UTTERMOST

Harroan Uttermost

2024 SERIES

Competency based

Biology

Revised and Updated

Learner's book

Book 4

Unlock your full competency potential

2024
Series

A sample teaching guide
Appears at the end

HARROAN-UTTERMOST

Biology S4

New curriculum learner's book for s.4

Student's information.

This book belongs to:

Name .....

School .....

Class .....

Stream.....

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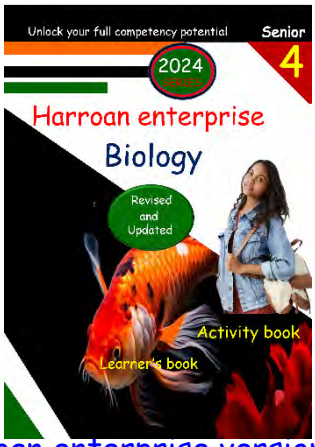
Changes in 2024 versions

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 1

Asexual Reproduction

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

- Understand the concept of asexual reproduction and its significance in the life cycles of different organisms.
- Identify and describe various methods of asexual reproduction, such as binary fission, budding, fragmentation, spore formation, and vegetative propagation.
- Explore the advantages and disadvantages of asexual reproduction compared to sexual reproduction.
- Describe the different adaptations and mechanisms that organisms have evolved for successful asexual reproduction.
- Examine real-life examples of asexual reproduction in plants, animals, and microorganisms and their ecological implications.

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1.1 Asexual reproduction in lower organisms

Introduction to Reproduction

Reproduction biology, although it may seem distant from our day-to-day lives, actually plays a crucial role in shaping the world around us. From the birth of a new baby to the growth of plants in our gardens, the wonders of reproduction surround us in our daily lives. By understanding the fundamentals of reproductive processes, we gain a deeper appreciation for the miracles of life and the integral role reproduction plays in sustaining our existence.

Reproduction is a fundamental process by which biologically matured living organisms produce offsprings that are genetically similar to them. It is the ability of an organism to produce new individuals of the same species. Reproduction ensures survival and continuity of different types of individuals in the population. The new individuals produced undergo growth and development before they reach the period of being capable to reproduce.

Importance of Reproduction in Daily Life

1. Human Life existence: Reproduction is fundamental to the existence of the human race. It is through reproduction that new generations are born, ensuring the survival and diversity of our species. The birth of a child is a momentous event in the lives of individuals and families, highlighting the significance of reproduction in our daily lives.

2. Food Production: Reproduction is essential in the domain of agriculture and food production. Plants reproduce through processes such as pollination and seed formation, which are responsible for the growth and propagation of crops. Without reproduction, we would not have a sustained supply of food to meet our daily nutritional

Reproduction ensures survival & continuity of organisms

3. Economic Impact: Reproduction has significant economic implications. Livestock and poultry industries rely on successful reproduction for the production of meat, milk, eggs, and other animal-based products. It also underpins industries related to plant breeding, where new varieties are developed to enhance crop yields, disease resistance, and other desirable traits.

Challenger

1. Imagine a world without reproduction. How do you think this would impact human existence and the continuation of our species?
2. Consider a scenario where plants no longer reproduce. What consequences might this have on food production and the availability of fresh fruits and vegetables in our daily lives?

Use the answer sheet template

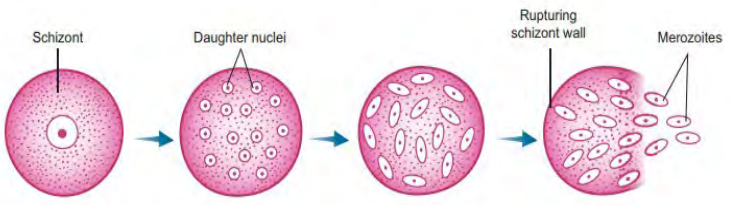
Key question: Define asexual reproduction & describe the different types of asexual reproduction

While the overarching goal of reproduction is the same, the methods and mechanisms can vary widely among different species. Understanding the different types of reproduction is essential for comprehending the diversity and complexity of life on our planet. From asexual reproduction to sexual reproduction, each method has its unique characteristics and advantages.

Group activity:

1a) The figures below show the different types of asexual reproduction in lower organisms. For each, identify the type of asexual reproduction, describe how it occurs & outline examples of organisms which have that type of asexual reproduction

b) identify common characteristics in all the types and hence derive the meaning of the term asexual reproduction



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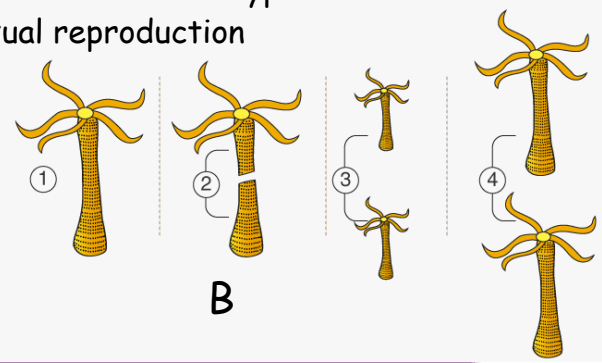

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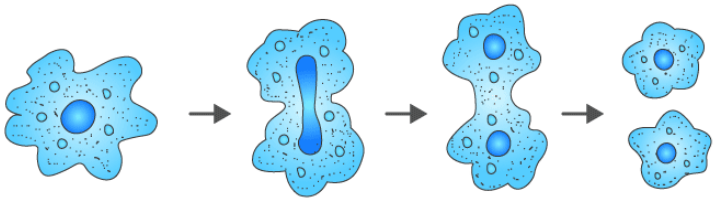

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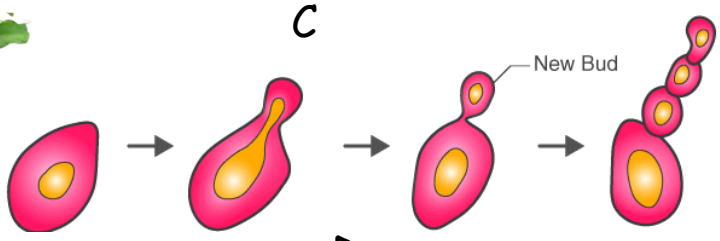

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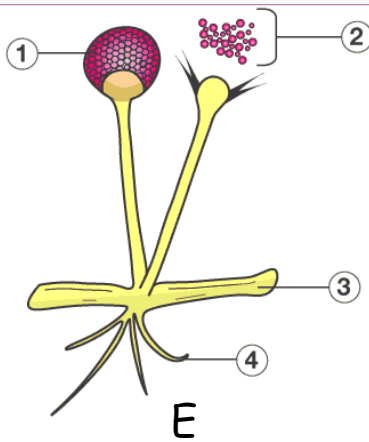

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Use your brain power!

2. Imagine you are studying a species of bacteria that reproduces through binary fission. Describe how this method of reproduction contributes to the rapid growth and spread of bacterial populations.

3. Imagine you are studying a population of bacteria in a lab. Suddenly, one bacterium starts dividing into two identical daughter cells through binary fission every 20 minutes. How many bacteria will you have after 3 hours?

4. In your garden, you accidentally break a leaf from a succulent plant. To your surprise, the leaf falls on the soil and starts developing roots and new shoots. Explain how fragmentation helps succulent plants multiply and create new individuals.

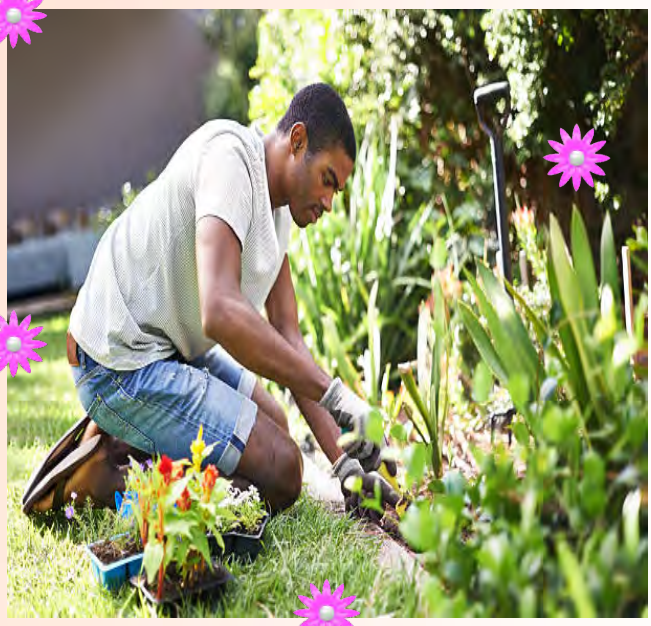
My notes — Answer template

1.2 Asexual Reproduction in Plants

Key question: Identify and describe the mechanisms of natural vegetative propagation

Guide notes

Asexual reproduction in plants is a fascinating process that allows plants to reproduce and multiply without the involvement of seeds or the need for pollinators. Through various methods, plants are capable of producing new individuals using vegetative structures of the parent plant. This ability to reproduce asexually has significant implications for plant survival, propagation, and human activities. In plants, asexual (vegetative) reproduction involves the growth of a new plant from other parts of plant such as a stem, leaf or root but not from the seed. People use vegetative reproduction to grow new plants from a root, stem or leaf This is what is referred to as vegetative propagation.



