

Biology

Teacher's Guide
Grade 9

ISBN
Price



Federal Democratic Republic of Ethiopia
Ministry of Education

FDRE
MOE



Federal Democratic Republic of Ethiopia
Ministry of Education



Biology

Teacher's Guide

Biology

Teacher's Guide

Grade 9



Grade 9



Biology

Teacher's Guide

Grade 9

Writers: Zufan Bedewi , PhD
Hawassa University

Zelalem G/mariam, PhD
Hawassa University

Editors: Kedir Woliy, PhD (**Content Editor**)
Hawassa University

Girma Moti, MA (**Curriculum Editor**)
Hawassa University

Temesgen Daniel, PhD (**Language Editor**)
Hawassa University

Illustrator: Simachew Ayanaw, MSc.
Bahir Dar University

Designer: Tesfamichael Getu, PhD.
Bahir Dar University



FDRE Ministry of Education



Hawassa University

First Published xxxxx 2022 by the Federal Democratic Republic of Ethiopia, Ministry of Education, under the General Education Quality Improvement Program for Equity (GEQIP-E) supported by the World Bank, UK's Department for International Development/DFID-now merged with the Foreign, Common wealth and Development Office/FCDO, Finland Ministry for Foreign Affairs, the Royal Norwegian Embassy, United Nations Children's Fund/UNICEF), the Global Partnership for Education (GPE), and Danish Ministry of Foreign Affairs, through a Multi Donor Trust Fund.

© 2022 by the Federal Democratic Republic of Ethiopia, Ministry of Education. All rights reserved.

The moral rights of the author have been asserted. No part of this textbook reproduced, copied in a retrieval system or transmitted in any form or by any means including electronic, mechanical, magnetic, photocopying, recording or otherwise, without the prior written permission of the Ministry of Education or licensing in accordance with the Federal Democratic Republic of Ethiopia as expressed in the Federal Negarit Gazeta, Proclamation No. 410/2004 - Copyright and Neighboring Rights Protection.

The Ministry of Education wishes to thank the many individuals, groups and other bodies involved – directly or indirectly – in publishing this Textbook. Special thanks are due to Hawassa University for their huge contribution in the development of this textbook in collaboration with Addis Ababa University, Bahir Dar University and Jimma University.

Copyrighted materials used by permission of their owners. If you are the owner of copyrighted material not cited or improperly cited, please contact the Ministry of Education, Head Office, Arat Kilo, (P.O.Box 1367), Addis Ababa Ethiopia.

Printed by:
xxxxxxx PRINTING
P.O.Box xxxxxx
xxxxxxx, ETHIOPIA

Under Ministry of Education Contract no. xxxxxxxxxxxx

ISBN: XXXXXXXXXXXXX

Contents

Introduction to the Teacher's guide.....	i
Unit 1: Introduction to Biology (15 period)	1
1.1 Definition of Biology	2
1.2 Why do we study Biology?.....	4
1.3 The scientific method (or process)	5
1.4 Tools of a Biologist.....	7
1.5 Handling and using of a Microscope	8
1.6 General Laboratory Safety Rules	11
Unit 2: Living Things and their classification (18 Periods)	14
2.1 Characteristics of life	15
2.2 Taxonomy of living things	16
2.2.1 Principles of classification.....	16
2.2.2 Taxonomic hierarchies in biological classification	17
2.3 Relevance of classification	18
2.4 Linnaean system of nomenclature	19
2.5 Common Ethiopian animals and plants	20
2.6 The five-kingdom system of classification	22
2.7 Renowned Taxonomists in Ethiopia.....	31
Unit 3: Cells	33
3.1 What is cell?	34
3.2 Cell theory	35
3.3 Cell structure and function.....	37
3.4 Types of cells	41
3.5 Animal and plant cells.....	43
3.6 Observing cells under a microscope.....	44

3.7	The cell and its environment	45
3.8	Levels of Biological Organization.....	50
Unit 4:	Reproduction (29 periods)	53
4.1	Introduction Reproduction.....	54
4.2	Asexual reproduction.....	55
4.3	Types of asexual reproduction	55
4.4	Sexual reproduction in Humans.....	57
4.5	Primary and secondary sexual characteristics.....	58
4.6	Male reproductive structures	59
4.7	Female reproductive structures	60
4.8	The Menstrual cycle	61
4.9	Fertilization and pregnancy.....	63
4.10	Methods of birth Ccontrol.....	64
4.11	Sexually transmitted infectious: transmission and prevention.....	66
Unit 5:	Human health, Nutrition, and Disease	72
5.1	What is food.....	73
5.2	Nutrition.....	74
5.3	Nutrients.....	75
5.4	Balanced diet.....	78
5.5	Deficiency diseases.....	80
5.6	Malnutrition	82
5.7	Substance abuse.....	84
5.8	Infectious and noninfectiousdiseases (modes of transmission and prevention).....	87
5.9	Renowned Nutritionists in Ethiopia	90
Unit 6:	Ecology (15 Periods).....	91
6.1	Ecology.....	92
6.1.1	Definition of ecology.....	92

6.1.2	Biotic and abiotic components	93
6.1.3	Ecological levels	94
6.1.4	Ecosystems (Terrestrial and aquatic).....	95
6.1.5	Biomes	96
6.1.6	Ecological succession	99
6.2	Ecological relationships.....	100

Introduction to the Teacher's guide

The introduction of the teacher's guide provides relevant information on learning in general and learning Biology at the secondary level in particular. It includes the following sections:

- Basic learning principles
- A shift in learning approaches
- Learning approaches in Biology
- Objectives of secondary level Biology
- Active learning methods in Biology
- Model lesson plan

I. BASIC LEARNING PRINCIPLES

1. Learning is an active engagement of learners

The learner uses sensory input and constructs meaning out of it. Students learn to learn as they learn. Learning consists of both constructing meaning and constructing systems of meaning.

2. The crucial action of constructing meaning is mental; it happens in the mind

Physical actions and hands-on experience may be necessary for learning, but it is not sufficient; we need to provide activities that engage the mind as well as the hands.

3. Learning involves language; the language we use influences learning

On the empirical level researchers have noted that people talk to themselves as they learn.

4. Each learner is a unique individual in terms of needs, interests and Abilities

A teacher should recognize and handle the individual differences during the lesson. An Individual difference is a good opportunity to learn; it should not be taken as a weakness of the learner.

5. Learning is a social activity

Learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances.

6. Learning is contextual:

We do not learn isolated facts and theories in some abstract form. We cannot separate what we have in mind from the rest of our lives; we learn in relationship to what else we know, what we believe, our prejudices, and our fears. We cannot divorce our learning from our lives.

7. One needs the knowledge to learn

It is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. Therefore, any effort to teach must be connected to the state of the learner, must provide a path into the subject for the learner based on that learner's previous knowledge.

8. It takes time to learn

Learning is not instantaneous. For significant learning, we need to revisit ideas, ponder them, try them out, play with them and use them. This cannot happen in the 5-10 minutes usually spent in a gallery. If you reflect on anything you have learned, you soon realize that it is the product of repeated exposure and thought.

9. Motivation is a key component in learning

Not only motivation helps to learn, it is essential for learning. It helps the learner to be very much involved in learning and inspired more to learn.

II. SHIFT IN LEARNING APPROACHES

- A twofold major shift of emphasis in learning approaches includes
 - » A major shift of emphasis in terms of the learning process.
 - » A major shift of emphasis in terms of learning outcome.
- A shift in the learning process is from
 - » depositing knowledge in students to making students construct their knowledge.
 - » learning by listening to multi-sensory learning.
 - » teacher-centred approaches to student-centred approaches
 - » transmission- or expository-oriented approaches to discovery or inquiry oriented approaches.
- A shift in learning outcome is, in turn, two-fold
 - » A shift from over emphasizing the cognitive type of development to giving equal emphasis for all the three types of development, i.e., cognitive, psychomotor and affective domains
 - » A shift is in the levels of learning outcomes i.e, from lower levels to higher levels of learning outcomes in all three domains. For instance, under the cognitive domain, emphasis should be given to engaging learners in high- order thinking tasks such as analysis, synthesis, and evaluation

2.5 Energy, matter and organization

Living things are highly ordered and complex matter, which is ensured through a continuous supply of matter and energy by metabolism.

2.6 Growth, development and differentiation

Living things grow, develop and differentiate by a genetic plan and influenced by the environment.

2.7 Complementarity of structure and function

The function of any part of an organism is closely related to its structure and from its structure, the function can be inferred.

2.8 Regulation and homeostasis

Living things prefer the optimum and have a regulatory mechanism to adjust in the face of changing environment.

2.9 Complementarity of organism and environment

The interaction between organism and environment at all level of organization modifies both the organism and the environment.

IV. OBJECTIVES OF THE SECONDARY BIOLOGY

The broad competencies of secondary biology in Ethiopia include:

Knowledge

- Demonstrate an understanding of indigenous knowledge and practices and their relevance in today's world;
- Understand the applications of biological knowledge in society and their social, ethical, health, economic and environmental implications and
- Interpret and apply their biological, technological, and environmental knowledge to make decisions about real problems and challenges in the context of their daily lives.

Skills

- Analyze and interpret data, graphics, and other forms of information using scientific methodologies to solve biological problems;
- Develop skills such as identification, observation, recording, making predictions, synthesis, analysis, and concluding the identified issue or phenomena of investigation and
- Demonstrate life skills and 21 st century skills efficiently and effectively to cope up with problems in their life and contemporary world.

Values and attitudes

- Show an interest in the study of biology, appreciate the wonders and complexity of Nature, and show respect for all living things and the environment;
- Stimulate intellectual curiosity, increases awareness of the fragile ecosystem, and stimulates critical thinking;
- Recognize their responsibility for conserving, protecting, and maintaining the quality of the environment for future generations; and develop positive values and attitudes and a healthy lifestyle and
- Appreciate and respect for the natural world, its diversity, fragility, and finite nature, especially when harvesting from the environment.

Learning outcomes and specific learning objectives for grade 10 Biology are listed at the beginning of each unit, both in the students' text and teacher's guide. They will serve as a checklist concerning the content, instructional resources, learning methods, and assessment as part of the teaching-learning process.

V. SELECTED ACTIVE LEARNING METHODS IN BIOLOGY

Selected Method	Description
Discovery – teacher guides students to discover scientific facts for themselves	Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions. Students develop qualities such as self-confidence, curiosity, interest and co-operation.
Discussion – sharing of ideas between students and teacher	Allows sharing of each other's ideas. Allows everyone to participate actively. A few people may end up dominating the discussion. Not easy to conduct for large classes. Can be time-consuming. Teacher can easily lose track of the argument
Brainstorming – teacher presents students with a word or concept and then writes down as many ideas about it or links to it as the students can provide	Useful for gauging how much students know, recognizing how many links between topic areas they have made, picking up misconceptions that the students may have. Can keep a record of initial brainstorm and return to it after the lesson – ask students to identify how many of their initial ideas were right and how many wrong. Can reinforce new and accurate ideas
Problem solving – students are presented with an exercise where they must find an answer to a problem	Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions. Students develop desirable qualities such as seeking knowledge, curiosity, enquiry and responsibility. Can waste time if not properly planned and guided

Assignments – specific task given to students to find out about a particular problem or issue	Students have the opportunity to research a topic and look for information on their own.
Worksheets – handouts to guide students in practical work	Allows students to think for themselves without outside influence. Allows individual ideas to be shared in a group.
Demonstration – teacher carries out practical work if materials/ equipment are inadequate or the procedure is too complex or unsafe for students	Students develop skills such as identification, observation, recording, making predictions, synthesis, analysis and drawing conclusions. Students develop desirable qualities such as self-confidence, curiosity, interest and co-operation.
Practical activities – students carry out practical work individually or in groups; students gain hands-on experience	Gives teacher an opportunity to develop students' interest in the subject. Teacher has opportunity to interact with students. Teacher provides the standard/expected results for each activity. Can be used with discussion method (during discussion of results). Students develop skills such as identification, observation, collecting, measurement, manipulation, data recording, investigation, making predictions, interpretation, evaluation, synthesis and drawing conclusions. Students develop desirable qualities such as self confidence, curiosity, interest and cooperation.
Field work – outdoor learning activity	Helps students develop skills such as identification, observation, collecting, measurement, data manipulation, recording, analysis, report writing and verbal reporting. Students appreciate the environment. Can waste time if not properly planned and guided
Project – short- or long-term investigation	Helps students develop (among others) report-writing, presentation and data-analysis skills. Students develop skills in using scientific methods. Can be time-wasting if not properly planned and guided.

VI. ASSESSMENT IN BIOLOGY

- Written test,
- observation of student's participation,
- presentation
- reflection
- written assignment,
- Practical activity/performance
- Lab report
- written test
- practical test

VII. MODEL LESSON PLAN

ERR model or framework for preparing lesson plan

- ERR is an abbreviation : E = Evocation, R= Realization of meaning, R = Reflection
- ERR elaborates how students must engage in before, during and after or at the end /closure of learning session.

1. Evocation phase/stage

- This is a stage where students are initiated to recall their previous knowledge through different activities before the “new” topic is presented to them.
- The purpose of this phase , through active engagement, is to allow learners to recall their own knowledge and establish foundation or link to the new topic

2. Realization of meaning phase/stage

- During this phase learners receive new information or ideas through listening to a lecture, reading a text, watching a film, or doing an expt.
- The teacher at this phase is a facilitator of learning. The students inquire knowledge, independently sustain active engagement , and , as a result realize meaning

3. Reflection phase/stage

- During this phase the teacher and students revise the new topic, and look back over ideas they have encountered and the meaning they have realized.
- Students should be supported to exchange ideas and express new information and ideas in their own words.
- A teacher practically manages this phase by group discussions, asking students to talk or write or share ideas about what they are learning.

Lesson Topic: Biotic and abiotic components

Minimum learning competency (MLC): Classify living things based on taxonomic principles

Lesson Objectives: At the end of this lesson, students will be able to:

- explain the biotic and abiotic components of an ecosystem .

Time: 40 minutes

Instructional resources: biotic and abiotic components of an ecosystem

Evocation (10 minutes)		
Teacher's activities	Students' activities	Formative continuous assessment
Brainstorm: Ask students what they know about biotic and abiotic components of an ecosystem.	Tell the teacher what they know about biotic and abiotic components of an ecosystem. Listen to the teacher's introduction and tell which biotic and abiotic components they are familiar with and which factor they do not know	Identify students' conception (prior knowledge) and misconception through oral questions
Realization (20 minutes)		
<p>Presentation: Use the figure of the Students plan an oral poster presentation on the biotic and abiotic components.</p> <p>Divided students into two groups, one making a poster on biotic components and the other on abiotic components.</p> <p>Group I: identify the common types of biotic factors in an ecosystem .</p> <p>Group II: identify the common types of abiotic factors in an ecosystem.</p> <p>Facilitate and provide assistance for pair or group discussion.</p> <p>After finishing their respective task let the two groups pair (regroup) and share ideas.</p> <p>Invite students that have accomplished tasks effectively for whole class discussion.</p>	<p>Follow the presentation and explanation of the teacher</p> <p>Be a member of any one of the group and listen to the teacher's instruction.</p> <p>Perform the given tasks through pair discussion and cooperative learning as instructed by the teacher within 8 to 10 minutes.</p> <p>Ask for assistance as they encounter difficulties.</p> <p>Two groups share ideas and take a note on what they discussed.</p> <p>Accept teacher's invitation to share ideas in the whole class discussion.</p>	<p>Ask students to give examples of biotic and abiotic from the diagram.</p> <p>Follow the participation of individual student in a group by moving around the groups.</p> <p>Conduct peer assessment by exchanging / sharing results.</p> <p>Comment and give feedback to whole class discussion.</p>
Reflection (10 minutes)		
<p>Stabilization:</p> <ul style="list-style-type: none"> • Use the chart and summarize what the biotic and abiotic components are. • how biotic and abiotic influence the distribution of organisms. • Respond to questions from students <p>Checking and Evaluation</p> <ul style="list-style-type: none"> • Ask questions related to the Objective <ol style="list-style-type: none"> 1. Why is solar energy such an important factor for most ecosystems? 2. Which abiotic factor is more important for aquatic organisms compared to terrestrial once? 3. Name four examples of abiotic factors. 	<p>Pay attention to teacher's summary and take summary notes.</p> <p>Respond to questions forwarded to them.</p>	

ORGANIZATION OF UNITS OF THE TEACHER'S GUIDE

Each unit in the teacher's guide contains the following sections

- Learning competencies
- Specific learning objectives
- Hints for teaching
- Suggested active learning methods
- Feed back to Activities
- Further references/reading resources
- Answer to self-test questions /review question

Unit 1: Introduction to Biology (15 period)

Contents	Competency	Learning Strategies	Assessment
1.1. Definition of Biology 1.2. Why do we study Biology? 1.3. The scientific method 1.4. Tools of a Biologist 1.4.1. Laboratory tools 1.4.2. Field tools 1.5. Handling and using of light Microscope 1.5.1 Parts and function of light microscope 1.5.2 Handling and using light microscope 1.6. General Laboratory Safety Rules	Define Biology Explain why Biology is studied? Plan a biological investigation using the scientific method Identify some common tools of a Biologist Utilize a microscope Execute general laboratory safety rules	1. Let the students tell how they perceive the term science and let them relate this with what they think about biology. Then together with their classmates, they come up with the list of definitions of biology and relate these with their textbook definition. 2. Students are asked to reason out their rationale for studying biology. Then let them explore through a guided exercise to come up with personal and social benefits of biology 3. To determine the importance of temperature for seed germination, let the students are grouped into 4-5, germinate bean seeds at different temperatures (room temperature and in the refrigerator). Hypothesize the differences in germination. Design experiment. Measure the times of germination and length of the seedlings. Interpret the results. Conclude and infer the result for all other seeds. 4. Let the students list down and tell the functions of major tools of a biologist. 5. Practice the proper handling and manipulation of the microscope 6. Let the students explore the safety rules in the laboratory (show pictures of scientists in laboratories and for learners to discuss why goggles and laboratory coats are used, why hair is tied back, why reagents are labelled with hazard labels etc.)	1. DA: Competency 1 E: Written / Verbal AI: Written test, observation of student's participation, presentation, reflection. 2. DA: Competencies 2 & 3. E: Verbal/ written AI: Reflection, observation of students' during discussion / written assignment, tests. 3. DA: competencies 4-7. E: Verbal/ written/Practical/p performance AI: Observation, reflection, presentation/Lab report, written test, practical test, written assignment

DA: Desired Achievement; E: Evidence; AI: Assessment Instrument

Learning outcomes

At the end of this unit, a student will be able to:

- explain the nature and importance of Biology.
- manipulate common tools of a Biologist.
- apply common laboratory safety rules

1.1 Definition of Biology

This section should take approximately 2 period.

