: Carbon in life
Topic: Carbon in life

Lesson No: 1
Learner's book pgs: 1 to 5

Lesson Title: Diversity of carbon compounds

Preparations: test tubes, spatula, heat source

Lesson flow

1. Introduction
   - Review s2 knowledge about carbon in the environment by asking: What are allotropes of carbon, what are the properties of each carbon, what are the importance of each allotropes in daily life
   - Introduce can you recall; let learners discuss about the question and expected answers.
   - Introduce the key question to learners. Listen to what they have to say about it. They don't have to be perfect at the start of the period but they should have a right answer for the same question at the end.
   - Let learners go through the given guide notes in form of discussion.
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   - Ask students to present their findings from the activity.
   - Write their findings on the blackboard.
   - Facilitate active students' discussions.
   - Confirm the findings with the students.
   - Let other groups ask the discussing groups questions on what they are discussing
   - Settle arguments arising within learners

1.1 Diversity of Carbon Compounds

Can you recall

The environment consists of several carbon compounds which include plants, animals, textiles, plastics, drugs. Etc. The element carbon is available abundantly in nature and occurs in free as well as in combined state.

The name carbon is derived from the Latin word "carbo" meaning coal. Carbon is found in nature in free state as well as compound state. Carbon in free state is found as graphite and diamond and in combined state as;

- carbon dioxide
- carbonates such as calcium carbonate
- fossil fuels such as coal, petroleum, natural gas

Key question: How can you show that a material contains carbon?

Guide notes

In the earth's crust, carbon is present to the extent of approximately 0.27% in the form of carbonate, coal, petroleum. In the atmosphere, the proportion of carbon in the form of carbon dioxide is approximately 0.03%. some types of plants which grow on the ocean floor convert carbon in marine water into calcium carbonate

Group activity:

Group activity: showing that materials we use in everyday life contain carbon.

What you need: Heat source, plastic bottles, sugar, cotton wool, dry leaves, seeds, maize flour, test tubes, spatula and test tube holders

Caution; Be careful when using the heat source such that you don't burn yourself.

What to do?

- Put part of each of the materials in separate test tubes.
- Heat each test tube and observe the changes in the substances. Use a test tube holder to hold the test tube when heating. For a piece of a plastic bottle, you can heat directly without placing it in a test tube. Use a pair of tongs when holding the plastic.
- Observe what happens when heating each of the substance

Use your brain power!

Two of your siblings are having an argument about the composition of milk. One says milk contains carbon and another says milk doesn't contain carbon. By using a practical scientific approach, how would you end their argument.

Learners should research about the questions before the lesson period such that more time is given to discussion. Researching during the lesson periods wastes a lot of time actually it may take the entire lesson period

Teacher's notes

Below are some of the expected answers on the group activity& use your brain power questions

Can you recall- answers

1- to investigate the acidic or basic nature of the gas released by heating coal
Or. To determine if the gas emitted from burning coal has any effect on the PH of litmus paper.
Or. To assess the potential environmental impact of coal combustion by analyzing acidity of gas released
2- carbon dioxide 3 – moist blue litmus paper turns red
Carbon dioxide is an acidic gas which dissolves in water forming carbonic acid. Hence the moist blue litmus turns red

How to show that a material contains carbon

By heating it to give a black residue. The black substance remaining in the test tube or formed on part of the heated substance shows that a substance contains carbon.
It is easy to test the presence of carbon. Just take a small sample of what you want to test and burn it. Every substance having carbon will turn black.

Group activity

Material	Observations on heating
Plastic bottle	It melts, deforms, and a black substance is formed on the burnt part
Sugar	It melts, changes to golden brown, to dark brown to black.
Cotton wool	Produces a bad smell and leaves a black residue
Dry leaves	Smoke, burnt part turns black
Seeds	Turns to black on burning, testa soften
Maize flour	Turns black

Note; more observations can be seen.

b) All substances turn black on heating.

c) all provided materials contain carbon

d) For the report, a report template is provided at the starting pages in both learner s' book and teaching guide. The structure can be used to come up with a report

Use your brain power!