Imagine you have a beautiful flowering plant in your garden that you want to share with your friend. Instead of collecting seeds or waiting for flowers to produce fruits, you can use natural vegetative propagation methods to create new plants. By taking stem cuttings, dividing bulbs, or separating baby plantlets from the parent plant, you can easily generate genetically identical replicas of the original plant. This allows you to propagate your favorite plants quickly and share them with others, enhancing biodiversity in gardens and fostering a sense of connection and exchange among plant enthusiasts.

Vegetative propagation is any form of asexual reproduction in plants in which a new plant grows from a fragment of a parent plant and not from seeds. Similar to other types of asexual reproduction this form of reproduction does not involve gamete formation and fertilisation. Vegetative propagation uses parts of the original plant such as stems, leaves and roots to initiate a new plant. Plants such as bananas, sweet potatoes, cassava and pineapples have the ability to reproduce by vegetative propagation. Vegetative propagation is also known as vegetative reproduction or vegetative multiplication. Many plants can reproduce by vegetative propagation either naturally or by artificial means. Natural propagation occurs without human intervention. Artificial vegetative reproduction is the propagation which occurs as a result of human intervention and manipulation.

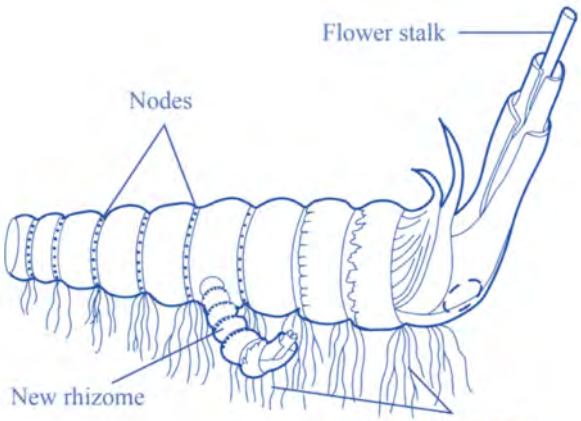
Natural vegetative propagation There are various plant structures through which natural vegetative propagation can occur. Vegetative structures that enable natural vegetation reproduction include rhizome, stolon, bulb, corm, tubers suckers, and bulbils.

Group activity:

Group activity:

Identifying & describing plant mechanisms of natural vegetative propagation

1 The figures below show the different mechanisms of natural vegetative propagation in plants. For each, identify the mechanism of natural vegetative propagation, describe how it leads to formation of new plants and outline examples of plants with that mechanism of vegetative propagation



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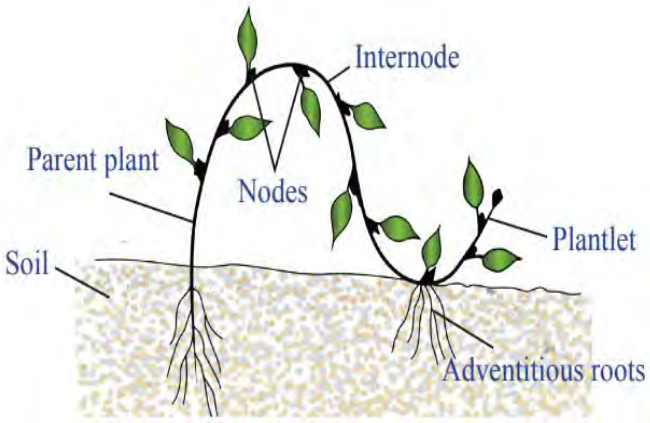

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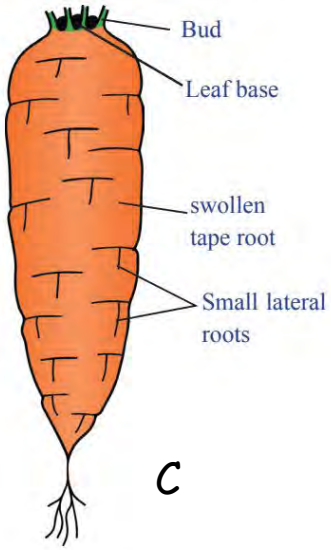

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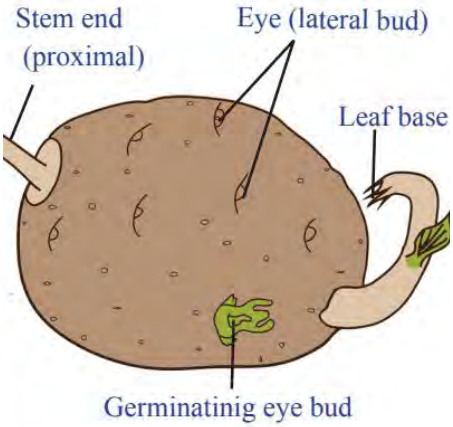

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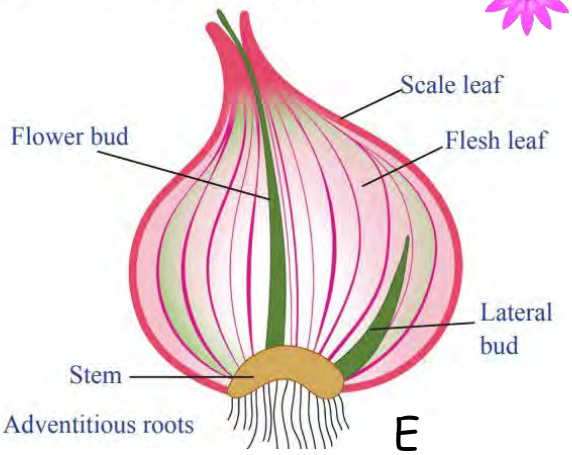

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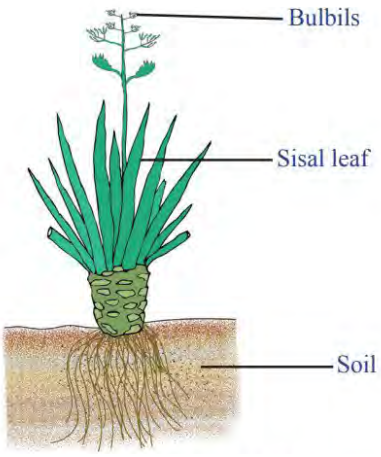

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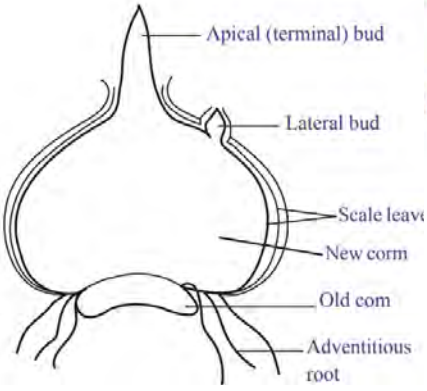

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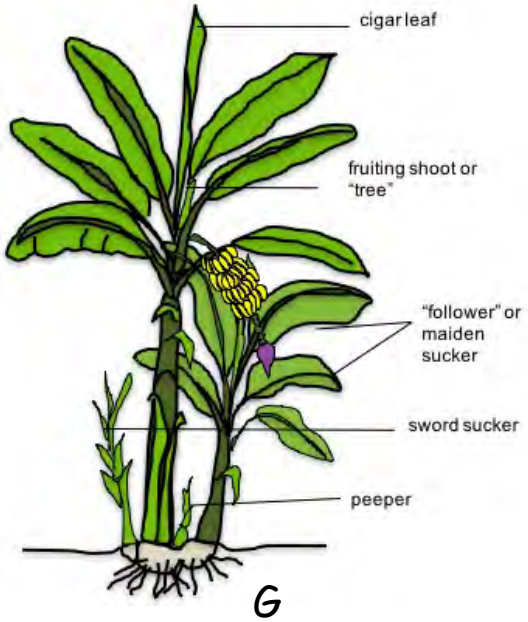

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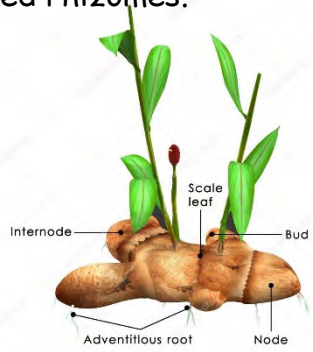
2.You notice a plant in your garden that has spread and created a new plant through the growth of horizontal stems called runners. What method of natural vegetative propagation is this plant utilizing, and how does it benefit the plant?