Learning objectives

By the end of this section, the students should be able to:

- define Biology.
- explain about the relation of biology to other subject.

Teaching notes

In this section, students will learn about the meaning of Biology. You can help them by giving brief reminder of the meaning of science from their grade seven lesson. Students will learn about the scientific way of studying life. This section gives you chances for relating the subject of Biology with Chemistry and Physics through the study of elements, chemical bonds and light energy. Other scientific concepts like, conversion of radiant energy into organic molecules by photosynthesis is studied with the knowledge of chemistry and physics.

Living things are different from non living things because they have some common properties that are shared by all living things. An object is generally considered to be alive if it displays all of important properties simultaneously. living systems have characteristics in common.

They are composed of one or more cells; are complex and highly ordered; can respond to stimuli; can grow, reproduce, and transmit genetic information to their offspring; need energy to accomplish work; an maintain relatively constant internal conditions (homeostasis); and are capable of evolutionary adaptation to the environment.

Living systems show hierarchical organization. The hierarchical organization of living systems progresses from atoms to the biosphere. At each higher level, emergent properties arise that are greater than the sum of the parts. Biology unifies much of natural science. The study of biological systems is interdisciplinary because solutions require many different approaches to solve a problem.

For example, Biology also study the nature of energy transactions by thermodynamics and the conversion of radiant energy into organic molecules by photosynthesis the reactions known in chemistry and physics.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Definition of Biology		
SA	Ask the students to brain storm the meaning of science from their previous grade (grade seven), and some characteristics of living things then comparing it with the meaning of Biology	Group discussion
MA	Students read notes on the topic and write short note from their text-Book	
CA	Students read notes	Class work
What relationships does Biology have with other fields of natural sciences?		
SA	Ask the student the relation of Biology with other subjects	Think share pair
MA	Students read about the relation of Biology with other sciences,	Working on individual exercise
CA	Students could work on the activity which focus on properties of living things and they should read the key points at the end of the topic to refocus on the main points of the topic.	

Discussion Point

In this section, students will learn about the meaning of Biology. They are given a brief reminder of the meaning of science from their grade seven lesson. This section gives you chances for relating the subject of Biology with chemistry and Physics through the study of elements, chemical bonds and light energy. Give them a hint that indicates that the knowledge of chemistry, physics etc. is important to study Biology.

Feedback to Activity 1.1

Let the students write down the common properties of living things that distinguish them from non-living things and compare their answer with other students. The following are common properties of living things those found in student's textbook.

Living things:

- are composed of one or more cells
- are complex and highly ordered
- can respond to stimuli, grow, reproduce, etc.
- transmit genetic information to their offspring
- need the energy to accomplish work
- can maintain relatively constant internal conditions (homeostasis)
- are capable of evolutionary adaptation to the environment .etc.

1.2 Why do we study Biology?

This section should take approximately 2 periods.

Learning objectives

By the end of this section, the students should be able to:

- explain why biology is studied
- give examples of biological application

Teaching Methods

In this section, your students will learn about why we study Biology. They will give a number of examples on how our day-to-day life relating to Biology.

In this section, your students will learn about how the study of biology affects our everyday life in different ways; you can relate all current situations to the study of Biology. For example, explain about COVID 19, which needs the knowledge of Biology to understand the nature of the virus, which is important to prevent the disease.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Why do we study Biology?		
SA	Point out why we study Biology, by asking brainstorming questions about how the knowledge of biology is applied in different fields.	Think- pair- share
MA	Students read notes about the application of Biology and help them to read and understand the notes found in attention box which deals about the application of Biology in medicine, health, agriculture etc.	Group discussion
CA	Students take short note. Make conclusion by doing the activity and discussing in groups.	Individual Class work
Application of Biology		
SA	Students discuss and develop a mind map which shows how Biology is related with our day to day life; keep this until the end of the series of lessons.	Think share pair
MA	Students read and make notes about the importance of studying biology in our life	Asking questions
CA	Students could work on the activity and have a short notes. Students should discuss within groups and between groups.	

Feedback to Activity 1.2

Let the students form a group with other students sitting at the back of their seats. Help them to discuss in groups and write short note of their discussion.

Students can use the examples of application mentioned in the text book such as:

- Wine-making, the brewing of beer, the baking of bread and the production of cheese all depend on fermentation processes brought about by yeasts, other fungi and bacteria, or enzymes from these organisms.
- Antibiotics, such as penicillin, which are produced by mold fungi or bacteria.
- The production of industrial chemicals such as citric acid or lactic acid needs bacteria or fungi to bring about essential chemical changes.
- Sewage disposal depends on bacteria in the filter beds to form the basis of the food chain that purifies the effluent.
- Radiation can also be medically beneficial which is helping to treat cancer, studied by combination of two subjects Physics and Biology.
- Discovery of the structure of DNA by Watson and Crick in 1953 and subsequent achievements in DNA science led to the technologies of DNA manipulation that are transforming applied fields such as medicine, agriculture, and forensics Forensic analysis of DNA samples from crime scenes.

1.3 The scientific method (or process)

This unit should take approximately 3 periods of teaching time.

Learning objectives

By the end of this section, the students should be able to:

- explain about scientific method
- explain about the meaning of hypothesis
- practice about Formulating hypothesis
- practice about doing scientific experiment and drawing a bar graph

Teaching Notes

In this section, your students will learn about the scientific method that scientists follow while performing scientific experiments and writing up the results. By following the scientific method carefully, scientists make sure that their conclusions are based on observations and that other scientists can repeat their experiments. The steps for scientific method are: observations, questions, hypothesis, experiment, conclusion (result) and communication with other scientists.

To determine the importance of temperature for seed germination, let the students be grouped into 4-5, germinate bean seeds at different temperatures (room temperature and in the refrigerator). Hypothesize the differences in germination. Design experiment. Measure the times of germination and length of the seedlings. Interpret the results. Conclude and infer the result for all other seeds.

The students will learn steps of scientific experiment from simple example problems.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Scientific experiment		
SA	Students brainstorm; ask questions scientific experiment and its important steps.	Group discussion
MA	Students read on scientific methods and they will see a common example for to give hint for the scientific problem formulating scientific method to solve the problem. (Illustrates hypothesis testing for a hand lamp that doesn't work).	Think pair share.
CA	Students give common problems to relate it with scientific experiment which helps the student to see how their day to day life has many problems which need to be solved.	Individual assignment
The steps of scientific experiment		Active learning
SA	Ask brainstorming questions about scientific method is related with our day-to-day life; keep this until the end of the series of lessons.	Discussion
MA	Students read and write short note. Students will critically think about how hypothesis is formed based on activities on their textbook.	Group work
CA	Students could work on the activity and have short notes. Students should discuss within groups and between groups.	Individual assignment
Example of scientific experiment		Discussion
SA	Ask brain storm questions about scientific method	Group work
MA	Students could produce a bar chart of seed germination, which is ex-ample of scientific experiment. Drawing a bar graph helps the students practice applying their skills as they doing their experiment.	Individual assignment
CA	Students could work on the activity and have short notes. Students should discuss within groups and between groups	Individual practical work

Feedback to Activity 1.3

In this activity, let students work in a group and discuss about the idea written on the activity. This activity helps them to practice how to formulate hypothesis. In this activity, you can ask them to give another example and help them to formulate hypothesis. This activity can have different hypothesis.

In the activity, students should work an experiment on seed germination. This activity is done as a homework but you can make them to bring their germinated seed. You ask them to measure the growth of the seeding on each day, and let them draw a bar graph using X axis for measurement of time /hour of germination and, at Y axis, indicate the length of the germinated plants. This activity makes the student to practice scientific experiment and they can develop a skill to draw a bar graph.

1.4 Tools of a Biologist

This unit should take approximately 4 periods.

Learning objectives

By the end of this section, the students should be able to:

- explain about the major tools of Biologist
- identify some laboratory equipment
- explain their function

Teaching notes

In this section students will learn about biological tools. The main tools for biologists are microscope. Here your students should know about the types of Microscope (light microscope, compound microscope and electron microscope. This section needs visual observation of microscope. If microscope is not available, you can show them the diagram. In addition, other tools like incubator, autoclave, Petridis and others are mentioned in student's book. Students should identify the different tools of Biologist and observe the diagram.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Major tool of Biologists (Microscope)		Discussion Group work Individual assignment Think share pair Self test
SA	Students brainstorm by asking questions about microscope. Help them to remind grade seven Biology lessons.	
MA	Students read about types of microscope and write a short note. Demonstrate the picture of microscope in figure found in student's text book and help them to identify the types and parts of microscope.	
CA	Students identify different parts and types of microscope.	
Other tools of biologists		Discussion Group work Individual assignment Think share pair Self test
SA	Students discuss the function of laboratory tools .	
MA	Students read and make notes about the importance of laboratory tools like autoclave, incubator, petri dishes and test tube	
CA	Students could have a short notes. Students should discuss within groups and between groups.	

Other tools of biologists		Think share pair Self test Practical activity
SA	Student brain storm by asking question on the previous lesson	
MA	Students have a note about laboratory tools like flasks, beakers, balance etc. Students should identify the picture of these laboratory materials.	
CA	Students could have short notes. Students should discuss within groups and between groups.	
Laboratory observation for the tools of Biologists		
SA	Revising the function of different laboratory tools	Think share pair Self test
MA	Make a group of students and ask them to identify the laboratory tools, students should explain the important function of those laboratory materials.	
CA	Students should discuss within groups and between groups.	

Types of microscope

Make sure that students understand the difference between light, compound and electron microscope. Show them how much every activity of biologist depends on microscope.

Other tools of Biologists

The student's textbook lists the main tools of Biologists like: autoclave, incubator, petri dish etc. In addition, there are some pictures of the tools of biologists in textbook. It is important to help the students to identify the tools found in picture 1.10.

Feedback to Activity 1.4

Let the students write down the name of the tools they know that are used by biologists and compare their answer to others.

Feedback to Activity 1.5

The dot gets bigger more than the original size because of the hand lens and after a while, the piece of paper is burning because of the converging of the radiation ray on the piece of paper.

1.5 Handling and using of a Microscope

This section should take approximately 2 periods.

Learning objectives

By the end of this section, the students should be able to:

- handle the microscope
- use the microscope

Teaching Notes

This section introduces your students about how simple microscope is handled and used. This section explains the whole steps of handling the microscope. It is very helpful if students have access to see how microscope is handled, which is important to develop their skill of using microscope. If Microscope is not available, you can use model of microscope and the diagram in the textbook.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Handling the microscope		Discussion Group work Individual assignment Think share pair Self-test activity
SA	Point out the parts of the microscope and let students understand how far microscopes are extremely important and expensive.	
MA	Students read about handling of microscope; if possible, they should practice how to handle it safely; then they write short notes.	
CA	Students take a short note	
Using microscope		Active learning
SA	Asking brainstorm questions about the important parts of a microscope, which is used to observe specimens?	Discussion
MA	Students read notes in the textbook. Students work all the steps on focusing of microscope and practice it in science laboratory of the school.	Group work
CA	Make conclusion by asking some questions about the function of objective lenses, coarse and fine adjustment etc. Make the students to do the activity	Individual assignment

Most microscopes have several different powerful lenses attached to them, allowing the viewer to inspect the content at more than 100 times its actual size. Biology, as a modern science, would not exist without the microscope, and good microscopes are essential tools for day-to-day activities for most biologists. In addition to their importance, microscopes are extremely expensive; therefore, it is very important to handle the device properly.

Handling Microscope

The text indicates how to handle the microscope. In this section, microscope handling such as removing it from cabinet, carrying and preparing it for focusing will be elaborated and it should be practiced by students.

Using Microscope

The section explains how to use the microscope. Here important steps for focusing are mentioned.

CONTROLLING AND FOCUSING THE LIGHT

1. Observing from the side of the microscope, use the coarse focus knob to open focus on your microscope until the stage and objective lenses are as far apart as possible.

2. Turn on the illuminator and adjust it to maximum brightness.
3. Place a piece of thin paper on the stage, placed to cover the hole in the stage. Secure the paper against the stage using the stage clips or mechanical stage. A bright illuminated circle should be visible through the paper.
4. If your sub stage condenser is focusable, rack the focus up and down and note the effect on the size and sharpness of the illuminated circle on the paper.
5. Locate the diaphragm control. Adjust that control to open the diaphragm. If your microscope has a disk diaphragm, rotate the disk
6. Use the dimmer switch to decrease the brightness and then back up to maximum.

FOCUSING THE MICROSCOPE

1. Observing from the side, starting from the low-power(4X) objective is in position. The other Objectives i.e. 10X objective is longer, the 40X objective longer and the 100X objective longest of all.
2. Gently turn the coarse-focus knob to close focus until you reach the focus stop.
3. Looking through the eyepiece, use the coarse-focus knob until you get the sharp focus.
4. Use the focus knob to squeeze the focus. Note that as one part of the field of view comes into sharp, depth of focus decreases with increasing magnification, a specimen that looks planar at 40X may show depth at higher magnifications.

Magnification is defined as the ratio of the size of the image to the size of the object:

Magnification = size of image/ size of object. With a compound microscope, the magnification is the product of both The eye piece and objective lenses, so if a microscope has a $\times 10$ eyepiece and $\times 40$ objective, the total magnification is $\times 400$.

Images of structures seen with a microscope usually show a give the magnification, so that the actual size of an object can be calculated based on the formula,

Actual size of glomerulus = size of image/ magnification

Feedback to Activity 1.6

Hand lens only has one lens

Feedback to Activity 1.7

Let the students fill the table by calculating the total magnification using the formula: Eyepiece

lens X Objective lens= Total magnification.

Feedback to Activity 1.8

For this activity, help students to use a microscope in the laboratory in order to understand how microscope magnifies things. Let them to use different types of objective lens to see the difference in magnification amount.

1.6 General Laboratory Safety Rules

This section should take approximately 2 periods.

Learning objectives

By the end of this section, the students should be able to:

- Explain about laboratory safety rules.
- Identify the major laboratory rules.

Teaching notes

Let the students explore the safety rules in the laboratory (show pictures of scientists in laboratories and for learners to discuss why goggles and laboratory coats are used, why hair is tied back, why reagents are labelled with hazard labels etc.)

SA = starter activity MA = main activity CA = concluding activity		
Major safety rules of laboratory		Active learning
SA	Students brainstorm by asking questions about major safety rules of laboratory.	Discussion Group work Individual assignment Think share pair Self test Practical activity
MA	Students read on textbook about laboratory safety rules. Students work on activity such as why goggles and laboratory coats are used, why hair is tied back, etc.	
CA	Students identify the symbol of laboratory safety rules.	
Ten important laboratory safety rules		
SA	Ask brainstorm questions about what the students know about the major laboratory safety rules.	Discussion Group work Individual assignment Think share pair Self test Practical activity
MA	Students read text book about the major safety rules and write short note. If possible, students observe symbol of the laboratory safety rules, fire extinguisher, first-aid kit readily in the laboratory, and safety shower in the laboratory. If your school has no science laboratory, use a picture from the text book and other references.	
CA	Students complete the activity questions. Students do unit summary questions; this questions encourage students to read the text actively.	

Feedback to Activity 1.9

Let the students answer these questions before reading the notes in the textbooks.

Answers to Review Questions

I. Choose the correct answer for the following questions

1. A 2. C 3. A 4. D







II. Write short answer for the following questions.

5. The difference between light and electron microscope is: light microscopes uses a beam of light to view specimens and in the case of electron microscope it use a beam of electrons (instead of a beam of light) and electromagnets (instead of glass lenses) to enlarge the image of an object.

6. Write the function of the following common laboratory tools:

- » Test tubes: used to culture microorganisms.
- » Wash bottle: To wash and scrub glass wear.
- » Dropper: used to transfer small volume liquids.
- » Test tube rack: to hold or put test tube
- » Spatula: used to pick laboratory chemicals or media from stalk container.
- » Dissecting pan: holds specimen being dissected.
- » Mortar and pestle: used to grind substances
- » Forceps: Used to hold up or pick up small materials
- » Flasks: flasks are useful for culture, heating substances, and for temporary storage of solutions and liquid specimens.

7. Symbols of laboratory safety rules.

	Don't touch laboratory animals.
	Wear safty goggles
	Wear laboratory safty coat
	Wear gloves when necessary
	Don't eat in the laboratory
	Clean your work place

8. Microscope have several objective lenses to facilitate a quick change in the magnification of a specimen and high power objective lens provides a higher degree of magnification, which allows to zoom in closer to the object being studied and see more detail and a lower power lens will provide a wider field of vision.