My report for the experiment to test my hypothesis.

Title : An experiment to show that milk contains carbon

Introduction: Milk must contain carbon. This is because milk contains carbohydrates whose building blocks are carbon. To show that milk contains carbon, i plan to put some milk in an evaporating dish and heat the dish strongly using a Bunsen burner then observe what remains behind at the bottom of an evaporating dish on complete evaporation of the milk.

Hypothesis: Milk could be containing carbon

Materials & apparatus: milk, bunsen burner, evaporating dish, heat source

Procedure:

- Pour milk to half fill an evaporating dish
- Place the evaporating dish containing milk on a tripod stand with a wire gauze under a bunsen burner.
- Light the bunsen burner to boil all the milk from the evaporating dish.
- Observe what remains at the bottom of an evaporating dish.

Results:

- I observed a black residue at the bottom of an evaporating dish.

Analyzing the results:

Complete evaporation of milk gave a black residue at the bottom of an evaporating dish. The black residue must be carbon.

Conclusion:

Milk contains carbon

Learning objectives

Students will be able to:

- give examples of daily life materials which contain carbon.
- Show practically that a material contains carbon.

Assessment

Students are able to:

- Classify materials in daily life into those which contain carbon and those which don't.
- Explain how to show that a material contains carbon or not.

More on discussion for findings

ask these questions as discussion points to the learners discussing or even to the entire class to unlock learners' competency potential on showing that a material contains carbon

1. How did you ensure your safety during the activity?
2. Which challenges did you face during the activity?
3. How can those challenges be prevented or minimized?
4. Was you're your hypothesis right? If not what was your way forward?

   A teacher can add on other questions

4. Summary & conclusion

- Ask students to open their learners' books And write answers for the key question & use your brain power in the answer sheet space provided.
- Learners can add any other relevant information & summaries in the answer sheet template provided.

It's better for learners to write notes after discussions such that the answer template is not wasted.

- Ask the key question once again & listen to Learner's responses. As a form of assessment, ask learners the questions appearing in the assessment table

Suggested lesson time allocation

Duration: 80 minutes (two 40 mins double lesson)
Introduction: 10 minutes
Activity: 35 minutes
Discussion for findings: 25 minutes
Summaries & conclusion: 10 minutes