Use your brain power!

1. You encounter a plant in a wetland area with underground stems called rhizomes.



Task: Identify the plant species and describe the role of rhizomes in its natural vegetative propagation. Discuss how rhizomes aid in the plant's adaptation to its environment and enhance its survival.

2. You attend a horticulture workshop and learn about a plant that produces miniature plantlets on its leaves.

Task: Identify the plant species and describe the process through which these miniature plantlets are formed. Discuss the significance of this method of natural vegetative propagation and how it contributes to the plant's ability to colonize new habitats.

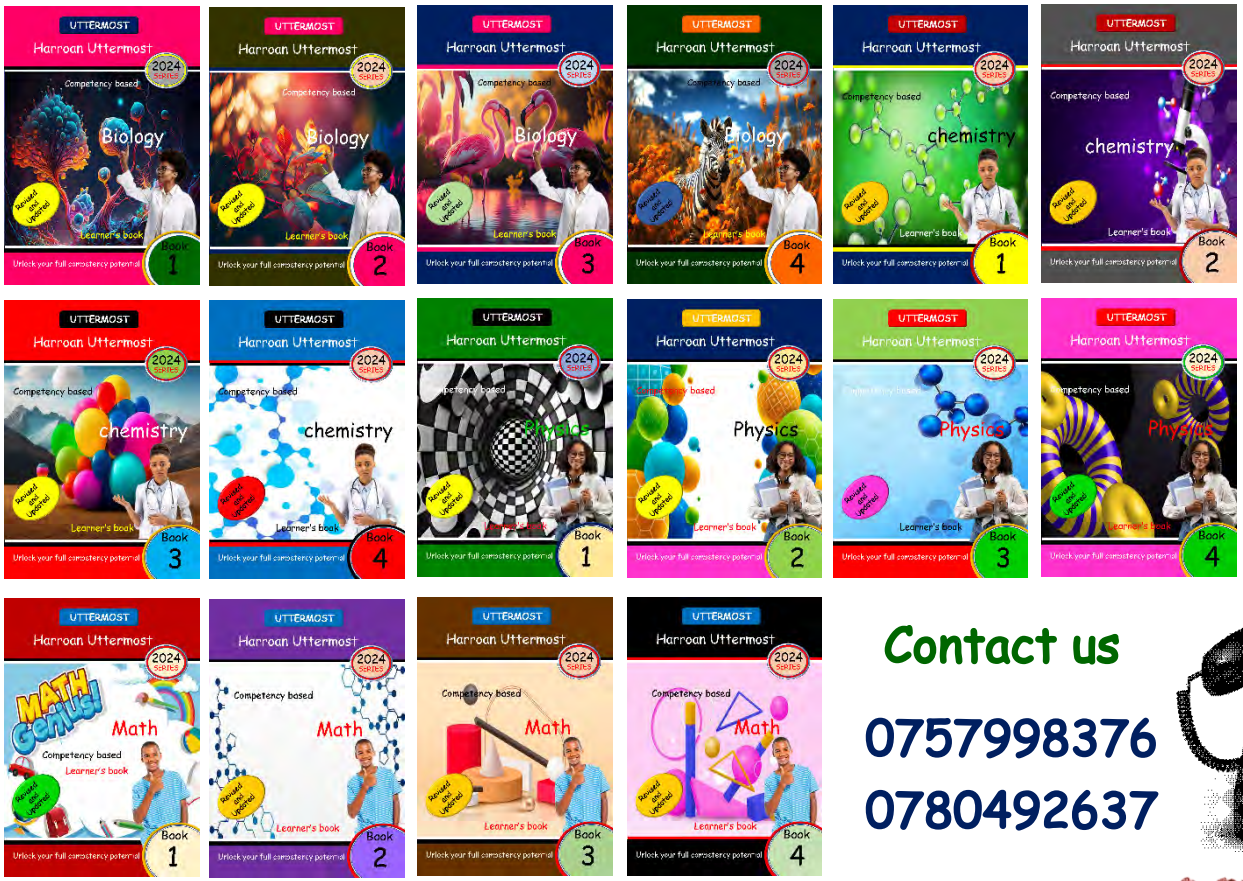
Why a new version each year?

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**

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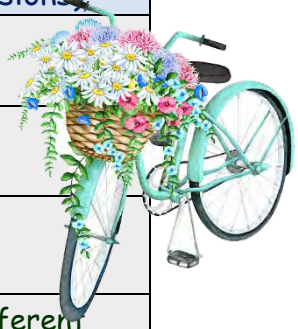
Book(s) price	Price	Additional benefits (Tp costs, free teaching guide, free other versions)
1 learner's book	25,000	None
1 teaching guide	30,000	None
Learner's book + teaching guide	50,000	None
5 to 9 learners' Books	20,000 each	None. The books can be of different classes or subjects
10 to 19 learners' 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

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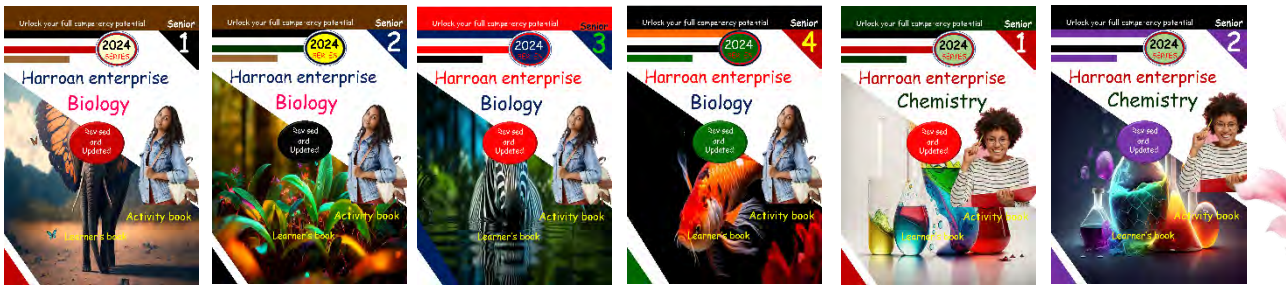
Selling structure for standard clear print out. Order starts from 10



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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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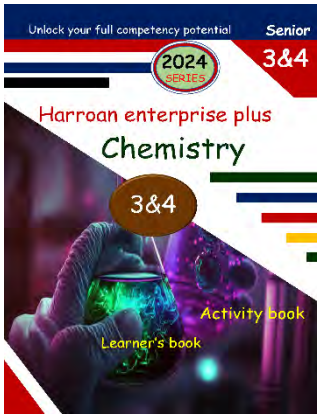
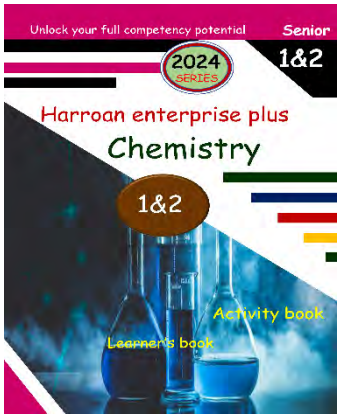
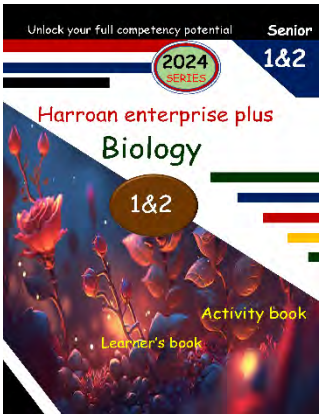
Book pages 300

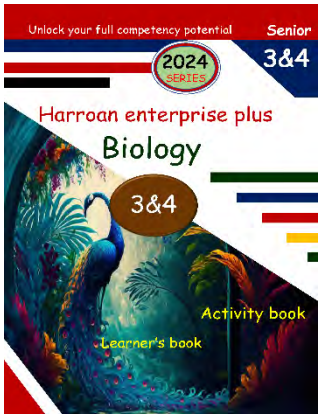
2. Enterprise plus series – 2024 series

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 Artificial vegetative propagation in Plants

Key question: Identify and describe the different methods of artificial vegetative propagation

Guide notes

Artificial propagation, also known as plant propagation or plant breeding, refers to the deliberate manipulation and reproduction of plants by humans. It involves techniques such as grafting, rooting cuttings, tissue culture, and seed propagation to create new plants with desired traits. These techniques allow us to replicate and propagate plants that possess specific characteristics we find valuable or to preserve genetic diversity.