9. The diaphragm on the microscope is used to change the amount of light that is being allowed to enter through the slide. Closing the diaphragm will decrease the amount of illumination of the specimen but increases the amount of contrast. The light to the field is reduced as the diaphragm is closed. Smaller diameter and therefore lets in less light.

10. In order to focus on an object, one should move the stage away from the objective lenses rather than towards each other in order to prevent crashing the lens into the slide.

11. Oil immersion is a technique used to increase the resolving power of a microscope and improve the image quality. The oil immersion increase the resolving power by decreases the light refraction (bending of the light), allowing more light to pass through the specimen to the objectives lens. Oil immersion eliminate any air gaps and loss of light due to refraction and maximizes the amount of light that goes through the objective lens.

Unit 2: Living Things and their classification (18 Periods)

Contents	Competencies	Learning Strategies	Assessment
2.1. Characteristics of living things	State the characteristics of living things	Let the students explore the meaning they give to life, then form groups and explore all characteristics of living things	DA: Competencies 1 & 2 E: verbal/ written evidence of mentioning all characteristics
2.2. Taxonomy of living things	Classify living things based on taxonomic principles	Let the teacher ask the students what they know about the characteristics of living things	AI: Observation of response and group discussion, reflection, presentation/ Written test, portfolio
2.2.1. Principles of classification	Argue for or against the importance of classification	Being in groups of 4-5 let the students discuss what they know about the taxonomy of living things	DA: Competencies 3-7
2.2.2. Taxonomic hierarchies in biological classification	Describe the system of Linnaean nomenclature	The students explore the importance of classification from books and internet resources	E: Verbal/ written/practice
2.3. Relevance of classification	Classify common Ethiopian animals and plants based on their unique characteristics and dichotomous keys	Let the students discuss the Linnaean system of classification in groups of 4-5 students	AI: Reflection, presentation/ written tests, field reports/ observation
2.4. Linnaean system of nomenclature	List the characteristic features of the five kingdoms	Let students to classify the common plants and animals in Ethiopia using their unique characteristics and dichotomous keys	DA: Competency 8
2.5. Common Ethiopian animals and plants	Appreciate the works of renowned taxonomists in Ethiopia	Let the students come up with at least 20 different living things and in groups, classify them into related taxa, and let them give the common characteristics that define each category	E: Verbal
2.6. The five-kingdom system of classification	Let the students to study the works of renowned Ethiopian taxonomists and relate this with the taxonomic discussion they had		AI: Reflection, presentation
2.7. renowned taxonomists in Ethiopia			

DA: Desired Achievement E: Evidence AI: Assessment Instrument

Learning Outcomes: At the end of this unit, a student will be able to:

- Explain what life is,
- Identify the characteristics of living things,
- Classify living things based on taxonomic principles,
- Tell the relevance of classification, and
- Appreciate renowned taxonomists of Ethiopia.

2.1 Characteristics of life

Learning objectives

By the end of this sub – topic, the student will be able to

- State the characteristics of living things

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Characteristics of life		
SA	<p>As brainstorming activity, let the students explore the meaning they give to life, then form groups and explore all characteristics of living things.</p> <p>Let the teacher ask the students what they know about the characteristics of living things. This will pave the way to proceed to present characteristics of living things.</p> <p>Ask students to distinguish living things from non-living.</p>	<p>Collaborative learning groups / Brain storming,</p> <p>Gapped/enhanced lecture.</p>
MA	<p>Let students discuss what makes living things different from non-living.</p> <p>Let students sort the things they see in their environment into living and non-living.</p> <p>Let students read the section on the characteristics of living things and take a note (section 2.1).</p>	
CA	<p>Assess students' prior knowledge, their misconception and misunderstanding about life and living things</p> <p>Ask students the definition of life.</p> <p>Raise oral questions on characteristics of living things and give feedback to students' response</p>	<p>Suggested formative assessment</p>

Feedback to Activity 2.2: Collaborative learning groups

Students may tell car, computer, books, exercise books, pen, cloths, rocks, mobile phone, house, etc. as non-living and cows, goats, sheep, plants, insects, fish, donkey, horse, lion, cats, dog, flowers, birds as living things.

Feedback to Self-test

Answer to Question 1: No, defining life with simple sentence is not an easy task. It would be better to put the characteristic features of living things (see section 2.1).

Answer Question 2: All living things are made up of one or more cells; all living things are made up of one or more cells; all living organisms respond to stimuli; all living things can grow; all living things can grow; all living things can excrete; all living things display ordered complexity and all living things maintain homeostasis

2.2 Taxonomy of living things

2.2.1 Principles of classification

Learning objectives

By the end of this sub – topic, the student will be able to

- classify living things based on taxonomic principles

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Principles of classification		
SA	<ul style="list-style-type: none"> ▪ Start asking students to know what comes to their mind when they think about taxonomy of living things. ▪ Being in groups of 4-5 let the students discuss what they know about the taxonomy of living things. ▪ They may reflect that taxonomy is about classifying living things into plants and animals. 	Jigsaw groups / Brain storming, Think– Pair - Share, Mind mapping
MA	<p>Let students read the section on the principles of classification and take a note (section 2.2.1).</p> <p>They may reflect that taxonomy is about classifying living things into plants and animals. Students may classify animals/plants into:</p> <ul style="list-style-type: none"> o Useful versus harmful o Insects versus non-insects o aquatic organisms versus territorial organisms o black and white creatures into the same group o plants with flower versus without flower o tree versus herbs, etc. 	
CA	<p>Suggested Formative Assessment:</p> <p>Ask students about the criteria used to classify organisms in their school compound/ village</p>	

Feedback to Activity 2.3: Reflective discussion

The degree of being organised may vary from student to student. Some students may say no but other may say yes! However, to be organised is a useful characteristics of a person.

Therefore, as a student it is advisable to organise your belongings such as books and clothes into groups to easily get them back when you need them.

2.2.2 Taxonomic hierarchies in biological classification

Learning objective

By the end of this sub – topic, the student will be able to

- describe the importance of hierarchies in biological classification

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Taxonomic hierarchies in biological classification			
SA	<p>Start asking students to know what comes to their mind when they think hierarchies in biological classification.</p> <p>Ask student to group organisms they knew as an increasing or decreasing order.</p> <p>Alternatively you could give them a list of names of organism's written on a flash card and let them group them into similar groups.</p> <p>Give them the names of local plants or animals' species.</p>		<p>Reflective discussion / Gapped/enhanced lecture, Group Discussion, Cooperative learning</p>
MA	<p>Let students read the section on the taxonomic hierarchies in biological classification and take a note (section 2.2.2).</p> <p>Ask them to write the species name of the local plant or animal.</p> <p>Ask them to write the genus name of the local plant or animal.</p> <p>Ask them to write the family name of the local plant or animal.</p> <p>Ask them to write the order name of the local plant or animal.</p> <p>Ask them to write the class name of the local plant or animal.</p> <p>Ask them to write the phylum/division name of the local plant or animal.</p> <p>Ask them to write kingdom name of the local plant or animal.</p> <p>Ask them to write domain name of the local plant or animal.</p>		
CA	<p>monitoring group discussion and cooperative learning</p> <p>give students quick and relevant feedback</p> <p>peer assessment and reflection on group paired work</p>		<p>Suggested Formative Assessment:</p>

Feedback to Activity 2.4: Problem solving

Biologists need to organize living things in hierarchies, since it helps to simplify the study living things and makes the study organized or systematized.

Feedback to Self-test

Answer to Question 1: Taxonomic hierarchy is the process of arranging various organisms into successive levels of the biological classification either in a decreasing or an increasing order.

Answer to Question 2: Below is a taxonomic hierarchy using *Walia ibex* as an example.

Taxon	Walia ibex
Kingdom	Animalia
Phylum	Chordate
Class	Mammalia
Order	Artiodactyla
Family	Bovida
Genus	Capra
Species	Capra walie

2.3 Relevance of classification

Learning objective

At the end of this section, the student will be able to:

- describe the relevance of classification

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Relevance of classification		
SA	<p>Start asking students to know what comes to their mind when they think relevance of classification.</p> <p>Ask student the relevance of classification to the various aspects biological investigation (e.g. Agriculture, medicine, environmental studies, etc.).</p>	Gapped/enhanced lecture, Group Discussion, Cooperative learning
MA	<p>Students can discuss or debate on the relevance of classification, e.g., agriculture, medicine, ecological /environmental studies etc.</p> <p>Students read texts in section 2.3 and make notes on relevance of classification in various aspects biological studies.</p>	
CA	<p>Students presented the outcome of their debate on the relevance of classification</p> <p>monitoring group discussion and cooperative learning</p> <p>give students quick and relevant feed back</p> <p>peer assessment and reflection on group work</p>	Suggested Formative Assessment:

Feedback to Activity 2.5: Investigating

Answer: Human beings classify organisms based on their similarities and differences. For example, all animals with backbone are classified into vertebrate (e.g., fish, amphibians, reptiles, birds, and mammals) and without backbone into invertebrates (e.g., sponges, rotifer, nematodes, segmented worms, molluscs, and arthropods). Alternatively, plants could be classified as vascular plants versus non-vascular plants, seed plants versus non-seed plants, flowering plants versus non-flowering plants, or monocots versus dicots.

Answer: The purposes of classifying organisms are manifold but the first and foremost reason is to make the study of organism simpler and organized.

Feedback to self- test

Answer to Question 1: D

2.4 Linnaean system of nomenclature

Learning objective

At the end of this section, the student will be able to:

- describe the system of Linnaean nomenclature

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Linnaean system of nomenclature		
SA	Start asking students to what they knew about Carl Linnaeus. Ask students the contributions of Carl Linnaeus to the Science of Taxonomy? How did he classify living organism? Ask students about binomial classification.	Group Discussion, Cooperative learning
MA	Let students make a book reading or web search on the history of Carl Linnaeus, his works, how he did classify plants and animals; the basis of his classification. Alternatively, let students read section 2.4 and take note on the major works of Carl Linnaeus.	
CA	Let students summarize what they have got on the works of Carl Linnaeus. monitoring group discussion and cooperative learning give students quick and relevant feedback peer assessment and reflection on group paired work	Suggested Formative Assessment:

Feedback to Self-test

Answer Question 1 : Binomial system: is an internationally agreed system in which the scientific name of an organism is made up of two parts showing the genus and the specific epithet (e.g., *Ensete ventricosum*, *Zea mays*, *Panthera leo* etc.). The first letter of name of the genus is a capitalized and the specific epithet always starts with a small letter; is underlined when handwritten or italicized when printed.

Answer Question 2: *Musca domestica*, *Mus musculus*, *Canis familiaris*, *Felis catus* and *Capra hircus*

2.5 Common Ethiopian animals and plants

Learning objectives

At the end of this section, the student will be able to:

- classify common Ethiopian animals and plants based on the taxonomic categories.
- write the scientific names of common Ethiopian plant and animals species
- use dichotomous keys to identify unknown organism

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Common Ethiopian animals and plants			
SA	Start asking students to write the local and scientific names common Ethiopia plant and animal species. Alternatively you could give them a list local names common Ethiopia plant and animal species written on a flash card and let them write the scientific names.		Discovery, Question and answer
MA	Let students classify common Ethiopia plant and animal species using dichotomous keys. Alternatively, let students read section 2.5 and take a note on the common Ethiopian animals and plants; & dichotomous keys. Let students plan a poster or a presentation on common Ethiopia plant and animal species. Provide magazines, books, access to computers, visit to the library or any other resources for students to help them produce their poster or a presentation on common Ethiopia plant and animal species in Ethiopia.		
CA	Arrange a field trip for the students to visit Local Park, farm yard etc. give students quick and relevant feedback peer assessment and reflection on group work		Suggested Formative Assessment:

Feedback to Activity 2.8: Inquiring and researching

Dichotomous keys are used to identify unfamiliar organisms. They simplify the process of identification. Each key is made up of pairs of contrasting features (dichotomous means two branches), starting with quite general characteristics and progressing to more specific ones.

Feedback to Self-test

Answer to Question 1:

No.	Common names	Scientific names
1	Elephant	<i>Loxodonta africana</i>
2	Ethiopian Wolf	<i>Canis simensis</i>
3	Gelada	<i>Theropithecus gelada</i>
4	Lion	<i>Panthera leo</i>
5	Walia	<i>Capra walie</i>
6	Ostrich	<i>Struthio camelus</i>
7	Wattled Ibis	<i>Bostrychia carunculata</i>
8	Enset	<i>Ensete ventricosum</i>
9	Maize	<i>Zea mays</i>
10	Noug	<i>Guizotia abyssinica</i>
11	Tef	<i>Eragrostis tef</i>
12	Wheat	<i>Triticum aestivum</i>
13	Ethiopian Mustard	<i>Brassica carinata</i>
14	Barely	<i>Hordeum vulgare</i>
15	Banana	<i>Musa acuminata</i>
16	Finger Millet	<i>Eleusine coracana</i>
17	Sorghum	<i>Sorghum bicolor</i>
18	Chickpea	<i>Cicer arietinum</i>
19	Faba Bean	<i>Vicia faba</i>
20	Lentil	<i>Lens culinaris</i>

2.6 The five-kingdom system of classification

Learning objectives

At the end of this section, the student will be able to:

- list the characteristic feature of the five kingdoms,

SA = start Activity	MA= Main activity	CA = concluding activity	Suggested active learning methods
The five-kingdom system of classification			
SA	Write the terms 'kingdom' on the board and students brainstorm the meaning of the words.		Brainstorming, Question and answer; Cooperative learning
MA	Let students read section 2.6 and make notes on 'kingdom', checking how accurate their ideas were in the brainstorming exercise. Students plan a poster or a presentation on the five-kingdom system of classification. Provide magazines, books, access to computers, and a visit to the library or any other resources for students to help them produce their poster or a presentation on the five-kingdom system of classification.		
CA	Students display their posters or make their presentations give students quick and relevant feedback peer assessment and reflection on group work give quiz/test		Suggested Formative Assessment:

Feedback to Activity 2.9: Cooperative learning

Earliest naturalists such as Linnaeus recognized two groups i.e. plants and animals.

How many such groups should there be? The answer varies based on the systems of classification applied. It could be two (plants and animals); three (plants, animals and fungi); five (plants, animals, fungi, protists and monera).

Most biologists used to favor the adoption of two groups. What are these two groups? The answer is plants and animals.

Feedback to Self-test

Answer to question 1: Yes or no. Yes, because algae fulfil some properties of plants. No, there are characteristics of plants that algae do not fulfil.

Answer to question 2: Yes, kingdom Protista is suggested to include organisms such as algae and the like.

Feedback to Activity 2.10: Debates

Always, there are organisms that do not fit to the classification systems, for example, in the two-kingdom system of classification (plants and animals) the fungi do not fit to; in the three-kingdom system of classification (plants, animals and fungi) the Protista do not fit to; in the five-kingdom system of classification (plants, animals, fungi, protists and monera); the protista is a complex group. Therefore, it was difficult to develop rigid classification scheme.

Do you think the Whittaker five-kingdom scheme has solved the classification problems biologists are trying to answer for generations?

The answer is no, there are a number organisms that do not fit into the Whittaker five-kingdom scheme. That is why the six kingdom system was introduced which includes Eubacteria, Archaeobacteria, Protista, fungi, Plantae and animals.

Kingdom Monera

Learning objectives

At the end of this section, students will be able to:

- list the characteristic feature of the monera,
- describe importance of monera

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Kingdom Monera			
SA	Write the term 'Monera' on the board and students brainstorm the meaning of the words.		Brainstorming , Question and answer
MA	Let students read a notes on 'Kingdom Monera', checking how accurate their ideas were in the brainstorming exercise. Let students plan an oral presentation on the Kingdom Monera. Divide students into groups. Each group carries out activity 2.11: Write about the characteristics features of Monera. Each group puts together a presentation about characteristics features of Monera. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on Kingdom Monera.		
CA	Students watch each other's presentation and make notes on Kingdom Monera give students quick and relevant feedback give quiz/test		Suggested Formative Assessment:

Feedback to Activity 2.12: Collaborative learning groups

Useful

- provide nitrogen in a usable form for plants,
- flavor food,
- oxygen is a byproduct of making food and

Harmful

- endospores germinate in human lungs,
- cause infection in humans,
- Create toxins

Feedback to Self-test

Except some species of bacteria almost all species are useful (see Activity 2.12)

Pathogens: *Mycobacteria tuberculosis*, *Mycobacteria leper*, *Vibrio cholera*, *Salmonella*, *Shigela*, *Escherichia coli*, *Lactococcus lactis*,

Genetic engineering: *Agrobacteria sp.*

Kingdom Protista

Learning objectives

At the end of this section, students will be able to:

- list the characteristic feature of the protista,
- describe importance of Protista

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Kingdom Protista		
SA	Write the term 'Protista' on the board and students brainstorm the meaning of the words.	Brainstorming, Question and answer
MA	Let students read a notes on 'Kingdom Protista', checking how accurate their ideas were in the brainstorming exercise. Students plan an oral presentation on the Kingdom Protista i. Divide students into groups. Each group carries out activity 2.13: Write about the characteristics features of Protista. Each group puts together a presentation about characteristics features of Protista. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on Kingdom Protista.	
CA	Students watch each other's presentation and make notes on Kingdom Protista give students quick and relevant feedback give quiz/test give class work	Suggested Formative Assessment:

Feedback to Self-test

Answer to question 1: a brief summary to the characteristic features of protist are given below:

- There is no such thing as a typical protist.
 - Kingdom protista contains the most diverse organisms of all the kingdoms
 - There are single-celled (unicellular) protists as well as many-celled (multicellular) protists.
 - Some are microscopic, others are very large. Some can make their own food, some cannot.
- Protists have only one thing in common—they are all eukaryotes.

Answer to question 2: Protists have only one thing in common—they are all eukaryotes.