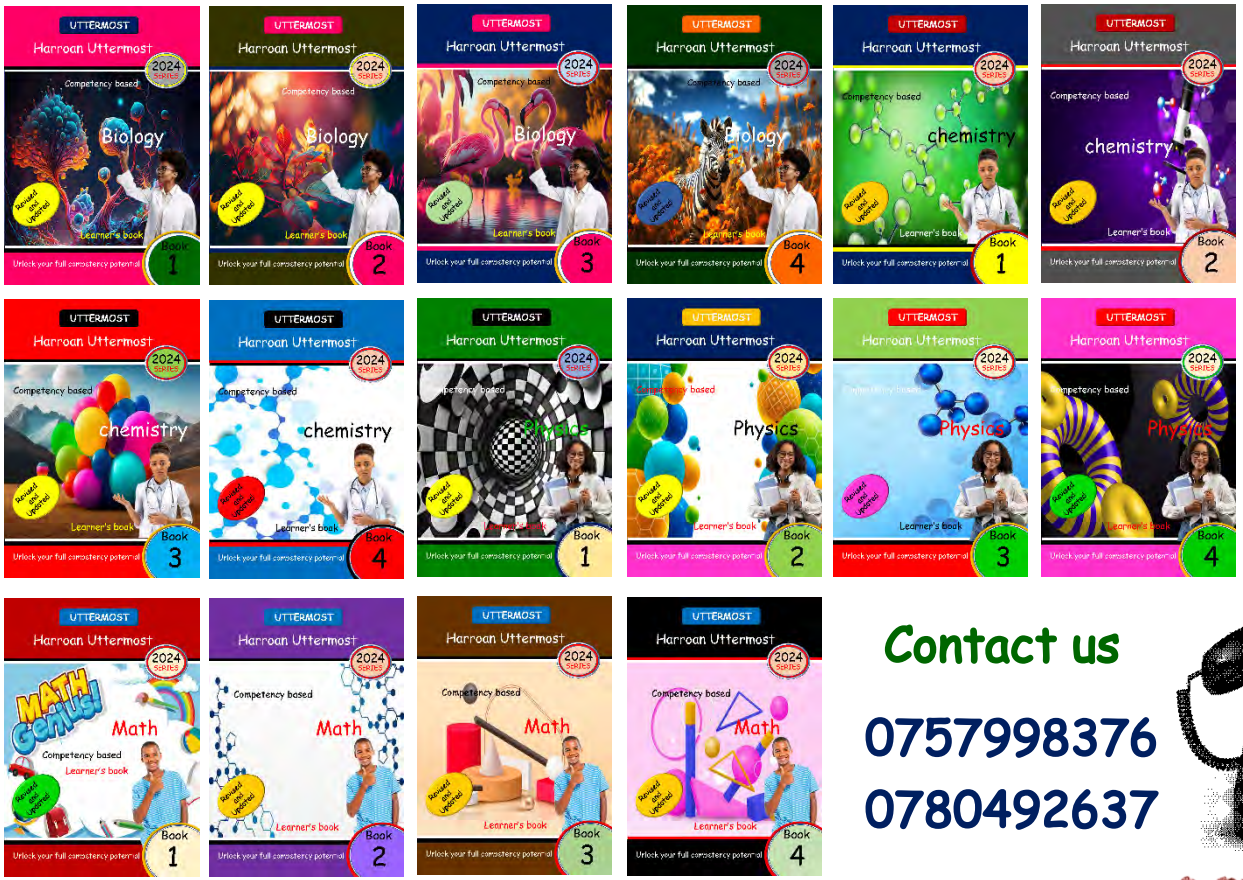
Why a new version each year?

Harroan releases new versions of learner's books each year in order to align the content with evolving education needs and standards. Producing new versions ensures that the content remains current & up to date. This allows learners to learn most relevant and accurate information. Education methodologies & pedagogical approaches evolve over time, incorporating new insights & strategies to enhance student learning.

2024 books on market

1. Uttermost series – 2024 series

Harroan uttermost versions are our third editions improved from our 2023 versions with new features like use your brain power, answer sheet template, improved guide notes & others. This sample contains a few pages of the Harroan Uttermost books. All other Harroan Uttermost books have the same structure.



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3. The standard clear format print- the one used in 2023 versions
4. The best quality hd print- the newly introduced one

Advert break **Book pages 210**

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1 learner's book	25,000	None
1 teaching guide	30,000	None
Learner's book + teaching guide	50,000	None
5 to 9 learners' Books	20,000 each	None. The books can be of different classes or subjects
10 to 19 learners' Books	18,000 each	None. Still the books can be of different subjects or classes
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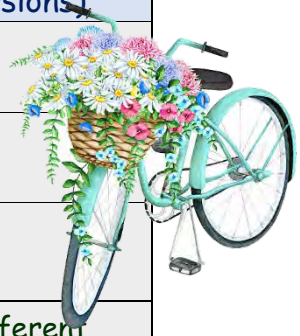

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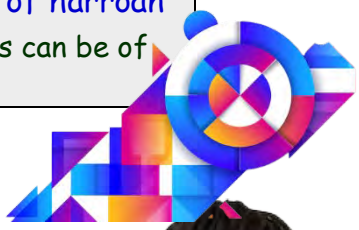

Harroan enterprise versions are first editions of our new books full of scenario & practical based questions which will unlock the learners' competence potential. The books are not practical books though they contain a practical view section with competence based practical questions. They are different from Harroan Enterprise plus that they concentrate on a particular class. They contain a full separate teaching guide.