In our daily lives, artificial propagation has a profound impact on gardening and horticulture. It enables us to reproduce our favorite plants, such as flowering ornamentals, fruit trees, and vegetables, ensuring we have a steady supply of beautiful and edible crops. Imagine being able to grow your favorite roses, tomatoes, or herbs consistently, year after year, without relying on chance seed germination. Artificial propagation makes it possible!

Moreover, artificial propagation is crucial in agriculture. Farmers utilize this technique to breed and propagate crops with desirable traits, such as improved yield, disease resistance, or nutritional content. By selectively cross-breeding plants and reproducing them through artificial propagation, we can obtain higher-quality crops that contribute to our daily food supply. This process helps meet the increasing demand for food around the world and promotes sustainable agriculture practices.

Artificial propagation also plays a vital role in the preservation of endangered plant species. By reproducing rare and threatened plants through techniques like tissue culture, we can safeguard their genetic material and prevent their extinction. This process is essential for maintaining biodiversity, protecting fragile ecosystems, and preserving plants with medicinal or ecological significance.

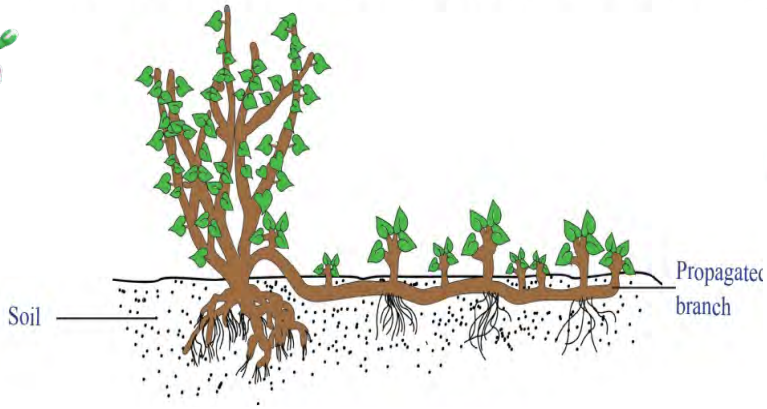
One of the primary reasons for utilizing artificial propagation is the ability to produce large quantities of plants with desirable characteristics. This technique is commonly employed in agriculture and horticulture to ensure a consistent supply of crops, flowers, and ornamental plants. By selectively breeding and propagating plants with specific traits, such as disease resistance, productivity, or aesthetic appeal, we can obtain improved varieties that meet our needs and preferences.

Group activity:

Group activity:

Identifying & describing plant methods of artificial vegetative propagation

1. The figures below show the different methods of artificial vegetative propagation in plants. For each, identify the method of artificial vegetative propagation, describe how each is carried out and outline examples of plants propagated in that method.



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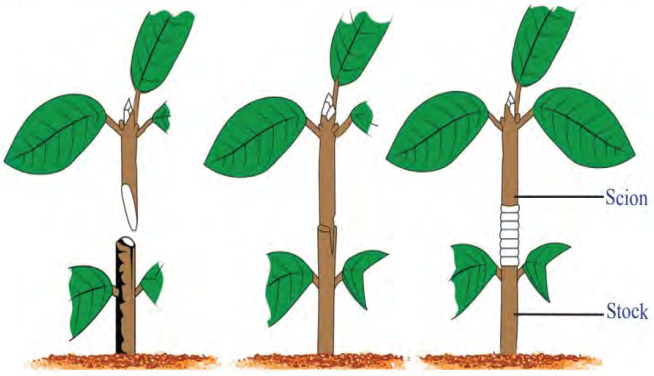

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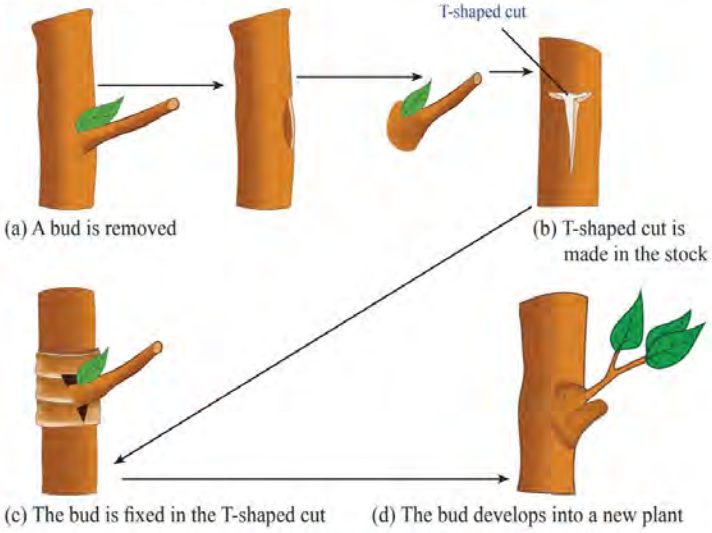

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Use your brain power!

2. You are a horticulturist working in a greenhouse. One of your colleagues wants to propagate a rare and endangered plant species to ensure its conservation. How would you suggest using artificial propagation techniques to increase its numbers?

3. You are a farmer who wants to improve the yield and disease resistance of your tomato crops. How would you employ artificial propagation methods to breed and propagate tomato plants with these desirable traits?

1.4 Growing plants at school by artificial propagation

Key question: how does artificial propagation contribute to the successful growth of plants at school?

Artificial propagation in schools not only supports science education but can also integrate with other subjects such as art, mathematics, and environmental studies. Students can document the growth of their propagated plants through drawings, measure and record changes in plant height and leaf count, and explore the interdependency of plants within ecosystems. Incorporating artificial propagation in schools allows students to actively participate in the wonders of plant reproduction. This hands-on approach provides a holistic learning experience, fostering curiosity, scientific inquiry, and appreciation for the natural world. By engaging in these activities, students develop important skills, gain a deeper understanding of plants, and cultivate a connection with nature that can last a lifetime.

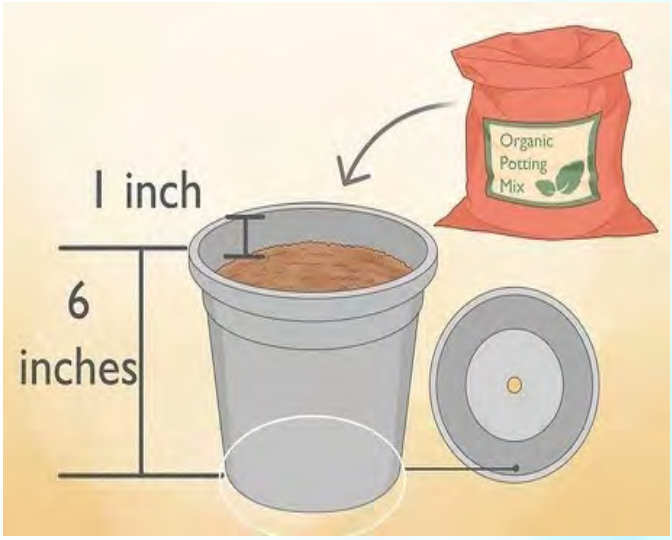
Growing plants by artificial propagation at school

Method 1: taking cutting

Materials; potting mix (soil mixture with organic matter & added nutrients), a healthy african violet plant, plastic bag, a pair off clippers

Procedure;