Kingdom Fungi.

Learning objectives

At the end of this section, the student will be able to:

- describe the kingdom fungi and give example of organisms
- describe the importance of fungi

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Kingdom Plantae			
SA	Write the term 'Fungi' on the board and students brainstorm the meaning of the words.		Peer conferencing / Brainstorming, Question and answer
MA	<p>Let students read a notes on 'Kingdom Fungi', checking how accurate their ideas were in the brainstorming exercise.</p> <p>Let students plan an oral presentation on the Kingdom Fungi.</p> <p>Divide students into groups.</p> <p>Each group writes about the characteristics features of Fungi.</p> <p>Each group puts together a presentation about characteristics features of Fungi. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on Kingdom Fungi.</p>		
CA	<p>Students watch each other's presentation and make notes on Kingdom Fungi</p> <p>give students quick and relevant feedback</p> <p>give quiz/test</p>		

Feedback to Activity 2.15: Peer conferencing

Fungi are everywhere. They are in your backyard, in air and water, on damp walls, on food, and sometimes even on your body. Some fungi are large, bright, and colorful. Most grow best in moist, warm environments.

Feedback to Self-test

Answer to question 1: a brief summary to the characteristic features of fungi are given below:

- Except for unicellular yeasts, fungi are filamentous multicellular organisms.
- Their bodies consist of long, slender thread-like structures called hyphae. Hyphae play an important role in how they obtain food.
- Fungi possess a cell wall that is made up of chitin and polysaccharides.
- Like animals, fungi are heterotrophic in nutrition.

Kingdom Plantae

Learning objectives

At the end of this section, the student will be able to:

- describe the kingdom Plantae and give example of organisms
- describe characteristic features of major divisions of plants
- give examples of flowering plants

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Kingdom Plantae		
SA	Write the term 'Plantae' on the board and students brainstorm the meaning of the words.	Brainstorming, Question and answer
MA	Let students read a notes on 'Kingdom Plantae', checking how accurate their ideas were in the brainstorming exercise. Students plan an oral presentation on the Kingdom Plantae. Divide students into groups. Each group carries out activity 2.17; Write about the characteristics features of plants. Each group puts together a presentation about characteristics features of plants. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on Kingdom Plantae'.	
CA	Students watch each other's presentation and make notes on Kingdom Plantae give students quick and relevant feedback give quiz/test	Suggested Formative Assessment:

Feedback to Self-test

Answer to question 1: a brief summary to the characteristic features of plants are given below:

- Plants make their own food through the process of photosynthesis. Plants have chloroplast and chlorophyll pigment, which is required for photosynthesis. Photosynthesis also provides oxygen in the atmosphere.
- They do not move from place to place; they are stationary.
- Their cells contain a rigid cell wall made up of cellulose.
- They reproduce asexually by vegetative propagation or sexually.

Feedback to Activity 2.17: Inquiring and researching

Vascular and non-vascular plants

non-vascular plants(no specialized conducting tissue): Bryophyta – Liverworts and Mosses

Vascular plants(well developed xylem and phloem tissue): pteridophyte (also known as the Filicinophyta - the ferns) and spermatophyte (Gymnospermae (also known as the Coniferophyta) – the conifers; Angiospermae (also known as the Angiospermophyta) – the true flowering plants)

Feedback to Activity 2.18: Interviewing

Example of important plants

Food (cereal, vegetables, fruits): tef, wheat, maize, carrot, barley, oranges, banana, oats, apple, sorghum, millets, rice, tomato, papaya, lemon, etc.

Medicinal: (e.g., endod, Enset, Aloe vera, Shiferaw, Hegenia, etc.)

Ornamental: (e.g., Enset, Pin tree)

Fiber tissue: (e.g., Enset)

Weeds: (e.g., water hyacin)

Construction (podocarpus, wanza, eucalyptus tree)

Kingdom Animalia

Learning objectives

At the end of this section, the student will be able to:

- list the characteristic feature of the animal kingdom,
- describe characteristic features of invertebrates and vertebrates
- list the common class of animals
- give examples of mammals and birds

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Kingdom Animalia		
SA	Write the term 'Animalia' on the board and students brainstorm the meaning of the words.	Brainstorming, Question and answer; Cooperative learning
MA	Let students read a notes on 'Kingdom Animalia', checking how accurate their ideas were in the brainstorming exercise. Students plan an oral presentation on the Kingdom Animalia. Divide students into groups. Each group writes about the characteristics features of animals. Each group puts together a presentation about characteristics features of animals. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on Kingdom Animalia.	
CA	Students watch each other's presentation and make notes on Kingdom Animalia give students quick and relevant feedback give quiz/test Give home works/assignments	Suggested Formative Assessment:

Feedback to self-test

Answer to Question 1: a brief summary to the characteristic features of animals are given below:

- Animals differ from both plants and fungi in their mode of nutrition. Unlike plants, animals are not photosynthetic. Animals consume food obtained from other organisms (i.e. they are heterotrophs). But unlike fungi, most animals do not feed by absorption; instead, animals ingest their food and then use enzymes to digest it within their bodies.
- In contrast to plants and fungi, however, animals lack the structural support of cell walls. Instead, animal cells are held together by structural proteins, the most abundant being collagen, which is found only in animals.
- Many animals have two types of specialized cells not seen in other multicellular organisms: muscle cells and nerve cells. In most animals, these cells are organized into muscle tissue and nervous tissue, respectively, and are responsible for moving the body and conducting nerve impulses.

Answer to Question 2: Invertebrates (animals without backbone) and vertebrates (animals backbone)

Feedback to Activity 2.20: Collaborative learning groups (hint you could use a dichotomous key)

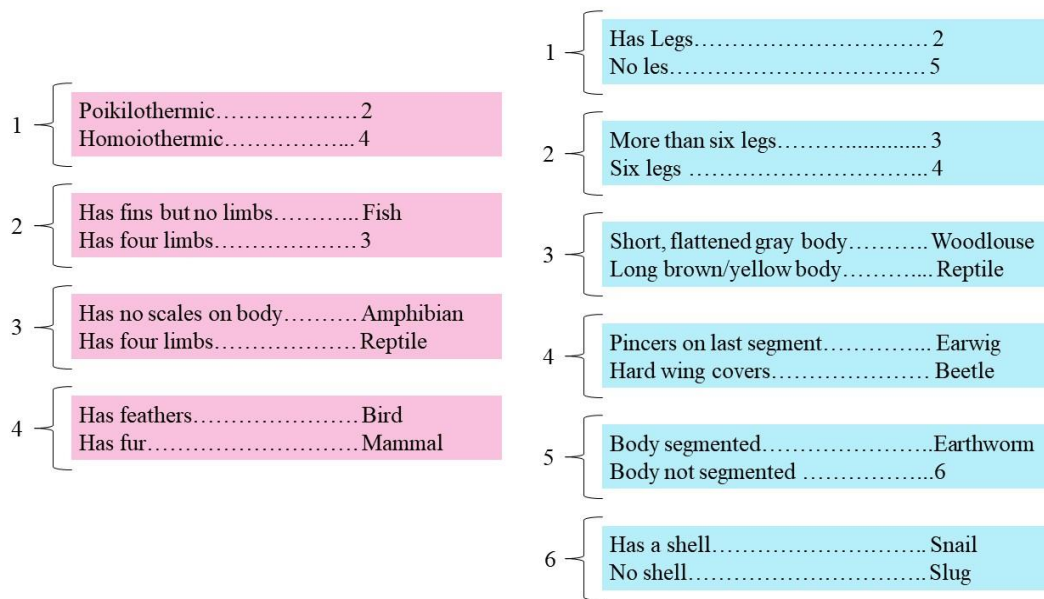


Figure 1. 3. Vertebrate (left) and Invertebrate (right) keys

Invertebrates: Porifera (sponges), Coelenterata (cidaria), Platyhelminthes (flatworms), Nematoda (roundworms or nemathelminthes), Annelida (segmented worms), Mollusca (soft-bodied animals), Echinodermata (spiny-skinned animals), and Arthropoda (joint-footed animals), etc..

Vertebrates: the fish, the amphibians, the reptiles, the birds, and the mammals, etc..

Feedback to Activity 2.21: Interviewing

Example of important insects

Insect pests: grasshopper, caterpillar, aphids, etc.

Vectors: tsetse fly, mosquitoes,

Pollinators: butter fly, honey bee

Apiculture: honey bee

Silvi-culture: silk worm

Feedback to Activity 2.22: Collaborative learning groups

Example of important vertebrates

Fish (Nile tilapia, cat fish): food, ecological, medicinal, aesthetic, cultural, sport hunting.

Birds (poultry, ostrich): food, ecological, medicinal, aesthetic, cultural, sport hunting

Mammals (cow, horse, donkey, hyena, lion, game mammals, etc.): food, ecological, medicinal, aesthetic, cultural, aesthetic, cultural, sport hunting

2.7 Renowned Taxonomists in Ethiopia

Learning objectives

At the end of this section, the student will be able to:

- Appreciate the works of renowned taxonomists in Ethiopia.

SA = start Activity	MA= Main activity	CA = concluding activity	Active Learning Methods
Kingdom Monera			
SA	Ask students the names ad works of renowned taxonomists in Ethiopia and students brainstorm their works.		Brainstorming, Question and answer
MA	Divide students into 5 groups and assign each group a renowned taxonomist in Ethiopia to discuss the work of the Ethiopian taxonomist. Students use the textbook and any other resources available to plan a presentation about one of a renowned taxonomist in Ethiopia.		
CA	Ask students the names ad works of renowned taxonomists in Ethiopia and students brainstorm their works. give students quick and relevant feedback give quiz/test		Suggested Formative Assessment

Feedback to Self-test (students could discuss about a renowned Ethiopian taxonomist they knew)

Professor Sebssbe Demssew, Professor Ensermu kelbessa & Professor Abebe Getahun, etc.

Feedback to the review question

Part One (True or False items): Say true if the statement is correct false if the statement is wrong

1. True	2.True	3.True	4.True	5.False
6.False	7.True	8.True	9.True	10.True

Part Two: Multiple Choices: Choose the best answer among the give alternatives

1.A	2.D	3.D	4.A
5.A	6.A	7.D	8. B

Part Tree: Critical thinking questions

- 1 Viruses cause many diseases, most short-lived and relatively mild, but some that are deadly.
- 2 Fish, amphibians, reptiles, birds & mammals.
- 3 Bacteria benefit other organisms by putting oxygen into the air, fixing nitrogen, and acting as decomposers. Some bacteria are human pathogens.
- 4 Fungi decompose materials, thus releasing nutrients that producers can take up and use. Fungi form mutually beneficial partnerships with plants and green algae. Some ants farm fungus as a source of food. Some fungi are pathogens that invade the tissues of plants and animals.
- 5 Ecological and economic importance of insects are: pollinators, food sources, removal of wastes and remains, crops pests, disease vectors, parasites & pathogens, etc.
- 6 Both groups have cell wall & no a nucleus. Both reproduce by binary fission.
- 7 Food sources (e.g., wheat, rice, tef, potato, tomato, maize, Soybeans, lentils, peas, peanuts, etc.), medicine, source of fabrics (e.g., linen, ramie, hemp, burlap, and cotton), fire wood, construction, ecological, etc.

Unit 3: Cells

Contents	Competencies	Learning Strategies	Assessment
3.1. What is a cell?	Define a cell	Let the students tell what they know about cells.	DA: Competencies 1 & 2
3.2. Cell theory	Outline the contributions of Theodor Schwann and Matthias Schleiden to the development of the cell theory	Based on the knowledge they have about the cell let the teacher introduce the cell and the cell theory	E: verbal/ written evidence of mentioning all characteristics
3.3. Cell structure and function			AI: Observation of response and group discussion, reflection, presentation/ Written test, portfolio
3.4. Types of cells		Let the students compare and contrast the structures of plant and animal cells using the generalized hypothetical models.	AI: Observation of response and group discussion, reflection, presentation/ Written test, portfolio
3.5. Animal and plant cells			DA: Competencies 3-7
3.6. Observing cells under a microscope	Compare and contrast the structures of plant and animal cells	Let students are provided with onion bulb skins and using cheek cells prepare temporary slides, study under the microscope, draw, and compare these with their learning in the general hypothetical model.	E: Verbal/ written/practice
3.7. The cell and its environment	Differentiate between eukaryotic and prokaryotic cells	Ask the students to list out the differences/similarities between the two model cells and then let them assign as prokaryotic or eukaryotic.	AI: Reflection, presentation/ written tests, field reports/ observation
3.7.1. Passive transport	Make temporary slides of plant and animal cells		DA: Competency 8
3.7.2. Active transport		Let them reflect on their experiment to outline observed structures(organelles) and speculate their functions	E: Verbal
3.8. Levels of Biological Organization	Observe and draw animal and plant cell parts under the microscope	Let the students prepare equal sized potato cubes and 10% NaCl solution and put the potato cubes in distilled water and salt solution. Let them speculate what will happen? After 1 hour observe their difference in size, weight, and conclude.	AI: Reflection, presentation
	Conduct substances across animal and plant cells experiments about the movement of substances across animal and plant cells (osmosis, diffusion)	Based on the two levels of organization introduced so far, students will be asked to explore other levels of biological organizations.	
	Construct with examples the different levels of biological organization		

Learning Outcomes: At the end of this unit, a student will be able to:

- describe what are cells,
- discuss the cell theory,
- compare the structure and function of plant and animal cells,
- prepare microscopic slides and observe under the microscope,
- describe movements in plant and animal cells, and discuss levels of cellular organization.

3.1 What is cell?

This section should take approximately 1 period of teaching time.

Learning objectives

By the end of this section, the students should be able to:

- realize every living things composed of cells.
- differentiate between unicellular and multicellular organisms.

Teaching Notes

In this section, students will learn about cell. This section starts by making the students to recall their grade seven lesson about cell. They will learn about cell which is the smallest and the basic unit of living things. The students will learn about unicellular and multicellular organisms. The students will recognize that some unicellular organisms are invisible with the naked eyes, but there are some exceptions like chicken egg cell which can be seen with the naked eye. This section deals that microscope is important to observe very small objects such as cells which can't be seen by our naked eyes.

Let the students tell what they know about cells. Based on the knowledge they have about the cell let the teacher introduce the cell and the cell theory

SA = starter activity MA = main activity CA = concluding activity		Active learning
What is cell?		Discussion
SA	Brainstorm students by asking questions about cell. Students write down the meaning of cell from their previous knowledge.	Group work
MA	Students read in text book about the meaning of cell and about the unicellular and multicellular organisms. Students work on activity 3.1 which asks the student to give example of unicellular and multi-cellular organisms. Students will learn more about cell from the box of attention.	Individual assignment Think pair share Self test Practical activity
CA	Students identify the type of the cells and have a short note about the lesson; they will read the main points from key notes on their text book.	

It is important to explain to students the function of cell, and how far unicellular organisms are invisible. In relation to the unicellular organism, it is important to mention about the function of microscope, which is important to observe such types of invisible things. In this section, it is important to indicate that some cells are visible e.g. chicken egg cell. Also, explain them how body of multicellular organisms is a cooperative society of many cells of specialized types.

In this activity, let the students make a group and help them to do the activity; this activity helps them to summarize what they have learned in this section.

Feedback to Activity 3.1 Group work

For this activity the student should arrange their sitting in order to discuss in groups about the study of cell and we are studying cell because all activity of organisms taken place in the cell. In addition, help them to identify unicellular and multicellular organisms and let them to give some examples of Unicellular and multicellular organisms.

3.2 Cell theory

This section should take approximately 2 periods.

Learning objectives

By the end of this section, the students should be able to:

- describe cell theory.
- identify scientists who have a role in the discovery of the cell theory.

Teaching Notes

This section introduces your students about the four scientists who have a role in the discovery and study of cells. Students will learn about the role an English scientist, Robert Hooke was the first to observe cells and to use the word cell for structures in living organisms. This will learn about other early German scientists, Matthias Schleiden and Theodor Schwann were the first to explain all plants and animals are made of cells, the basic views of what we now call cell theory. Then this section also continues discussing of a German pathologist, Rudolf Virchow (1856) established the idea that cells arise only by division of existing cells. Students will learn about the cell theory states that: The cell theory which states that, living organisms are composed of one or more cells, cells are the smallest unit of life and cells arise only by division of a previously existing

cell. The student also recognizes about cells, which are varying considerably in size and shape, but they share certain common features.

Cells vary considerably in size and shape but they share certain common features:

- Every living cell is surrounded by a membrane, which separates the cell contents from everything else outside.
- Cells contain genetic material, which stores all of the instructions needed for the cell's activities.
- Many of these activities are chemical reactions, catalysed by enzymes produced inside the cell.
- Cells have their own energy release system that powers all of the cell's activities. So, cells can be thought of as the smallest living structures nothing smaller can survive.

SA = starter activity MA = main activity CA = concluding activity		Active learning
The role the four scientists in the discovery and study of cell.		
SA	Students brainstorm by revising the previous lesson about cell	Discussion
MA	Students read on textbook about the important role of scientists who were working on the discovery of cell and cell theory. Students observe the picture of the first cork cells published by Robert Hooke. Students relate the discovery of cell with the discovery of microscope.	Group work Individual assignment
CA	Students revise the discoveries of the cell.	
Cell theory		Think share pair
SA	Asking brainstorm questions on what the students know about the composition of plant and animals.	
MA	Students read and write short note from their textbook about the major findings of cell which are used as a base for cell theory. Students state the cell theory and common features of cells.	Self test
CA	Students identify the three cell theories and they read the key notes on their textbook. Students read the key notes which help them to refocus on the main points of the topic. Help them to make a connection between the idea of cell theories.	Practical activity

Cell theory

Here you will explain to students the importance of research findings by Robert Hooke Matthias Schleiden, Theodor Schwann and Rudolf Virchow. You will indicate how these findings help for the development of cell theory. In addition to cell theory, students should learn about certain

common features of different cell. You should help them to recognize that even though cells have different shape and size, they have certain common features.