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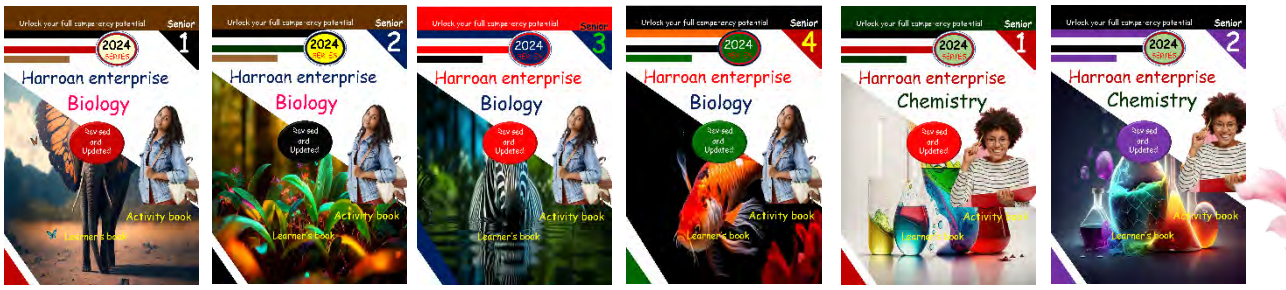

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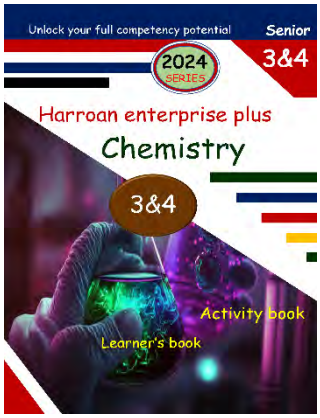

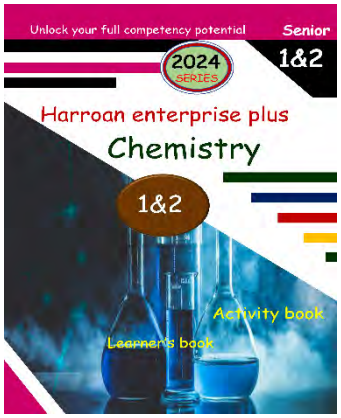

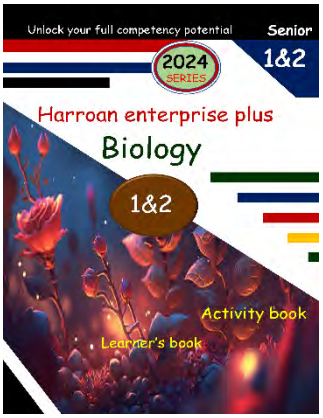

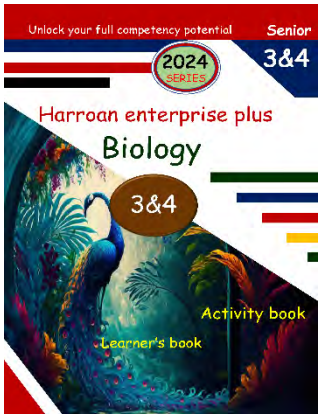

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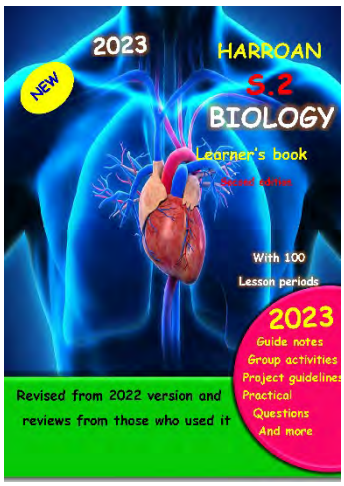

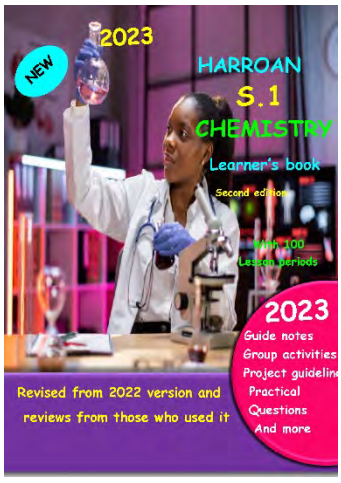

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