1. Fill a pot or seedling flat with a well-draining potting mix. When you're only propagating a few cuttings, choose a 6-inch (15 cm) flower pot. No matter what container you use, make sure it has drainage holes so excess moisture can drain out. Fill the pot or flat with an organic potting mix so it's about 1 inch (2.5 cm) below the edge. If you want to make your potting mix for cuttings, mix equal parts compost, vermiculite, and peat moss

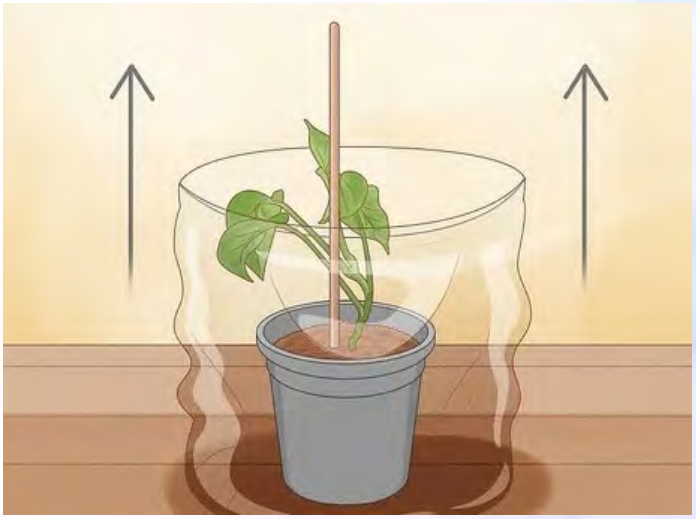


2. Take a cutting from stems, leaves, or roots from the current growing season. Take your cutting while your plant is actively growing so it's more likely to develop roots. Put on a pair of gardening gloves and use a clean pair of clippers for your cutting. The main places to take cuttings are from the stem, leaf, or roots, but the location and size of the cutting depends on the type of plant you're propagating

3. Prepare your cuttings to help encourage healthy growth. Plant cuttings may not put their energy into growing new roots without a little encouragement first. For stem and leaf cuttings, rooting hormone helps new roots form so the plant can reestablish itself. Root cuttings need to stay cool and moist before they're planted so they don't dry out

4. Insert the cutting into the potting mix. For a stem cutting, push about a third of the stem into the potting mix so the buds point upward. With a leaf cutting, just stick the base vertically into the potting mix so the cut end is buried. If you took a root cutting, position large-diameter roots vertically so they're 2–3 inches (5.1–7.6 cm) below the surface. Make sure you don't place your cutting in the pot upside-down, or else it will not propagate or grow properly.

5. Place both the pot and the cutting into a plastic bag. Put gardening stakes into the potting mix to keep the plastic bag from touching your plants while they're growing. Put your pot into a large, clear plastic bag and tie it closed to trap in the moisture and humidity. Cuttings can't take up water from the potting mix since they don't have roots yet, so the bag helps your plants retain moisture.
Some seedling mats come with plastic covers that snap on so you don't need a plastic bag.



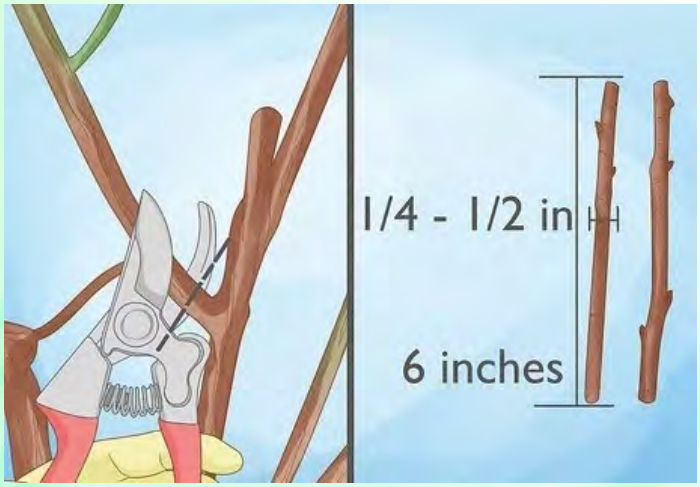
6. Keep your cutting in a bright, warm area out of direct sunlight. Choose a south- or east-facing window and place the bag with your cuttings there. Maintain a temperature around (21 °C) to grow your cuttings and establish roots. Avoid putting your cuttings in direct sunlight because it can stress your plants and cause them to burn or drop leaves.

7. Moisten the potting mix every few days if it dries out. Take the pot out of the bag every 2–3 days and check if the potting mix feels damp to the touch. If the mix feels dried out, use a spray bottle or watering can to lightly wet it. Let the water come out of the container's drainage holes before putting the bag back on. If the bag has water pooling in the bottom, empty it out before putting the container back inside.

8 Transplant the cutting after 2–3 weeks when it grows roots. Gently work your hand underneath the cutting and lift it up from the potting mix to see if roots have formed. Once you see roots, keep the plastic bag untied to decrease the humidity. Then, fill a new pot with moist potting mix and transplant your cutting to its new home. If you don't see roots yet, place the cutting back in the container and compact the soil around it. Put the bag back on, retie it, and check for roots again in 1–2 weeks.

Method 2: grafting

1. Grafting is taking the stem from one plant and attaching it to the rootstock of another plant. Once your plants go dormant or drop their leaves, start grafting your plants so they can get more established during the next growing season. Grafting works best for fruit trees when you want to preserve the flavors and qualities of the fruit.



2. Collect 6-inch (15 cm) pieces of wood from the plant you're propagating. Choose branches or stems (also known as "scions") from the last growing season rather than mature branches because they're more likely to propagate successfully. Choose straight pieces with multiple buds growing on them. Use a pair of garden clippers to trim the pieces off of the existing plant.

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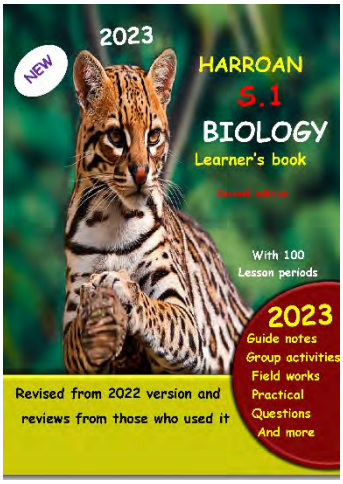

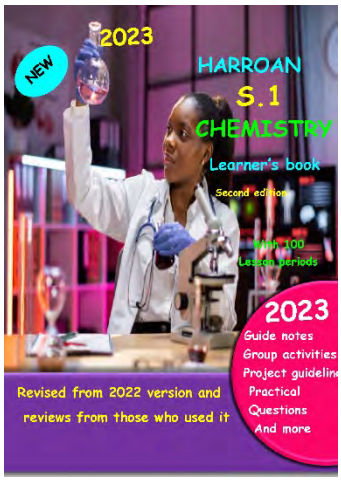

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Chapter 2

sexual Reproduction In Humans

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

- Define sexual reproduction and describe its importance in the life of organisms.
- Identify and label the reproductive organs and structures in both male and female organisms.
- Describe the functions of each reproductive structure in their respective roles in reproduction.
- Compare male and female gametes
- Describe the process of fertilization of an ovum and the developments of the zygote up to birth
- Describe the meaning and importance of antenatal medical care
- Outline health risks/complications associated with early/teenage pregnancy and abortion
- understand the common issues associated with reproductive systems
- analyse the challenges faced by people living with HIV/AIDS and how to overcome them.

A sample of the teaching guide for Harroan uttermost s4 appears on the next page


UTTERMOST
Harroan Uttermost
Teaching guide
Biology
Competency based
Book
4

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.