The smallest organisms are unicellular – they consist of just one cell. Larger organisms are multicellular – they are composed of many cells.

Feedback to Activity 3.2 Group work

Let the students arrange their sitting in order to discuss in groups about the three important points of cell theory.

The cell theory states that:

- 1 Living organisms are composed of one or more cells.
- 2 Cells are the smallest unit of life
- 3 Cells arise only by the division of a pre-existing cell.

All living organisms are made up of one or more cells, which are considered the fundamental units of life. Even unicellular organisms are complex! Inside each cell, atoms make up molecules, which make up cell organelles and structures.

pre-existing cells mean the cell which divided to form 2 new daughter cells. That pre-existing cell was one of the 2 cells which got divided from its parent cell.

3.3 Cell structure and function

This section should take approximately 3 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- identify the main structure of cell.
- state that the cytoplasm of all cells contains most organelles like, nucleus, ribosomes, rough endoplasmic reticulum.
- describe the function of the structure of cell.
- list the main structure of the cell.

Teaching Notes

This section introduces your students about how cells have different structures and different functions. Students will learn about the organization of cell which varies between different

organisms and they should recognize that in multicellular organisms, some cells have the same shape and same function but other cells have

different shapes and different functions; here students will realize the picture of nerve and muscle cells in their textbook . Let them observe the shape and function of nerve and muscle cell. They will learn about the organization of cell which varies between different organisms.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Structure and function of the cell		
SA	Let students brainstorm the function of different cells in human body.	
MA	Students read the text book about cell structure and function of different cells. Let them observe the shape of nerve cell and muscle cell in the textbook. Students also realize the different functions of nerve and muscle cells. Students also read the notes in the attention box and realize how the study of cell structure is applied in antibiotic usage.	Discussion Group work Individual assignment Think pair share Self test
CA	Students take a note on structures and functions of the cell. Make the students to actively work in groups or in pairs on activities to incorporate active learning.	Practical activity
Cell structure and function (cell wall, Cell membrane, cytoplasm, organelles)		
SA	Ask students brainstorm questions on what the cell structure and organelles of cell and their function	
MA	Students read and write short note from the textbook about the major structure such as cell wall, cell membrane, and cytoplasm. Here, it is important to show them the model of the cell and where these structures are found. If you don't have a model, let them observe the cell picture on the textbook.	
CA	Students read the key notes from textbook.	
Other cell organelles		
SA	Let the students observe the picture of the cell and help them to identify different organelles.	Active learning
MA	Students observe the organelles of the cell. Write the short note about different organelles of the cell. Show them how organelles perform their function, by explaining the function of ribosomes in synthesizing of protein, the function of endoplasmic reticulum, Golgi apparatus and vesicles in protein transport. Help the students to read and understand the note in attention box; some have important examples which can be related to the function of organelles.	Discussion Group work Individual assignment Think pair share Self test Practical activity
CA	Students read the summary in key notes and do the activity questions.	

Cell structure and function. In this section, you will explain about how different cells have different functions and different shapes. It is important to explain that cells also resemble one another in certain important ways and contain common cell structures such as nucleus, cytoplasm and cell membrane.

You will elaborate the additional notes, which show application of the study of cell structure in using antibiotics etc.

You will explain about other organelles and their functions. In addition to the above structure, there are many tiny structures in the cytoplasm called organelles. An organelle is a distinct structure within a cell, having a specific function. Some of these organelles have membrane while others don't. The nucleus is a particularly large and distinctive membrane-bound organelle that contains the cell's genetic material. They will learn about the organelles that make up the cell and all of their different roles in the cell. Students will also recognize that different cells are adapted for different roles in the body. Most cells contain one nucleus, which is usually seen as a rounded structure enclosed in a membrane and embedded in the cytoplasm. The function of the nucleus is to control the type and quantity of enzymes produced by the cytoplasm. It regulates the chemical changes which take place in the cell. In addition, controls cell division. The nucleus is where DNA is replicated and transcribed to form mRNA, which is exported via the nuclear pores to the cytoplasm. Inside the nucleus there are chromosomes. The chromosomes contain a very long molecule of DNA. The DNA determines the sequences in which amino acids are linked together in the cytoplasm to form protein molecules. Within the nucleus there is a darker area called the nucleolus. This is where new ribosomes are made, following a code on part of the DNA. The nucleus is where DNA is replicated and transcribed to form mRNA, which is exported via the nuclear pores to the cytoplasm.

Feedback to Activity 3.3

For this activity, help them to realize and list the structure and function of the cell; let them and help them to fill the table

Function	Cell structure
Control all activity of the cell	Nucleus
Control the transport of material into and out of the cell	Cell membrane
The place where protein is synthesized	Ribosome
Packaging of the materials in the cell	Golgi apparatus
Produce energy	Mitochondria
Support the plant cell externally	Cell wall

Feedback to Activity 3.4

For this activity, make the students to arrange their sitting to discuss in groups; in order to save the time, students who sit back and forth can be one group. The answer for the first question can be cells have different structure to perform their function; so the shape of the cell depends on its function.

For example, the nerve cell in human body is very long and extends throughout the body to reach the different muscle cell.

Feedback to Activity 3.5

Difference between cell wall and cell membrane:

Cell wall	Cell membrane
Only found in plant cell	Found in animal and plant cell
Made up of cellulose	Made up of lipid and protein
It is permeable	It is semi permeable
It is rigid	It is a very thin not rigid as cell wall

Feedback to Activity 3.6

A chromosome is made of chromatin, which is a combination of DNA and proteins. Chromatin is thread like structure made up of DNA molecules and associated proteins. Each long chromatin fibre constitutes one chromosome.

DNA is the genetic material that organisms inherit from their parents. It is double stranded helical macromolecule consisting of nucleotide monomers with deoxyribose sugar, a phosphate group, and the nitrogenous bases adenine (A), cytosine (C), guanine (G), and thymine (T).

Feedback to Activity 3.7

Let the students make a group of five students and discuss in group about it. It is the ribosome, which is attached on rough endoplasmic reticulum which makes rough endoplasmic reticulum rough.

The Golgi apparatus, vesicles and rough endoplasmic reticulum have a cooperative work in material transport of the cell; for example, proteins can be made by rough endoplasmic reticulum. This protein made by the rough endoplasmic reticulum may be placed inside a transport vesicle which is attached on Golgi bodies. The Golgi apparatus with the vesicles functions in the collection, packaging, and distribution of molecules within the cell or even outside the cell.

Feedback to Activity 3.8

Let the students make a group, each group of students and discuss. Metabolically, very active cells contain thousands of mitochondria, for example, muscle cells because they need more energy for their metabolic action.

3.4 Types of cells

This section should take Approximately 3 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- describe the difference between prokaryotes and eukaryotic cell.
- give examples of the two types of cell.

In this section, students learn the two types of cells. Students should understand that cells are grouped into two types based on cell structure and cellular organization.

You should help the students to identify the prokaryotic cells and eukaryotic cells. You should explain the structure difference between prokaryotic and eukaryotic cells. List some examples of prokaryotic and eukaryotic cells.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Types of cells (Prokaryotic and eukaryotic cell)		
SA	Asking brainstorm questions about the difference between bacterial cell and human cell, and help them to relate their answer to prokaryotic and eukaryotic cells.	Discussion Group work
MA	Students read about types of cell from their textbook. Let them observe the picture of prokaryotic and eukaryotic cell in their textbook. Students also realize the difference between prokaryotes and eukaryotes. Students should also read the notes in the attention box to understand the meaning of eukaryotes.	Individual assignment Think pair share Self test
CA	Students read the key notes and write the short note about the two cell types.	Practical activity
Prokaryotic and eukaryotic cell		
SA	Students give examples of prokaryotic and eukaryotic cell.	Discussion Group work
MA	Students read and write short note from the textbook and they study figure of prokaryotes and eukaryotes.	Individual assignment Think pair share
CA	Students read the key notes from textbook and understand the ideas found in table 3.1.	Self test

Prokaryotic and eukaryotic cell

Here, you should explain the students the main difference between prokaryotes and eukaryotes.

Here it is important to indicate that prokaryotes are different from eukaryotic cells because of the absence of membrane-bounded nucleus and also they do not have numerous membrane-bounded organelles. These Prokaryotic cells are generally much smaller than eukaryotic cells. Most prokaryotic organisms are unicellular. Prokaryotes have a cell wall outside the cell membrane. You can help the student to read table 3.1.

Prokaryotes were the first organisms to evolve on Earth. They are mostly small in size and are found almost everywhere – in soil, in water, on our skin, in our intestines etc.

Prokaryotes have a cell wall outside the cell membrane which protects the cell, maintains its shape and prevents it from bursting. In prokaryotes the cell wall contains peptidoglycan. It is often referred to as being extracellular.

The cytoplasm of prokaryotes is not divided into sections by membranes. It's. Organelles are present in the cytoplasm. Living organisms need to produce new cells. They can only do this by division of pre-existing cells. Cell division in prokaryotic cells is called binary fission and it is used for asexual reproduction.

Feedback to Activity 3.9.

Food vacuole is a membrane-enclosed sac, which has a digestive function. It is present in unicellular protozoans such as amoeba, plasmodium, etc. They work as an intracellular stomach, digesting the ingested food.

What is meant by contractile vacuoles?

Contractile vacuole, regulatory organelle, usually spherical, found in freshwater protozoa and lower metazoans, such as sponges and hydras, that collects excess fluid from the protoplasm and periodically empties it into the surrounding medium. It may also excrete nitrogenous wastes.

Feedback to Activity 3.10.

For this activity, make the students to arrange their seats to discuss in groups in order to save the time. Students who sit back and forth can be one group. Tell them to have a short note for their answer. After their discussion, ask them to read their note for the class. The common cell structures found in both prokaryotic and eukaryotic cells are ribosomes, chromosomes, cell wall

(only in plant cell in Eukaryotes), flagella. Let them to give example of prokaryotic and eukaryotic cells.

Examples of prokaryotes can be any kinds of bacteria and eukaryotes are plants, animals etc.

3.5 Animal and plant cells

This section should take Approximately 2 period of teaching time.

Learning objectives

By the end of this section students should be able to:

- list the structures of plant and animal cells.
- describe the differences in structure between plant and animal cells

Teaching Note

This section explains about the similarities and differences between animal and plant cells. Your students can compare and contrast between animal and plant cells. Students can list the common structure of these two cells. These common structures are cell membrane, nucleus, cytoplasm, and organelles like mitochondria, golgi

apparatus. It is very important to let the students state some differences of animal and plant cell structures. These differences are: the presence of centriole, cell walls, chloroplast and large permanent vacuoles only in plant cells.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Plant and animal cell		Discussion
SA	Asking brain storm Questions	Group work Individual assignment
MA	Students answer the questions and take a short note about plant and animal cell	
CA	Summarize about the main parts of plant and animal cell.	
Difference between plant and animal cell		Think pair share
SA	Asking brain storm questions about the difference between plant and animal cell	Self test
MA	Students read about plant and animal cell. Let them observe the picture of plant and animal cell in their textbook. Students also realize that some cell structures are found only in plant cell and others structures only found in animal cells.	Practical activity
CA	Students read the key notes and table 3.2 which summarize the difference between plant and animal cells.	

Feedback to Activity 3.11.

For this activity, let the students fill the table on the different animal and plant cell

Features	Animal Cell	Plant Cell
cell wall	Absent	Present
Cell membrane	Present	Present
Nucleous	Present	Present
Chloroplast	Absent	Present
Vacuole	Small	Large
Mitochondria	Present	Present
Smooth and rough endoplasmic reticulum	Present	Present
Golgi bodies	Present	Present
ribosomes	Present	Present

3.6 Observing cells under a microscope

This section should take Approximately 2 periods.

Learning objectives

By the end of this section students should be able to:

- draw the cell structures as seen with the light microscope.
- label the cell wall, cell membrane, cytoplasm and nucleus of the cell.

Teaching Notes

In this section, students learn how they prepare a slide of plant and animal. This will be done using onion and cheek cell for plant and animal cell respectively. The students also develop their practical skill by preparing a slide and observing under microscope. They also develop their skill by drawing and labelling the cell that they observe during their practical activity.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Observing plant cells under a microscope		Discussion Group work Individual assignment Think pair share Self test Practical activity
SA	Asking brainstorm questions from their previous lesson which is unit one how to handle and using a microscope.	
MA	Students carry out activity about observing plant cells and making careful. Drawings and labelling the important part seen under light micro- scope. During their activity, it is very important to handle the micro-scope carefully.	
CA	Students draw the cell structures as seen with the light microscope and indicate the cell wall, cell membrane, cytoplasm and nucleus of the cell.	

Observing animal cells under a microscope		Active learning
SA	Students revise the different cells investigated in the previous session. They should identify the difference between animal and plant cell.	Discussion Group work
MA	Students carry out activity about observing human cheek cells and making careful drawings and labelling the important part seen under light microscope.	Individual assignment Think pair share
CA	Students make summary notes from key word and observe the cell picture placed in their textbook.	Self test

Feedback to Activity 3.12 and 3.13

Let the students do the laboratory activity on plant and animal cell. In this section, you should prepare onion epidermal cell in order to study plant cell and cheek cell to study animal cell.

You should prepare all the materials listed in the student's textbook. If you mount your specimen properly, students can observe cell wall, cell membrane and the nucleus. Let the students to identify the position of nucleus in plant and animal cell. Nucleus in onion epidermal cell is found at one part of the cell, this is because of large vacuole in plant cell. The position of nucleus in animal cell found at the centre of the cell.

3.7 The cell and its environment

This section should take Approximately 5 periods of teachingtime.

Learning objectives

By the end of this section students should be able to:

- define the term diffusion and osmosis.
- describe the importance of diffusion and osmosis for the transport of gases and solutes.
- describe the importance of active transport.

Teaching Notes

This section introduces your students about the cell membrane which forms the barrier across all substances entering or leaving the cell, and controls what enters and leaves cells. It is important to indicate that the cell membrane is selectively (semi) permeable because it chooses what can go in and out and permeable because it can help materials to be crossed. It is very important to help your students understand the concept of partially permeable membranes and the importance of diffusion, osmosis

and active transport in both plant and animal cells. It can be interesting for students to understand the application of diffusion and osmosis in life. Students should work on the suggested practical work in this section as possible which help them to understand the movement of the materials.

A cell membrane consists of a double layer of phospholipid molecules. This structure arises because in water a group of phospholipid molecules arranges itself into a bilayer, with the hydrophilic heads facing outwards into the water and the hydrophobic tails facing inwards, therefore avoiding contact with water. This is the basic structure of a cell membrane. Protein molecules float in the phospholipid bilayer. Many of the phospholipids and proteins have short chains of carbohydrates attached to them, on the outer surface of the membrane. They are known as glycolipids and glycoproteins

The Cell membrane and its structure Diffusion		Active learning
SA	Asking brainstorm questions about some examples of the movement of materials across cell membrane.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read and write short note from the textbook about the passive transport system and active transport system. Let them understand the note written in the attention box which is about rolling a ball on a hill; for example help them understand the difference between active and passive diffusion. Students should observe pictures of the materials diffusion. Students discuss factors that affect the speed of diffusing particles and they should know why diffusion is important in life.	
CA	Students read and write short notes from text book.	
Osmosis		
SA	Students revise the movement of particles by diffusion and introducing about movement of water across cell membrane. Students should know that all movement of substances is possible, because of the movement of water.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read and write the important points about the movement of water into and out of the cell. They should understand that the movement of water is depending on the type of solution found the cell surrounding. They recognize this movement in hypertonic, hypotonic and isotonic solution.	
CA	Students read the summary in key word and complete the activity questions.	
Osmosis in Plant cells		
SA	Let students discuss the application of osmosis in plant cell.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students should read and take a short note that osmosis is important in plants to make the plant to become very rigid due to the pressure of water pressing outwards on the cell wall. They can understand that how turgor is necessary for plants to retain their upright posture and the extended state of their leaves. Student realize the wilting and turgidity of the plant by observing the picture of plant in their text book.	
CA	Students revise the plasmolysis and turgidity of plant cell and import-ant function of turgidity to make the plant strong.	
Osmosis in animal and amoeba cells		

SA	Let the students give some example of application of osmosis in animals.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students discuss on the effect of osmosis in animal cell, by using red blood cell which can crenate and burst because of unbalance movement of water in animal cell. Students develop practical skill by doing some laboratory activities.	
CA	Students summarize about osmosis by doing activities on their text book.	
Active transport		
SA	Students revise passive transport and introduce active transport.	
MA	Students should understand active transport which is the opposite of diffusion or osmosis. They should read a note in attention box to understand active transport easily.	
CA	Students take a summary note from key word box.	

Feedback to Activity 3.14

For this activity, help the student to discuss in pair and reflect their answer to their classmates. If the cell membrane is to lose its selectivity, all substances may enter to the cell and all other substances which is important for the cell may remove out of the cell.

Feedback to Activity 3.15

Let the students share their reflection with their friends on:

- Diffusion of the odor of incense stick from high to low concentration
- Diffusion of tea color in cap of water from high to low concentration

Feedback to Activity 3.16

Let the students exercise examples of diffusion in the classroom

Diffusion

The process of diffusion is explained by using perfume spray to show the movement from high concentration to low concentration. In the activity, the smell of perfume moves from where it is sprayed to where it reaches the last student at the corner.

You should select two students for this activity; the first student works on the spraying of the perfume and the other one to count number during the activity. Let the students discuss on the result of the activity. The movement of the perfume smell becomes faster when we increase the concentration of perfume. This indicates that concentration of substances affect diffusion.

Osmosis

Feedback to 3.17 Activity

Let the students' pair with their friends next to them. Then let them discuss about some examples

of osmosis, Feeling thirsty after having salty food because too much of salty food disrupt the balance of fluid in your cells. The extra salt outside the cell acts like a magnet, pulling water out of the cells.

The cells try to hold in the water and they send chemical messengers to the brain, protesting the saltiness of the fluid around them. When the thirst center goes on alert because things are too salty and the body needs water to dilute the salt, that's when you start to feel thirsty. The kidneys help dilute the salt too by slowing down urine production and conserving water. The constant balancing of salt and water in the body helps maintain the right amount of water in our cells and in the bloodstream. Swelling of resins and other seeds when they are soaked in water, this seed and the potato swells because it takes water .

Feedback to 3.18 Activity

Let the students' pair with their friends next to them. Then let them discuss about some examples of osmosis write short note and help them to read to other classmates. When osmosis explained in terms of the solutes, water moves from the area of lower solute concentration (Hypotonic) toward the area with the greatest concentration of solutes (Hypertonic).

Feedback to 3.19 Activity

Let the students form a group with the students sitting at the back seat. Help them to discuss in groups how osmosis is important in our society in the preservation of meat in the rural area where refrigerator is not available. Here, many people live in a rural area preserve meat by mixing the cut meat with salt; here water moves from meat (high concentration of water) to the salt (low concentration of water but high concentration of salt).

Feedback to 3.20 Activity

Let the students form a group with the students sitting at the back seat. Help them to discuss in groups and write short note of their discussion.

In human, during physical activity, the body may sweat in order to maintain a stable temperature. If liquids are not drunk to compensate for water loss through sweating, the body can become dehydrated. Loss of water from the blood results in the plasma becoming more concentrated .The cells become shrinks. Their surface area is reduced, causing them to be less effective in carrying oxygen. The shape of the cells is known as being crenate.

When a farmer applies chemical fertilizers to the soil, the fertilizers dissolve in the soil water. Too

much fertilizer can lower the osmotic potential of the soil water. This can draw water out of the plant root hair cells by osmosis, leading to wilting and death of crop plants. Why?

This is because high amount of fertilizer makes the soil to reduce its water concentration. This is because of the addition of solutes as fertilizer in the soil. Now, the movement of water is from high concentration (the plant) to low concentration (the soil). Therefore, the plant becomes wilt because it loses its water content by osmosis.

Feedback to 3.21 Activity

Use internet or book for your source and discuss how animals living in fresh water regulate osmosis and how they protect their body from bursting?

Fresh water animals these animals must have a way to balance the uptake and loss of water. The control of water balance is called osmoregulation. For example, a freshwater fish has kidneys and gills that work constantly to prevent an excessive buildup of water in the body.

Active transport

Active transport uses a substance called ATP as the energy supply for this process. Active transport is carried out by proteins in membranes, usually called pump proteins. The membranes of cells contain many different pump proteins allowing the cell to control the content of its cytoplasm precisely. The molecule or ion enters the pump protein and can reach as far as a central chamber. A conformational change to the protein takes place using energy from ATP. After this, the ion or molecule can pass to the opposite side of the membrane and the pump protein returns to its original conformation.

Feedback to Activity 3.22 Laboratory activity

Investigating osmosis in plant cells. 1. Observing osmosis in potato:

- i. prepare equal sized potato cubes and measure the its weight
- ii. make salt solution and put in a bottle
- iii. bring another bottle and put pure water in it
- iv. put the potato cubes in distilled water and salt solution.
- v. Let them speculate what will happen?
- vi. After 1 hour observe their difference in size, weight, and conclude.

Answer: the potato which is put in salt solution losses water by osmosis. Therefore, the weight decreases.

Observing osmosis in onion cell.

Epidermal strips are useful material for observing plasmolysis. Colored sap makes observation easier. Suitable sources are the inner surfaces of the fleshy storage leaves of red onion bulbs

- i. The strips of epidermis be placed in salt or sugar solution.
- ii. Small pieces of the strips can then be placed on glass slides
- iii. mounted in the relevant solution
- iv. Observed with a microscope.
- v. Plasmolysis may take several minutes, then discuss in groups.

Answer: the plasmolysis cell is observed with the microscope

Feedback to Activity 3.22 Laboratory activity

Investigating osmosis using model cell called dialysis tubing is partially permeable. We can use dialysis tubing to represent the cell membrane and the solution inside it to represent the cytoplasm.

If finding of the dialysis tube is difficult, it is better to use the intestine of sheep or ox from the butchers found in your surrounding). Tube A increases in volume because water enters the tube into the 'cell' by osmosis and , which becomes stretched. Tube B decreases in volume because water leaves out of the tube by osmosis

3.8 Levels of Biological Organization

This section should take Approximately 1 period of teaching time.

Learning objectives

By the end of this section students should be able to:

- define the terms tissue, organ and organ system
- list some examples of systems

Teaching Notes

This section introduces your students about a hierarchy of organization of life from atoms to complex multi-cellular organisms. Students learn the atoms are joined together to form molecules, to organelles, cells to tissue, then into organs and organ systems. This organization then extends beyond individual organisms to populations, communities, ecosystems, and finally the biosphere.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Level organization of living systems.		
SA	Ask brainstorming questions about the level organization of living systems.	Discussion Group work
MA	Students read about level of organization of living systems. Let them observe the picture to level organization of living systems.	Individual assignment Think pair share
CA	Students read the key notes to refocusing on what they have learned in the unit.	Self test Practical activity

Feedback to Activity 3.23

Let the students make a group and discuss in groups about level of organization in living things. The smallest level of biological organization that can display all the characteristics of life is cell.

Feedback to Activity 3.24

Let the students' pair with their friends next to them. Then let them discuss about How cells level of organization fit in our body and how the system is affected when tissue of the organism is damaged accidentally.

Feedback to Activity 3.25

Discuss in groups and give examples of some systems and their organs in human body. Student can give different examples

System	Organs
Digestive system	Mouth, small intestine and stomach
Circulatory system	Arteries, vein, capillaries, heart

Answer to Review Questions

Matching

1. b, 2. C 3, d 4, a 5,e

Fill in the blanks

1. Cell wall 2. Lysosomes 3. Vesicles 4. Organ 5. Isotonic

Choose the best answer

1.B 2.C 3.C 4.A 5. D

Short answer questions

1 The red blood cell burst by receiving more water. 2.Cell wall , chloroplast and large vacuole

- 2 Centrioles and lysosomes
- 3 The cell surrounding environment is hypertonic (contain more solute than the cell)
- 4 Copy and complete this table by using ticks and crosses to indicate if the structures are present or not.

cell structures	cheek cell (animal)	onion cell (plant)
nucleus	x	X
cell wall		X
chloroplasts		X
large vacuole		X
cytoplasm	x	X

Fill in Fill the blank spaces of the table with appropriate level organization of some organ system

Cell	Tissue	Organ	system
Red blood cell	cardiac muscle	Heart	Circulatory system
Egg, sperm	Epithelial tissue of male and female reproductive organ	Ovary, testes	Reproductive system
Mucous cell	Epithelial digestive tissue	Stomach, intestine	Digestive system
Xylem or phloem cells	Xylem /phloem	root /stem	Vascular system
Nerve cell	Nerve tissue	Brain	Nervous system

Fill the blank spaces of the table by saying YES or NO

	Diffusion	Osmosis	Active transport
It is the movement of substances like O ₂	YES	NO	NO
It is movement of water	NO	YES	NO
Movement of ions like K ⁺	NO	NO	YES
Energy is required	NO	NO	YES

Unit 4: Reproduction (29 periods)

Contents	Competencies	Learning Strategies	Assessment
4.1. Reproduction 4.2. Asexual reproduction 4.3. Types of asexual reproduction 4.3.1. Fission 4.3.2. Fragmentation 4.3.3. Budding 4.3.4. Vegetative reproduction 4.3.5. Parthenogenesis 4.4. Sexual reproduction in humans 4.5. Primary and secondary sexual characteristics 4.6. Male reproductive structures 4.7. Female reproductive structures 4.8. The Menstrual cycle 4.9. Fertilization and pregnancy 4.10. Methods of birth control 4.11. Sexually transmitted diseases: transmission and prevention	1. Appreciate that life perpetuates from generation to generation through reproduction (transfer of genetic material from parents to offspring). 2. Define asexual and sexual reproductions 3. Describe asexual reproductions in bacteria, fungi, and plants 4. Compare and contrast the advantages and disadvantages of asexual and sexual reproduction 5. Describe the biological, psychological, and social changes during puberty stage 6. Differentiate between the primary and secondary sexual characteristics of males and females in humans 7. Identify the structure and functions of the male reproductive organs. 8. Identify female reproductive structures and their functions. 9. Outline the phases of the menstrual cycle 10. Define fertilization and pregnancy 11. Discuss the methods of	1. Let the students speculate why/how life survives? For example, very few humans live for more than one hundred years but the human species has existed for thousands of years. How is this possible? Raise continuity of life as the focus of discussion through series of prompt questions to lead the students to recognize the role of reproduction and further to appreciate the transfer of genetic material from parent to offspring. 2. Students will define what sexual and asexual reproductions are 3. The students will explore the different types of reproduction and then further inquire if there are different types of asexual and sexual reproduction in different taxa. Based on their response the teacher will introduce topics in asexual and sexual reproduction. Teachers could facilitate learning by listing on the blackboard common organisms in their locality for them to classify. 4. In groups, they explore the advantages and disadvantages of asexual and sexual reproductions 5. Let the students discuss on the biological, physiological changes during puberty stage and list the primary and secondary sexual characteristics in groups of 4-5 students. 6. Let the students differentiate the primary and secondary sexual characteristics of males and females. 7. Let the students draw and label the male reproductive structures from books and internet resources 8. Let the students draw and label the female reproductive structures from books and internet resources; Let the students use animations of the male and female reproductive systems. 9. Let the students outline and discuss the phases of menstrual cycle (Hint: safe period, ovulation period, hormonal changes, etc)	1. DA: Competency 1 E: Verbal/Written AI: Presentation, reflection/Written test, observation 2. DA: Competency 2-4 E: Verbal/written/ Model, diagrams, AI: Reflection, demonstration, presentation/Written test, drawings. 3. DA: Competencies 5 & 6 E: verbal/Written AI: Observation, presentation/Written test 4. DA: Competencies 7 & 8 E: Verbal/pictorial/video AI: Presentation, reflection/drawings, written tests 5. DA: Competencies 9 - 12 E: Verbal/written/diagrams AI: Reflections, presentations, observations/drawings, written test 6. DA: Competency 13 E: Verbal/ written AI: Presentation/written report

	prevention of pregnancy 12. Describe the types, modes of transmission and preventive mechanisms of sexually transmitted diseases	10. The students will explore the process of fertilization, pregnancy and gestation period in groups of 4-5 students. 11. Let the students discuss what they know about the methods of prevention of pregnancy	7.DA: Competency 14 E: Verbal/ written AI: Reflection/written report
--	---	---	--

Learning Outcomes: At the end of this unit, student will be able to:

- Appreciate that life perpetuates from generation to generation through reproduction
- Compare and contrast the advantages and disadvantages of asexual and sexual reproduction
- Differentiate between male and female reproductive structures
- Discuss what are puberty and primary and secondary sexual characteristics
- Describe menstrual cycle, fertilization, pregnancy and sex determination
- Tell methods of birth control

4.1 Introduction Reproduction

Learning objective

At the end of this section the student will be able to:

- appreciate that life perpetuates from generation to generation through reproduction

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Reproduction			
SA	Ask students about reproduction and students brainstorm the concept of Continuity of life.		Gapped/enhanced lecture, Group Discussion, Cooperative learning
MA	Let students read section 4.1 and make notes on reproduction, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral presentation on the continuity of life. Divide students into two groups. Each group carries out activity 4.1: discuss the concept of reproduction. Each group puts together a presentation about characteristics of sexual and asexual reproduction. Provide books, access to computers, and any other resources for students to help them produce their oral presentation reproduction.		
CA	Students watch each other's presentation and make notes on sexual and asexual reproduction. <ul style="list-style-type: none"> ▪ monitoring group discussion and cooperative learning ▪ give students quick and relevant feed back ▪ peer assessment and reflection on group paired work 		Suggested Formative Assessment:

4.2 Asexual reproduction

Learning Objective:

At the end of this section, students will be able to:

- define asexual reproductions

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Asexual reproduction			
SA	Ask students about asexual reproduction and let them brainstorm the concept of asexual reproduction .		
MA	<p>Let students read section 4.2 and make notes on asexual reproduction, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the asexual reproduction. Divide students into groups.</p> <p>Each group carries out activity 4.2: Write about the characteristics features of asexual reproduction.</p> <p>Each group puts together a presentation about characteristics features of asexual reproduction.</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation on asexual reproduction.</p>		Gapped/enhanced lecture, Group Discussion, Cooperative learning
CA	<p>Students watch each other's presentation and make notes on asexual reproduction.</p> <ul style="list-style-type: none"> ○ monitoring group discussion and cooperative learning ○ give students quick and relevant feed back ○ peer assessment and reflection on group work ○ give class work 		Suggested Formative Assessment:

4.3 Types of asexual reproduction

Learning objectives

At the end of this section the student will be able to:

- describe process asexual reproductions in bacteria, fungi, and plants
- describe the mechanism of fission
- describe the mechanism of fragmentation
- describe the mechanism of budding
- describe the mechanism of vegetative propagation
- describe the mechanism of gamogenesis

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Asexual reproduction in bacteria, fungi, animals and plants			
SA	Ask students about asexual reproduction in bacteria, fungi, animals and plants and let students brainstorm.		Brainstorming
MA	<p>Let students read section 4.3 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the asexual reproduction in bacteria, fungi and plants.</p> <p>Divide students into four groups. Let first group student work asexual reproduction in bacteria, the second group on asexual reproduction in fungi, third group work on asexual reproduction in animals & fourth group work on asexual reproduction in plants.</p> <p>Each group puts together a presentation about asexual reproduction in bacteria, fungi, animals and plants</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation on asexual reproduction in bacteria, fungi, animals and plants</p>		Cooperative learning Jig saw group
CA	<p>Students watch each other's presentation and make notes on asexual reproduction in bacteria, fungi, animals and plants.</p> <ul style="list-style-type: none"> ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work ○ give quiz/test 		Suggested Formative Assessment:

Feedback to Activity 4.3: Experiment on budding and fragmentation

- Task 1: arrange the necessary material for the field visit
- Task 2: go to the field in your village or school compound search for a plants species that reproduce with a vegetative mechanism.
- Task 3: cut a piece of the plants without damaging the part of plants.
- Task 4: examine parts of the collected specimen and take notes
- Task 5: draw and label important parts
- Task 6: make a presentation to your classmates

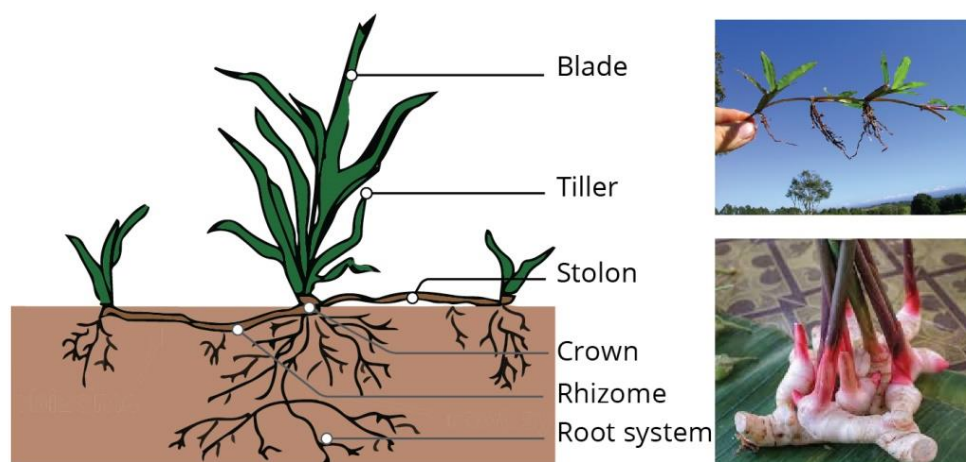


Figure 4.6. Reproduction using stolon and rhizomes

Feedback to Activity 4.4: Experimentation on growing potato plants from tuber.

Make a field visit to your village and collect specimens of potato plants. Materials required include potato tubers, potato, razor blade, iodine solution, microscope, slide, cover slip, and large pot. Take a note on the morphological features and grow potato plants from tubers.

Feedback to Activity 4.5: Experimentation on growing onion plants from bulbs.

Make a field visit in your village and collect specimens of onion plants. Material required bulb and pot containing soil mixed with compost. Take a note on the morphological features and grow onion plants from bulbs.