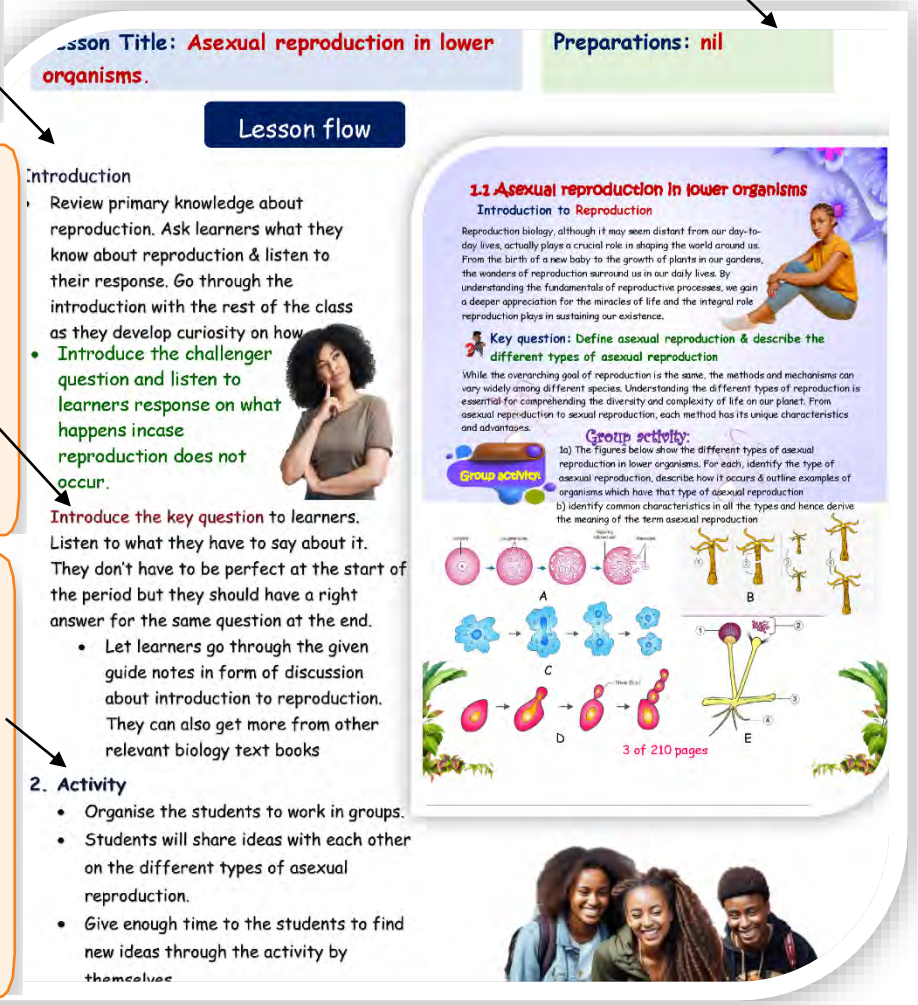
Main contents of the Teaching guide

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.

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

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..



Lesson Title: Asexual reproduction in lower organisms.

Preparations: nil

Lesson flow

Introduction

- Review primary knowledge about reproduction. Ask learners what they know about reproduction & listen to their response. Go through the introduction with the rest of the class as they develop curiosity on how
- Introduce the challenger question and listen to learners response on what happens incase reproduction does not occur.

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 about introduction to reproduction. They can also get more from other relevant biology text books

2. Activity

- Organise the students to work in groups.
- Students will share ideas with each other on the different types of asexual reproduction.
- Give enough time to the students to find new ideas through the activity by themselves

1.1 Asexual reproduction in lower organisms

Introduction to Reproduction

Reproduction biology, although it may seem distant from our day-to-day lives, actually plays a crucial role in shaping the world around us. From the birth of a new baby to the growth of plants in our gardens, the wonders of reproduction surround us in our daily lives. By understanding the fundamentals of reproductive processes, we gain a deeper appreciation for the miracles of life and the integral role reproduction plays in sustaining our existence.

Key question: Define asexual reproduction & describe the different types of asexual reproduction

While the overarching goal of reproduction is the same, the methods and mechanisms can vary widely among different species. Understanding the different types of reproduction is essential for comprehending the diversity and complexity of life on our planet. From asexual reproduction to sexual reproduction, each method has its unique characteristics and advantages.

Group activity:

1a) The figures below show the different types of asexual reproduction in lower organisms. For each, identify the type of asexual reproduction, describe how it occurs & outline examples of organisms which have that type of asexual reproduction

b) identify common characteristics in all the types and hence derive the meaning of the term asexual reproduction

A B C D E

3 of 210 pages

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

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

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.

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

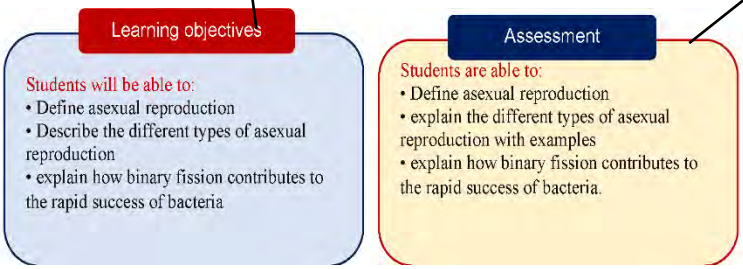
- Ask the key question once again & listen to Learner's responses. As a form of assessment, ask learners the questions appearing in the assessment table

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

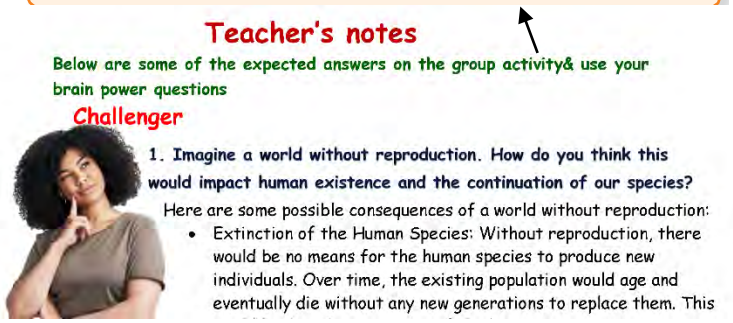
Teacher should reflect own lesson along this criteria through the lesson. The three components of knowledge, thinking skills, attitude & values are also indicated in the teacher's manual.

'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

Challenger

1. Imagine a world without reproduction. How do you think this would impact human existence and the continuation of our species?

Here are some possible consequences of a world without reproduction:

- Extinction of the Human Species: Without reproduction, there would be no means for the human species to produce new individuals. Over time, the existing population would age and eventually die without any new generations to replace them. This

Theme: Reproduction in organisms
Topic: Asexual Reproduction

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

Lesson Title: Asexual reproduction in lower organisms.

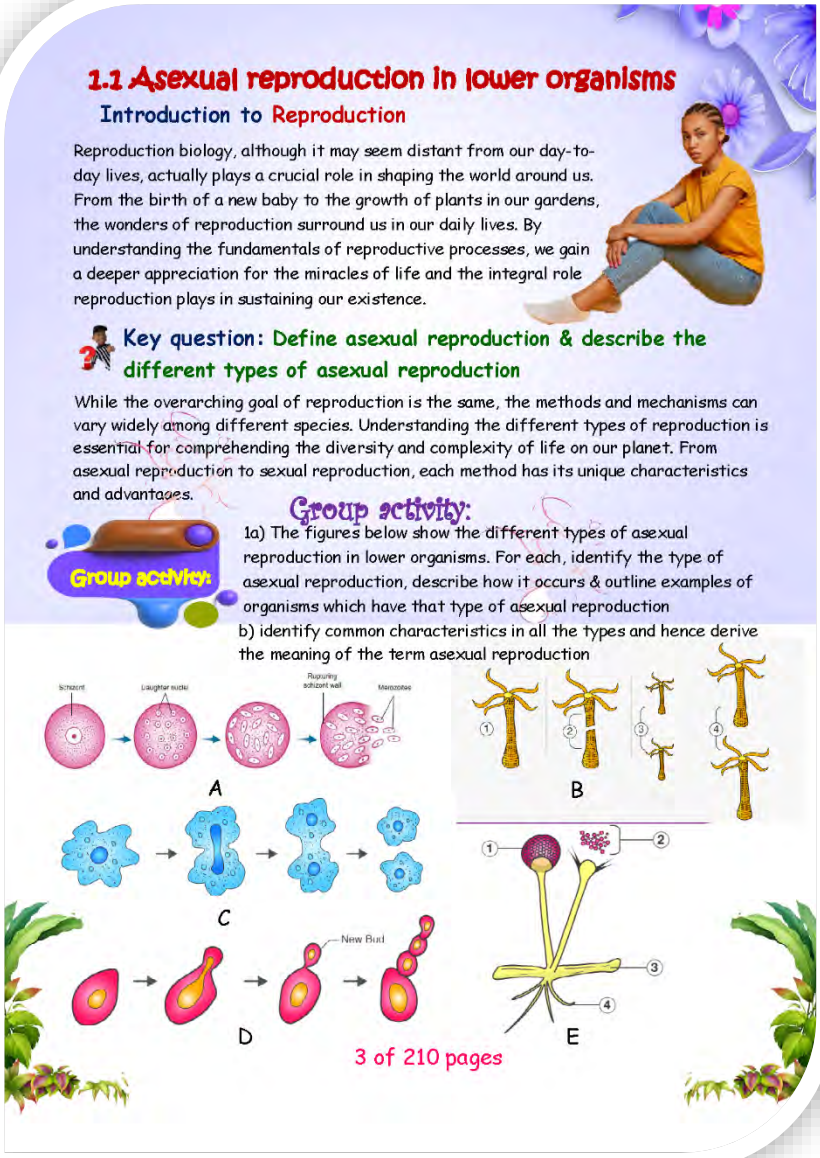
Preparations: nil

Lesson flow

1. Introduction
   - Review primary knowledge about reproduction. Ask learners what they know about reproduction & listen to their response. Go through the introduction with the rest of the class as they develop curiosity on how
   - Introduce the challenger question and listen to learners response on what happens incase reproduction does not occur.