Feedback to Self-test

Answer to question 1: The nucleus of the orgasms divide repeatedly and each daughter nucleus breaks away together with a small portion of the cytoplasm, resulting in the production of many daughter cells

Answer to question 2: It is due to the decomposing effect of fungi

4.4 Sexual reproduction in Humans

Learning objective

At the end of this section students will be able to:

- describe the mechanism of sexual reproduction
- compare and contrast asexual and sexual reproduction

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Sexual reproduction		
SA	Ask students about sexual reproduction and let students brainstorm the concept	Discovery, Question and answer
MA	Let students read section 4.4 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the sexual reproduction. Divide students into two groups. Let first group student work asexual reproduction and the second group work on asexual reproduction. Write about the characteristics features of sexual ad asexual reproduction. Each group puts together a presentation about characteristics features of sexual and asexual reproduction. Provide books, access to computers, and any other resources for students to help them produce their oral presentation on characteristics features of sexual ad asexual reproduction.	
CA	Students watch each other’s presentation and make notes on characteristics features of sexual ad asexual reproduction. <ul style="list-style-type: none"> ○ Students may answer review questions. ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work 	

Feedback to Activity 4.6. Cooperative learning: Advantages and disadvantages of sexual reproduction

Advantages	disadvantages
Increases variability	Males and female are required: Sex cells/gametes are involved
Give potential to resist adverse conditions–catastrophes	Sexual reproduction is highly energy demanding

Feedback to Self-test

Answer to Question 1: does not need the involvement of males and female partners, faster, uniformity

4.5 Primary and secondary sexual characteristics

Learning objective

At the end of this section students will be able to:

- differentiate between the primary and secondary sexual characteristics of males and females in humans
- describe the biological, psychological, and social changes during the stage of puberty

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Primary and secondary sexual characteristics			
SA	Ask students about primary and secondary sexual characteristics and let students brainstorm the term Puberty. describe psychological, and social changes during the stage of puberty		Discovery Gapped/enhanced lecture, Group Discussion, Cooperative learning
MA	<p>Let students read section 4.5 and make notes on and, checking how accurate their ideas were in the brainstorming exercise.</p> <p>Students plan a poster presentation on the primary and secondary sexual characteristics in males and females.</p> <p>Divide students into two groups.</p> <p>Let first group student work Primary sexual characteristics and the second group work secondary sexual characteristics.</p> <p>Write about primary and secondary sexual characteristics.</p> <p>Each group puts together a presentation about characteristics features of animals.</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation on primary and secondary sexual characteristics in males.</p>		
CA	<p>Students watch each other’s presentation and make notes on primary and secondary sexual characteristics in males and female</p> <ul style="list-style-type: none"> ○ monitoring group discussion and cooperative learning ○ give students quick and relevant feed back ○ peer assessment and reflection on group work 		

Feedback to Activity 4.7

. Inquiring and researching

- Puberty begins in the early teen years. **Puberty** is the time when **secondary sex characteristics** begin to develop.
- Secondary sex characteristics begin to develop so that sexual maturity is reached.

Feedback to Self-Test

Answer to question 1: follicle-stimulating hormone (FSH) and luteinizing hormone (LH).

Answer to question : secondary sex characteristics in females are:

- Develop more hair, especially under the arms and in the pubic area.
- The hips broaden, and
- More fat is deposited in the breasts, buttocks, and thighs.
- The menstrual cycle begins.

4.6 Male reproductive structures

Learning objective

At the end of this section students will be able to:

- Identify the structure and functions of the male reproductive organs.

SA = start Activity MA= Main activity A = concluding activity		Active learning methods
Male reproductive structures		
SA	Ask students about male reproductive structures and let students brainstorm.	brainstorm, Question and answer
M A	Let students read section 4.6 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the reproductive structures. Students should read section 4.6 and make notes on the male reproductive structures and how it is adapted to reproduction. Provide books, access to computers, and any other resources for students to help them produce their oral presentation male reproductive structures.	
CA	Students watch each other's presentation and make notes on male reproductive structures. <ul style="list-style-type: none">○ Students may answer review questions.○ give students quick and relevant feedback○ peer assessment and reflection on group paired work	Suggested Formative Assessment:

Feedback to Activity 4.8. Reflective discussion

Male reproductive structures and function

Structure	Function
Epididymis	a single, coiled tube in which sperm finish their maturation process fluid into the vas deferens
Prostate gland	: a doughnut-shaped gland that lies below the urinary bladder and surrounds
scrotum	a sac that contains the testes; suspended directly behind the base of the penis
Seminal vesicle	a gland located at the base of the urinary bladder that secretes a fructose rich the top portion of the urethra; secretes an alkaline fluid that helps the sperm move
Vas deferens	a duct that carries sperm from the epididymis toward the ducts that will force the sperm out of the body; sperm can stay in the vas deferens for two or three months

Feedback to Self-Test

1. **Answer:** To keep optimum temperature for sperm survival
2. **Answer:** Mitochondria
3. **Answer:** Fluid secreted by these glands furnishes food to the sperm, lubricates the female reproductive tract for sperm, and counteracts the acidity of the vagina so that the sperm retain their viability longer after being deposited in the female.
4. **Answer:** one of a pair of long ducts that convey mature sperm toward the body surface
5. **Answer:** Prostate gland produces alkaline secretions that help raise the pH of the female reproductive tract, making this passage more hospitable to sperm.

4.7 Female reproductive structures

Learning objective

At the end of this section the student will be able to:

- Identify female reproductive structures and their functions.

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Female reproductive structures			
SA	Ask students about female reproductive structures and let students brainstorm.		Discovery, Question and answer
MA	Let students read section 4.7 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the male reproductive structures.		

	<p>Students should read section 4.7 and make notes on the female reproductive structures and how it is adapted to reproduction.</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation female reproductive structures.</p>	
CA	<p>Students draw and label the parts female reproductive structure along with their functions and present to the class.</p> <ul style="list-style-type: none"> ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work 	Suggested Formative Assessment:

Feedback to Activity 4.9. Investigating

Female reproductive structures and function

Structure	Function
Cervix:	the lower end of the uterus that leads into a narrow opening in the vagina
Corpus luteum	a structure that secretes the hormones estrogen and progesterone; progesterone causes changes to occur in the lining of the uterus that prepares it to receive a fertilized egg oviduct: a tube that transports eggs from the ovary to the uterus
Follicle:	a group of epithelial cells that surround a developing egg cell
ovaries	Egg production
Oviduct	Site of fertilization

Feedback to Self-Test

1. **Answer:** by the process of oogenesis (egg production/meiosis).
2. **Answer:** When the follicle bursts and releases the ovum with its coating of cells into the funnel of the oviduct.

4.8 The Menstrual cycle

Learning objective

At the end of this section the student will be able to:

- Outline the phases of the menstrual cycle

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
The Menstrual cycle		
SA	Ask students about the menstrual cycle and let students brainstorm.	Problem solving, Question and answer
MA	<p>Let students read about the menstrual cycle and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students read about the Menstrual cycle and make notes on the three phases (i.e. flow phase, luteal phase & luteal phase).</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation female reproductive structures.</p> <p>Alternatively, students could make internet search or ask a midwife nurse (gynaecologist) in your village (school clinic) about menstrual cycle and the three phases of the cycle.</p>	
CA	<p>Students draw and label the menstrual cycle and outline and discuss the phases of menstrual cycle (e.g., safe period, ovulation period, hormonal changes, etc.).</p> <ul style="list-style-type: none"> ○ Students may answer review questions. ○ give students quick and relevant feedback ○ peer assessment and reflection on group work 	Suggested Formative Assessment:

Feedback to Activity 4.10: Concept mapping

The **menstrual cycle** is the series of changes that the female body experiences each month. These changes include producing an egg and preparing the uterus for receiving the egg. Once an egg has been released during ovulation, the part of the follicle that remains in the ovary develops into the corpus luteum. The **corpus luteum** is a structure that secretes the two female hormones estrogen and progesterone. Progesterone causes changes to occur in the lining of the uterus. These changes prepare the uterus to receive a fertilized egg. The menstrual cycle begins during puberty. It will continue for 30 to 40 years. It stops at **menopause**. At menopause, the female stops releasing eggs and the secretion of the female hormones estrogen and progesterone decreases.

Feedback to Activity 4.11: Home work

- I. flow phase,
- II. **follicular phase**
- III. luteal phase

Feedback to Self-Test

1. **Answer:** see Activity 4.11
2. **Answer:** The endometrium is shed during menstrual flow
3. **Answer:** Estrogen and progesterone; progesterone causes changes to occur in the lining of the uterus that prepare it to receive a fertilized egg.

4.9 Fertilization and pregnancy

Learning objective

At the end of this section the student will be able to:

- define fertilization and pregnancy

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Fertilization and pregnancy			
SA	Ask students about fertilization, pregnancy, and let students brainstorm.		Brainstorming, Question and answer; Cooperative learning
MA	<p>Let students read about Fertilization and pregnancy and make notes on and, checking how accurate their ideas were in the brainstorming exercise.</p> <p>Students read about fertilization make notes on the major process. Dived students into groups let them discuss about major physiological, psychological, emotional changes that occur during pregnancy.</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation fertilization and pregnancy</p>		
CA	<p>Discuss with students about Fertilization and pregnancy.</p> <p>Ask students what happen during fertilization.</p> <p>Ask students about major physiological, psychological, emotional changes that occur during pregnancy.</p> <ul style="list-style-type: none"> ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work ○ give quiz/test 		

Feedback to Activity 4.12: Jigsaw groups

- The sperm then enters the cytoplasm of the ovum and the male nucleus of the sperm fuses with the female nucleus. This is the moment of fertilization. The released ovum is thought to survive for about 24 hours; the sperm might be able to fertilize an ovum for about 2 or 3 days. So there is only a short period of about 4 days each month when fertilization might occur. If this fertile period can be estimated accurately, it can be used either to achieve or to avoid fertilization (conception).
- The fertilized ovum (zygote) first divides into two cells. Each of these divides again, so producing four cells. The cells continue to divide in this way to produce a solid ball of cells, an early stage in the development of the embryo. This early embryo travels down the oviduct to the uterus. Here it sinks into the lining of the uterus, a process called **implantation**. The embryo continues to grow and produces new cells that form tissues and organs. After 8 weeks, when all the organs are formed, the embryo is called a **foetus**.

4.10 Methods of birth Control

Learning objective

At the end of this section, the student will be able to:

- discuss the methods of prevention of pregnancy
- discuss the advantages and disadvantages of different birth control methods.

A = start Activity MA= Main activity CA = concluding activity		Active leering methods
Methods of birth control		
SA	Ask students about methods of birth control and let students brainstorm	
MA	<p>Let students read about methods of birth control and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan a poster presentation on the advantages and disadvantage the various methods of birth control in female's ad males.</p> <p>Dived students into two groups let the first group work on birth control methods in males and the second group work on females.</p> <p>Provide books, access to computers, and any other resources for students to help them produce their oral presentation methods of birth control.</p> <p>Alternatively, students could make internet search or ask a midwife nurse (gynecologist) in your village (school clinic) about methods of birth control methods in males and in females</p>	Gapped/enhanced lecture, Group Discussion, Cooperative learning
CA	<p>Students draw and label the various methods of birth control methods in males and in females.</p> <ul style="list-style-type: none"> ○ monitoring group discussion and cooperative learning ○ give students quick and relevant feed back ○ peer assessment and reflection on group paired work ○ give class work 	Suggested Formative Assessment:

Feedback to Activity 4.13: Collaborative learning groups

No.	Birth control method	advantage	disadvantage
1	Abstinence	<ul style="list-style-type: none"> ▪ Sperm cannot come into contact with an egg and fertilization cannot happen. 	<ul style="list-style-type: none"> ▪ no
2	Monitoring body temperature	<ul style="list-style-type: none"> ▪ Reduce the side effect some contraceptive methods 	<ul style="list-style-type: none"> ▪ no simple, reliable way to recognize ovulation ▪ not very reliable
3	Cervical mucus	<ul style="list-style-type: none"> ▪ Could e combined with other methods -‘calendar’, ‘temperature’ 	<ul style="list-style-type: none"> ▪ Not 100% effective
4	Sheath or condom	<ul style="list-style-type: none"> ▪ Traps the sperm and prevents them from reaching the uterus. ▪ Prevents the transmission of sexually transmitted infections (STIs). 	<ul style="list-style-type: none"> ▪ Not 100% effective
5	Diaphragm	<ul style="list-style-type: none"> ▪ covers the cervix and stops sperm entering the uterus 	<ul style="list-style-type: none"> ▪ Does not prevent the risk of transmission of STIs (Fig. 4.17).
6	Femidom	<ul style="list-style-type: none"> ▪ semen is trapped inside the femidom ▪ reduces the risk of infection by STIs 	<ul style="list-style-type: none"> ▪
7	Spermicides	<ul style="list-style-type: none"> ▪ conjunction with condoms or diaphragms, they are effective. 	<ul style="list-style-type: none"> ▪ spermicides are not very reliable
8	Intra-uterine device (IUD)	<ul style="list-style-type: none"> ▪ prevents implantation of a fertilized ovum 	<ul style="list-style-type: none"> ▪ a small risk of developing uterine infections, and it does not protect against STIs.
9.	intra-uterine system (IUS)	<ul style="list-style-type: none"> ▪ prevents ovulation 	<ul style="list-style-type: none"> ▪ IUS does not protect against STIs.
10.	Contraceptive pill	<ul style="list-style-type: none"> ▪ suppress ovulation and so prevent conception 	<ul style="list-style-type: none"> ▪ Long-term use of some types may increase the risk of cancer of the breast and cervix. ▪ The pill does not protect against STIs.

Feedback to Self-Test

1. **Answer:** Does not prevent the risk of transmission of STIs
2. **Answer:** The operation cannot usually be reversed.
3. **Answer:** Avoid the chance of unwanted pregnancy & to make the chance contracting sensually transmitted infections low

4.11 Sexually transmitted infectious: transmission and prevention

Learning objective

At the end of this section the student will be able to:

- describe the types, modes of transmission and preventive mechanisms of sexually transmitted **infection**

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Sexually transmitted infectious: transmission and prevention			
SA	Ask students about sexually transmitted infectious: transmission and prevention and let students brainstorm.		Brainstorming, Question and answer
MA	<p>Let students read about sexually transmitted infectious (e.g., AIDS: Acquired Immune Deficiency Syndrome): transmission and prevention and make notes on and, checking how accurate their ideas were in the brainstorming exercise.</p> <p>Students plan a poster presentation on sexually transmitted infectious (e.g., AIDS: Acquired Immune Deficiency Syndrome): transmission and prevention.</p> <p>Dived students into two groups let the first group work on transmission of AIDS: Acquired Immune Deficiency Syndrome and the second group work on prevention of AIDS: Acquired Immune Deficiency Syndrome. Provide books, access to computers, and any other resources for students to help them produce their oral presentation methods of birth control.</p> <p>Alternatively, students could make internet search or ask a clinical nurse (gynecologist) in your village (school clinic) about cause, transmission and prevention of transmission syphilis and gonorrhoea</p>		
CA	<p>Ask students about cause, transmission and prevention of AIDS: Acquired Immune Deficiency Syndrome.</p> <ul style="list-style-type: none"> give students quick and relevant feedback give quiz/test 		

Feedback to Activity 4.15: Inquiry and research projects

- AIDS, syphilis and gonorrhoea
- Abstinence sexual intercourse
- use condom during sexual intercourse

Feedback to Activity 4.16: Peer conferencing

- HIV is transmitted by direct infection of the blood. Drug users who share needles contaminated with infected blood run a high risk of the disease. It can also be transmitted sexually, both between men and women and, especially, between homosexual men. Prostitutes,

who have many sexual partners, are at risk of being infected if they have sex without using condoms and are, therefore, a potential source of HIV to others.

- When AIDS first appeared, there were no effective drugs. Today, there is a range of drugs that can be given separately or as a ‘cocktail’, which slow the progress of the disease. Research to find a vaccine and more effective drugs is ongoing.

Feedback to Self-Test

Answer to Question 1: See feedback to activity 4.15.

Feedback to Review questions

Part One (Matching Items): Match items under column A with the appropriate item under column B.

1. E	2. F	3. H	4. L	5. K	6. J
7. B	8. C	9. I	10. A	11. G	12. D

Part Two (Multiple Choice): Choose the correct answer among the given alternative

1. A	2. C	3. B	4. D
5. B	6. C	7. A	8. B

Part Three: Critical thinking question

1. **Answer:** The sperm then enters the cytoplasm of the ovum and the male nucleus of the sperm fuses with the female nucleus.
2. **Answer:** Sperms are smaller in size compared to the egg, as the egg contains reserved food for the developing embryo.
3. **Answer:** A follicle is a group of epithelial cells. These epithelial cells surround a developing egg cell. FSH also causes a hormone called estrogen to be released from the ovary. Estrogen is a steroid hormone responsible for the secondary sex characteristics of females. These characteristics include the growth and maintenance of female sex organs. As in males, secondary sex characteristics include an increase in growth rates of the long bones of the arms and legs. In females, however, and unlike males, the hips broaden, and more fat is deposited in the breasts, buttocks, and thighs. The menstrual cycle begins.
4. **Answer:** Yes
5. **Answer**

- i. **Fission:** In **binary fission** the body of the unicellular parent divides by mitosis into two approximately equal parts, each of which grows into an individual similar to the parent. Alternatively, the nucleus of the organisms divide repeatedly and each daughter nucleus breaks away together with a small portion of the cytoplasm, resulting in the production of **many daughter cells**.
 - ii. **Fragmentation:** Fragmentation is one of the most common modes of asexual reproduction involving the breakdown of a parent organism into parts that develop into whole organism
 - iii. **Parthenogenesis:** a form of asexual reproduction in which an unfertilized egg develops into an adult organism.
 - iv. **Budding:** During the process a bulge forms on the side of the cell, the nucleus divides mitotically, and the bud ultimately detaches itself from the mother cell.
 - v. **Vegetative propagation:** Is a method of asexual reproduction in plants where structures with lateral meristems such as roots, stems, buds, and leaves give rise to new self-supporting individual. The following are types of vegetative reproduction.
6. **Answer:** Once an egg has been released during ovulation, the part of the follicle that remains in the ovary develops into the corpus luteum. The **corpus luteum** is a structure that secretes the two female hormones estrogen and progesterone. Progesterone causes changes to occur in the lining of the uterus. These changes prepare the uterus to receive a fertilized egg.
 7. FSH stimulates maturation of an ovarian follicle. The interval of follicle maturation before ovulation is the follicular phase of the cycle. During this time, cells around the egg secrete estrogens that stimulate the endometrium to thicken. The rise in estrogens encourages the pituitary to release more LH. The flow of LH causes the follicle to swell and burst. LH trigger for ovulation. The luteal phase of the cycle begins after ovulation. LH stimulates formation of the corpus luteum, which secretes some estrogens and a lot of progesterone. These hormones cause the uterine lining to thicken and encourage blood vessels to grow through it. The uterus is now ready for pregnancy.
 8. **Testosterone:** main hormone produced by testes; required for sperm production and development of male secondary sexual traits.
 9. The hormones cause the uterine lining to thicken and encourage blood vessels to grow through it. The uterus is now ready for pregnancy.