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 about introduction to reproduction. They can also get more from other relevant biology text books



2. Activity
   - Organise the students to work in groups.
   - Students will share ideas with each other on the different types of asexual reproduction.
   - Give enough time to the students to find new ideas through the activity by themselves.

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

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

Teacher's notes

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

Challenger

1. Imagine a world without reproduction. How do you think this would impact human existence and the continuation of our species?

Here are some possible consequences of a world without reproduction:

- Extinction of the Human Species: Without reproduction, there would be no means for the human species to produce new individuals. Over time, the existing population would age and eventually die without any new generations to replace them. This would lead to the extinction of the human species.
- Loss of Genetic Diversity: Reproduction allows for genetic diversity through the combination of genetic material from two individuals. Without reproduction, genetic variation would stagnate, leading to a loss of diversity within the human population. This lack of genetic diversity could reduce the adaptability and resilience of our species to changing environments and challenges.
- Impact on Social Structures: Reproduction plays a critical role in shaping family structures and relationships. In a world without reproduction, the concept of families as we know it would cease to exist. The traditional roles of parents, siblings, and extended family members would be completely altered or no longer relevant.

2. Consider a scenario where plants no longer reproduce. What consequences might this have on food production and the availability of fresh fruits and vegetables in our daily lives?

Here are some potential impacts:

1. Decline in Crop Yield: Plants reproduce through the formation of seeds or fruits, which contain the genetic information needed to grow new plants. Without reproduction, the availability of seeds for planting new crops would diminish, leading to a decline in crop yield. This would result in reduced food production, leading to scarcity and higher prices for fruits and vegetables.

2. Loss of Genetic Diversity: Reproduction allows for genetic diversity within plant species, which is important for the adaptability and resilience of crops. Lack of reproduction would lead to a loss of genetic diversity and increase the vulnerability of crops to pests, diseases, and changing environmental conditions. This could further reduce crop yields and impact the variety and quality of available fruits and vegetables.

3. Innovation in Agricultural Practices: The absence of plant reproduction would necessitate the development of alternative agricultural practices to sustain food production. This could involve techniques such as plant tissue culture, cloning, or genetic engineering to propagate plants without conventional reproduction. However, these methods may come with their own challenges and limitations.

Group activity:

1a) The figures below show the different types of asexual reproduction in lower organisms. For each, identify the type of asexual reproduction, describe how it occurs & outline examples of organisms which have that type of asexual reproduction

A - Multiple Fission: Multiple fission is a type of reproduction where a single parent organism divides into multiple offspring simultaneously. The parent organism's nucleus undergoes repeated divisions, forming multiple daughter cells, which are eventually released as independent individuals. Examples: Plasmodium

B - Fragmentation: Fragmentation occurs when a parent organism breaks into several fragments or pieces, each of which is capable of growing into a new individual. The fragments regenerate missing body parts to become complete organisms. Examples: ferns, sponges and some algae

C – Binary fission: In binary fission, a parent organism splits into two equal-sized daughter organisms. This division typically occurs through a replication of the genetic material followed by division of the parent cell into two separate cells. Examples: Bacteria, such as Escherichia coli (E. coli),

D – Budding: Budding involves the formation of a small outgrowth or bud on the parent organism. This bud grows and eventually detaches from the parent, becoming a separate individual. Examples: Hydra, yeast. A bud forms on the body of the parent, grows in size, and eventually detaches to become a new individual.

E – Sporulation: Sporulation involves the formation of specialized reproductive structures called spores. These spores are released from the parent organism and can grow into new individuals under favorable conditions. Examples: Fungi, such as molds and mushrooms,

b) identify common characteristics in all the types and hence derive the meaning of the term asexual reproduction

The common characteristics in all types of asexual reproduction are no involvement of Gametes, and no Genetic Variation: Based on these common characteristics, we can derive the meaning of the term "asexual reproduction." Asexual reproduction refers to a mode of reproduction in which offspring are generated from a single parent organism without the involvement of gametes, resulting in the production of genetically identical or very similar offspring.

Use your brain power!

2. Imagine you are studying a species of bacteria that reproduces through binary fission. Describe how this method of reproduction contributes to the rapid growth and spread of bacterial populations.

Here's how binary fission contributes to the rapid growth of bacteria:

1. Efficiency and Simplicity: Binary fission is a straightforward and efficient method of reproduction for bacteria. It allows for the direct division of a single bacterial cell into two identical daughter cells, each with a complete set of genetic material. This simplicity enables quick and efficient reproduction without the need for complex processes involved in sexual reproduction.

2. Short Reproductive Cycle: The time required for bacteria to complete the process of binary fission is relatively short. Bacterial replication and division can occur within hours, minutes, or even seconds, depending on the species and environmental conditions. This short reproductive cycle allows for a rapid increase in population size over a short period.

3. Lack of Mating Requirements: Binary fission does not require the involvement of another bacterial cell or the exchange of genetic material. Bacteria can reproduce independently without the need to locate and mate with a compatible partner, eliminating the time and energy spent on mating-related activities. This autonomy allows individual bacterial cells to focus solely on replication and growth.

3. Imagine you are studying a population of bacteria in a lab. Suddenly, one bacterium starts dividing into two identical daughter cells through binary fission every 20 minutes. How many bacteria will you have after 3 hours?

If one bacterium divides into two identical daughter cells through binary fission every 20 minutes, we can calculate the number of bacteria after 3 hours (180 minutes).

To calculate this, we can use the formula:

Final population = Initial population x (2^(total time / doubling time))

In this case:

Initial population = 1 bacterium (since we start with one bacterium)

Total time = 180 minutes (3 hours)

Doubling time = 20 minutes (time taken for one bacterium to divide into two)

Plugging in the values: Final population = 1 x (2^(180 / 20))

Calculating the exponential term: Final population = 1 x (2^9)

Final population = 1 x 512

Therefore, after 3 hours, you would have approximately 512 bacteria.

4. In your garden, you accidentally break a leaf from a succulent plant. To your surprise, the leaf falls on the soil and starts developing roots and new shoots. Explain how fragmentation helps succulent plants multiply and create new individuals.

Here is how fragmentation helps succulent plants multiply and create new individuals:

1. Regeneration: When a leaf breaks off from a succulent plant and falls on the soil, it can develop roots and new shoots. This regeneration ability allows the leaf to grow into a new plant.

2. Adventitious Roots: The leaf fragment forms roots that grow into the soil. These roots provide support and absorb water and nutrients, helping the leaf establish itself as an independent plant.

3. New Shoots: Along the damaged edge of the leaf, new shoots emerge and develop into complete plant structures. These shoots grow into new individuals, contributing to the multiplication of succulent plants.

4. Energy Reserves: Succulent plants store water and nutrients in their leaves and stems. When a leaf fragment starts developing roots and shoots, it can utilize these energy reserves to support its growth until it becomes self-sustaining.

5. Clonal Reproduction: Through fragmentation, succulent plants can create new individuals that are genetically identical to the parent plant. This allows for the spread of successful genetic traits and characteristics.

Learning objectives

Students will be able to:
- Define asexual reproduction
- Describe the different types of asexual reproduction
- explain how binary fission contributes to the rapid success of bacteria

Assessment

Students are able to:
- Define asexual reproduction
- explain the different types of asexual reproduction with examples
- explain how binary fission contributes to the rapid success of bacteria.

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. Learners should research abt the qns of the nxt period be4 the lesson period

- 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

Remind learners to research about questions of the next lesson period

Suggested lesson time allocation

Duration: 80 minutes (two 40 mins double lesson)
Introduction: 15 minutes
Activity: 30 minutes
Discussion for findings: 25 minutes
Summaries & conclusion: 10 minutes

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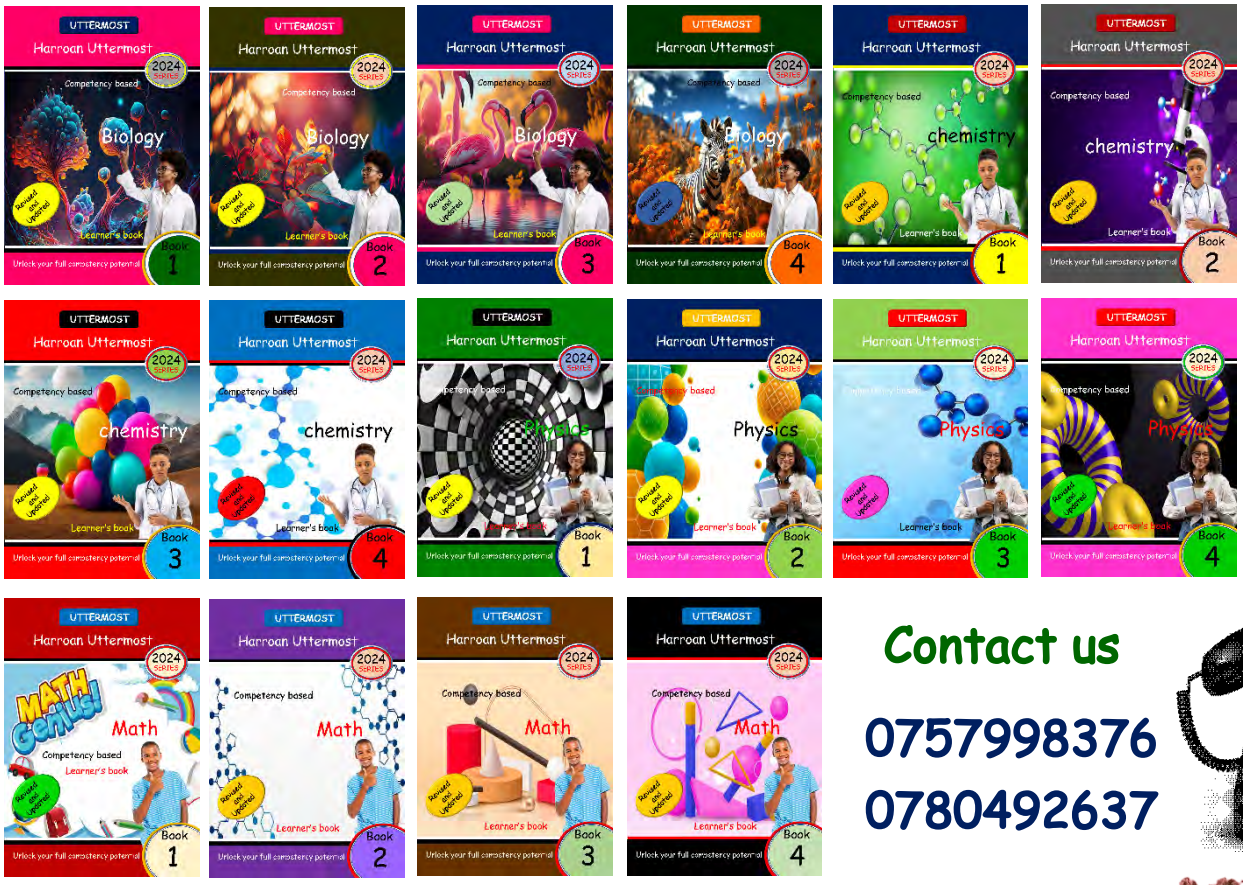

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1 teaching guide	30,000	None
Learner's book + teaching guide	50,000	None
5 to 9 learners' Books	20,000 each	None. The books can be of different classes or subjects
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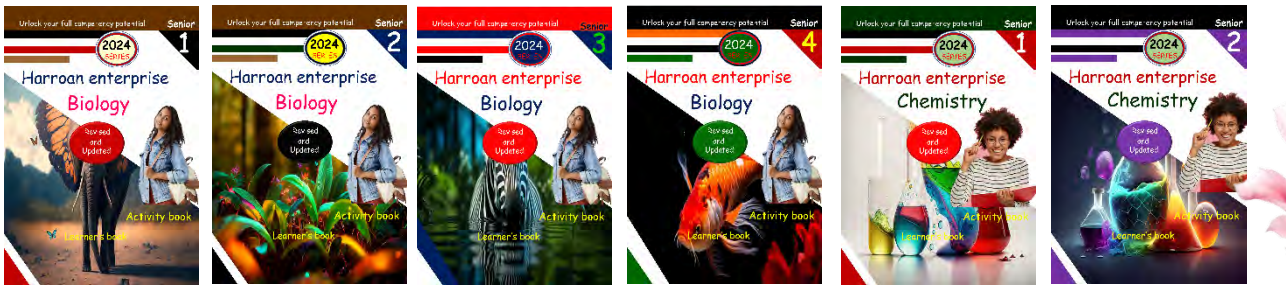

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40 to 49 learners' Books	15,500 each	Free transportation, books can be of different subjects or classes
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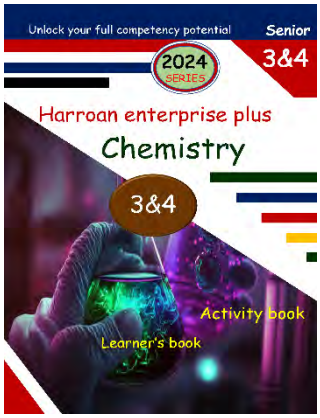

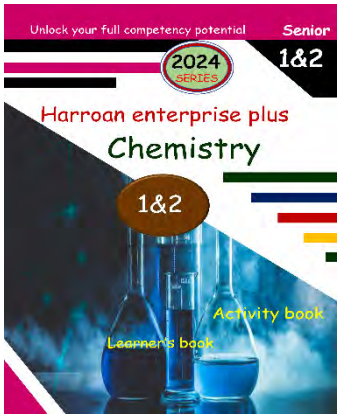

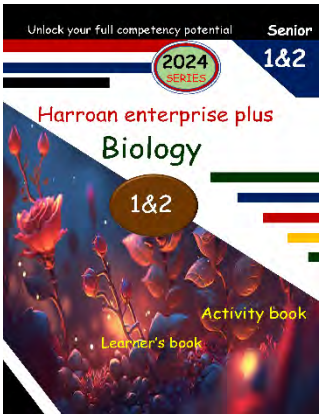

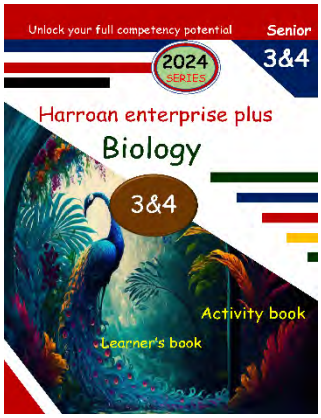

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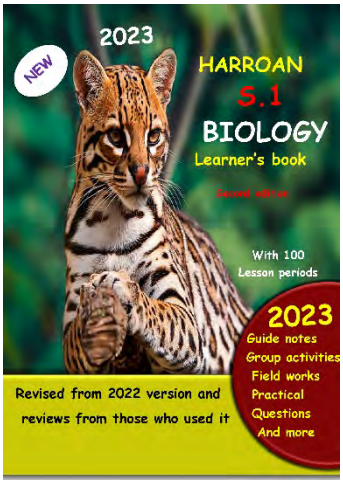

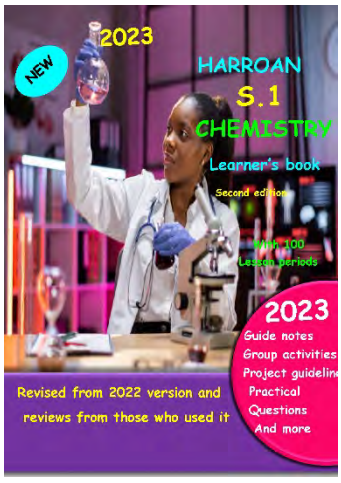

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