10. Answer

	STIs	Cause	Treatment
i.	Chlamydial infection	Bacteria	Antibiotics
ii.	AIDS	Virus	ART/vaccine
iii.	Syphilis	Bacteria	Antibiotics
iv.	Gonorrhoea	Bacteria	Antibiotics
v.	Trichomoniasis	Protozoa	Antibiotics

11. Answer:

- Vasectomy:** This is a simple and safe surgical operation in which the man's sperm ducts are cut and the ends sealed. This means that his semen contains the secretions of the prostate gland and seminal vesicle but no sperm so cannot fertilize an ovum. Sexual desire, erection, copulation and ejaculation are quite unaffected. The testis continues to produce sperm and testosterone. The sperm are removed by white cells as fast as they form. The testosterone ensures that there is no loss of masculinity. The sperm ducts can be rejoined by surgery but this is not always successful.
- Diaphragm:** A thin rubber disc, placed in the vagina before intercourse, covers the cervix and stops sperm entering the uterus. Condoms and diaphragms, used in conjunction with chemicals that immobilize sperm, are about 95% effective. However, a diaphragm does not prevent the risk of transmission of STIs (Fig. 4.16). There are no side effects, offers some protection against cervical cancer. It must be initially fitted by a doctor. May be incorrectly positioned or damaged and allow sperm past. Gives better protection against pregnancy when combined with spermicide. There is a chance of 2.5 pregnancies per 100 woman years.
- contraceptive pill:** The pill contains chemicals, which have the same effect on the body as the hormones oestrogen and progesterone. When mixed in suitable proportions these hormones suppress ovulation and so prevent conception. The pills need to be taken each day for the 21 days between menstrual periods. There are many varieties of contraceptive pill in which the relative proportions of oestrogen- and progesterone-like chemicals vary. They are 99% effective, but long-term use of some types may increase the risk of cancer of the breast and cervix. The pill does not protect against STIs.
- Spermicides:** Spermicides are chemicals which, though harmless to the tissues, can kill or immobilize sperm. The spermicide, in the form of a cream, gel or foam, is placed in the vagina. On their own, spermicides are not very reliable but, in conjunction with condoms or diaphragms, they are effective.

e. Laparotomy: A woman may be sterilized by an operation in which her oviducts are tied, blocked or cut. The ovaries are unaffected. Sexual desire and menstruation continue as before, but sperm can no longer reach the ova. Ova are released, but break down in the upper part of the oviduct. The operation cannot usually be reversed. Both vasectomy and laparotomy are almost 100% guaranteed to prevent pregnancy and permanent control of fertility. Remove the problem of human error in contraception. For women in particular it involves a general anesthetic. Not easily reversible. There a chance of 0.05 pregnancies per 100 woman years.

12. Answer:

Male Reproductive System		Female Reproductive System	
Structure	Role	Structure	Role
semen	the combination of sperm and the fluids produced in glands to either protect the sperm or move them through and out of the male body	oviduct	the tube down which the ova pass when released from the ovary
seminal vesicle	a gland located at the base of the urinary bladder that secretes a fructose rich the top portion of the urethra; secretes an alkaline fluid that helps the sperm move	follicle	a group of epithelial cells that surround a developing egg cell
prostate gland	a doughnut-shaped gland that lies below the urinary bladder and surrounds	cervix	the lower end of the uterus that leads into a narrow opening in the vagina
epididymis	a single, coiled tube in which sperm finish their maturation process fluid into the vas deferens	corpus luteum	a structure that secretes the hormones estrogen and progesterone; progesterone causes changes to occur in the lining of the uterus that prepares it to receive a fertilized egg
scrotum,	a sac that contains the testes; suspended directly behind the base of the penis	vagina	muscular tube that receives erect penis during sexual intercourse
vas deferens	a duct that carries sperm from the epididymis toward the ducts that will force the sperm out of the body; sperm can stay in the vas deferens for two or three months		
Bulbourethral gland	secrete a clear, sticky alkaline fluid		

13. Answer:

STIs	Cause
Chlamydial infection	Bacteria
AIDS	Virus
Syphilis	Bacteria
Gonorrhoea	Bacteria
Trichomoniasis	Protozoa

Unit 5: Human health, Nutrition, and Disease

Competencies	Contents	Learning Strategies	Assessment
1. Define nutrition 2. List the types of nutrients 3. Describe the role of a balanced diet especially for children, nursing mothers, athletes, and people with HIV/AIDS 4. Describe with examples the sources and deficiency diseases of nutrients. 5. Define malnutrition 6. Discuss the feeding habits that may lead to obesity and stunting 7. Examine the effects of smoking, alcohol use, chewing khat, cannabis, and other drug use, on the health, social, economic, cultural, and psychological wellbeing 8. Explain the modes of transmission and prevention of infectious diseases 9. Explain the causes and prevention methods of non-infectious diseases 10. List and appreciate renowned nutritionists in Ethiopia	5.1 What is food? 5.2 Nutrition 5.3 Nutrients 5.4 Balanced diet 5.5 Deficiency diseases 5.6 Malnutrition 5.7 Substance abuse 5.8 Types of diseases 5.8.1. Infectious diseases 5.8.2. Non-infectious diseases 5. Renowned Nutritionists in Ethiopia	1. Let the students tell what they know about nutrition and nutrients and explore the importance of a balanced diet for a healthy lifestyle 2. Let the students list down all types of nutrients necessary for human beings 3. Let the students explore if there are symptoms of deficiency diseases among children, nursing mothers, athletes, and people with HIV/AIDS in their locality and scaffold their learning by making library search for evidence at the regional and national level. 4. speculate if there is any manifestation of consequences of lack of vitamins and minerals, explore the role and sources of vitamins and minerals 5. Let students reflect on what malnutrition is, its effect and occurrence in their locality. Bring literature from a trusted source that indicates the magnitude of the problem at the national level [and other neighbour countries] and let them relate with the local discussion. 6. Let the students explore the causes and consequences of obesity in group of 4-5 students 7. Make groups of students and assign one drug for each group (smoking, alcohol use, chewing khat, cannabis, and other drug use) so that each group looks for literature, discuss and present their effect on health, social, economic, cultural, and psychological wellbeing. Announce the students not to take food supplements without the prescription of a physician. 8. Sit down into groups, list down the diseases they know, classify with their criteria into two groups, and name the groups. Furthermore, they explore the modes of transmission and prevention of each disease. Finally, the teacher will introduce the	1. DA: Competencies 1 & 2 E: Verbal/ written AI: Reflection, observation, written test 2. DA: Competencies 3 & 4 E: Verbal. AI: Observation of their speculation and participation in the classroom 3. DA: Competencies 5,6, and 7 E: verbal/ written AI: Observation of reflection and discussion as they relate malnutrition with effects and magnitude in their locality and at the national level. Written evidence of planning and reporting results/ advice from professionals 4. DA: Competency 7 E: verbal/ written AI: observation of their discussion, searching the literature, and presentation of their findings-group report. 5. DA: Competency 8,9,10 E: verbal/ written AI: actual observation of discussion and written documentation

		<p>concept of infectious and non-infectious diseases with examples, their modes of transmission, and prevention.</p> <p>9. Together with the teacher, students will read the works of a renowned Ethiopian nutritionist and associate the works with what they have learned in this unit.</p>	<p>of the classification and naming task etc.</p>
--	--	---	---

Learning Outcomes: At the end of this unit, a student will be able to:

- define nutrition
- mention the types of nutrients
- describe the role of a balanced diet especially for children, nursing mothers, athletes, and people with HIV/AIDS.
- describe with examples the sources and deficiency diseases of vitamins and minerals.
- define malnutrition
- discuss the feeding habits that may lead to obesity
- examine the effects of smoking, alcohol use, chewing khat, cannabis, and other drug use on the health, social, economic, cultural, and psychological wellbeing.
- explain the modes of transmission and prevention of infectious and non-infectious diseases
- list and appreciate renowned nutritionists in Ethiopia

5.1 What is food

This section should take Approximately 1 period of teaching time.

Learning objectives

By the end of this section students should be able to:

- Explain about food

Teaching note

The section explain about food. Food is any beneficial substance that is eaten, drunk, or otherwise taken into the body to sustain life, provide energy, promote growth, etc. It is consumed to provide nutritional support for an organism. Food is usually of plant, animal, or fungal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals.

In this section should understand the difference between food, nutrition and nutrients

SA = starter activity MA = main activity CA = concluding activity		Active learning
Nutrition		Discussion Group work Individual assignment Think pair share Self test Practical activity
SA	Asking brainstorm questions about the meaning of examples of food	
MA	Students read and write a short note about the the function of food Let them to differentiate food, nutrition and nutrients	
CA	Students read the key notes	

5.2 Nutrition

This section should take Approximately 1 period of teaching time.

Learning objectives

By the end of this section students should be able to:

- explain about nutrition

Teaching Notes

This section introduces the meaning of nutrition. Here you will be explaining the meaning of nutrition. Nutrition is the process of taking in food and converting it into energy and other vital nutrients required for life.

In this section, you will also explain why food is needed for the body; explain that food that we eat keeps us alive and it provides the nourishment for growth, repairs our body cells and gives energy.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Nutrition		Discussion Group work Individual assignment Think pair share Self test Practical activity
SA	Asking brainstorm questions about the meaning of nutrition	
MA	Students read and write a short note about the meaning of nutrition Let them to differentiate nutrition from nutrients	
CA	Students read the key notes	

5.3 Nutrients

This section should take Approximately 3 periods of teaching time.

Learning objectives

By the end of this section the students should be able to:

- list important nutrients
- explain about the importance nutrients

Teaching notes

This section explains the meaning of nutrients. You should help your students to differentiate nutrition from nutrient. Students can learn about the important nutrients found in our diet. You can ask them to identify each nutrient and its function. Then, you will tell your students to compare the macronutrients and micronutrients. Students can also compare the amount of energy from different nutrient groups. They can realize the nutrients each food gives. The important nutrients are: Carbohydrates, protein, Lipids (Fats and oil), Vitamins, Minerals, water and Fiber.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Carbohydrate and fats		
S A	Students are asked a brainstorming questions to list foods which are the source of carbohydrate and fats /oils	Discussion Group work
MA	Students read their textbook about the functions of carbohydrate and fats /oils food ; here, they can compare the energy obtained from carbohydrate and fats/oils. Students should read the notes in attention box in order to understand the energy amount obtained from these nutrients.	Individual assignment Think pair share Self test
C A	Students take a summary note and list food reach in carbohydrate and fats/ oils . They should state the compounds found in this nutrients. Students see the difference between fats and oils.	Practical activity
Proteins		
S A	Asking brainstorm questions about the function of protein and list protein reach foods.	Discussion Group work
M A	Students read their textbook and write short note about the function of protein food . Students see what compound makes protein different from carbohydrates and fats.	Individual assignment Think pair share Self test
C A	Students write short summary notes and do the activity in their text.	Practical activity

Vitamins and Minerals		
SA	Students revise the previously learned nutrients and they should identify what other nutrients needed by the body in addition carbohydrate, lipids and protein.	Discussion Group work Individual assignment
MA	Students read and write the important points about micro-nutrients which are important to prevent our body from deficiency diseases. Students should understand about vitamins and minerals /their function. In addition they should know about important function of fiber.	Think pair share Self test Practical activity
CA	Students read the notes and complete the activity questions.	Discussion Group work Individual assignment
Water and fiber		
SA	Let students discuss the function of water and let them give the answer orally to their classmates.	Think pair share Self test Practical activity
MA	Students should read and take a short note about the functions of water for the transportation of substances in human body; they should understand the function of fiber for the protection of constipation.	
CA	Students revise the important points by taking short note from the key words.	

Nutrients

Here you should explain the important nutrients and the students should understand what makes nutrients different from nutrition.

Carbohydrates and lipids

Here, you can explain the important functions of carbohydrates and fats/ oils. You may help the students to compare and contrast the two nutrients.

Types of carbohydrates: The simplest carbohydrate is simple sugar or monosaccharide which include glucose, fructose and galactose. Disaccredits like lactose, sucrose and maltose. The polysaccharides like starch.

Here there is laboratory activity on testing food, help the student to test carbohydrates, proteins and lipids.

Protein

Here you can explain the functions of protein for growth and replacement of dam- aged cells of human body. Students should identify the important differences be- tween protein and other energy diets.

Water and fiber

Here you can explain about the function of water in the transportation of material and as a solvent for the substances found in human body.

Students should understand about fiber/ roughage which is important to absorb water in colon in order to prevent constipation.

Feedback to Activity 5.1

Let the students form a group with the students at their behind seat. Help them to discuss in groups and write short note of their discussion.

The difference between organic and inorganic compounds

Answer: Organic compound is a chemical compound containing the element carbon or organic compounds are composed mostly of carbon, hydrogen, oxygen, and nitrogen atoms bonded together. Inorganic compounds: are substances found mostly in ion form e.g. minerals.

The difference between nutrition and nutrients is:

Nutrition is the process of taking in food and converting it into energy and other vital nutrients required for life.

Nutrients are chemical substances found in food and are used by the human body for growth or to provide energy.

They can give any point about functions of food such as: growth, energy, replacement of damaged tissues, disease protection etc.

Feedback to Activity 5.2

Food belonging to fructose, sucrose, starch etc. Fructose Sometimes called “fruit sugar,” fructose is a naturally occurring sugar found primarily in fruits, **Sucrose** or table **sugar** is found naturally in **sugar** cane and **sugar** beet

Starch. Potato, bread, Cereal foods, pasta, rice etc

In which group of carbohydrate that honey and table sugar is belonged?

A mixture of sugars and other carbohydrates, honey is mainly **fructose** and glucose, with remaining sugars including maltose, sucrose, and other complex carbohydrates.

Feedback to Activity 5.3

Let the students be in pair and calculate the amount of energy.

Answer: One gram of carbohydrate can provide, on average, 16 kilojoules (kJ) of energy and one gram of lipid gives 37 kJ of energy. Higher energy is obtained from fats and oils than carbohydrates.

Feedback to Activity 5.4

Let the students form a group with the students at their behind seat. Help them to discuss in groups and write short note of their discussion.

Answer: The source of vitamins can be any fruits and vegetables.

The foods which are rich in minerals are: milk, cheese etc. (for calcium), Red meat, liver, kidney, eggs, groundnuts, Tikur teff etc. (for Iron) Iodized salt, fish food etc. (for Iodine)

Feedback to Activity 5.5: Individual assignment

Use reference books or your textbook to fill the following table.

Nutrient	Sources	Use in the body	Deficiency disease
Vitamin C	Orange and lemon	build teeth and bones	Scurvy
Vitamin D	milk, butter, fish and made by skin in the presence of Sun	strengthens bones and teeth	Rickets
Vitamin A	carrot	To make pigment of the eye, help to see at night.	Night blindness
Iron	Red meat, liver, kidney, eggs, groundnuts, Tikur teff	synthesize the hemoglobin of red blood cells	Anemia
Iodine	Iodized salt, fish food	make thyroid gland to work properly	Goiter
calcium	milk, cheese	build teeth and bones	Soft bone

5.4 Balanced diet

This section should take Approximately 2 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- explain the meaning of balanced diet.
- list types of food which make a balanced diet.

Teaching Notes

In this section, students should learn about the diet which contains all of the previously studied five nutrients in the correct amount and proportion. This section gives you the opportunity to mention the cultural foods found in Ethiopia and you can explain their nutrient content.

Balanced diet depends on age, sex, activities and lifestyles. The other important thing that you should consider is the feeding habit of people which depends on where they live, their social issues, age, sex, personal activity and physiological conditions etc.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Balanced diet		
SA	Ask students brainstorming questions to list different cultural foods found in Ethiopia.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read their textbook about the meaning of balanced diet. They should list examples of cultural foods which fulfill the balanced diet proportion. Students can observe the picture of balanced diet and state them properly	
CA	Students take a note and give example of one meal which contains the balanced diet.	
Balanced diet depends on age, sex, activities and lifestyles		
SA	Students can explain if a balanced diet depends on age, sex, activities and lifestyles.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read their textbook and write short note about the feeding proportion of pregnant women, athletes, children and people whose work needs more physical activity. Students can list other social groups who need more energy from others.	
CA	Students revise the keywords; they carry out the activity by observing picture from the textbook.	

You can ask students to give examples of cultural foods in our country. You can explain balanced diet, the food which must contain enough carbohydrates and fats to meet our energy requirement, contains enough protein of the right kind to provide the essential amino acids to make new cells and produce tissues growth. Micronutrients also like minerals and vitamins

This section of the lesson gives you a great opportunity to explain to students that the feeding habit of people depends on where they live, their social issues, age, sex, personal activity and physiological conditions etc.

Feedback to Activity 5.6

Do you think that our body needs energy when we are resting, such as lying in our bed? If your answer is yes, why do we need food when we lying on our bed?

Let the students pair with their friends next to them, make them to discuss and write short note and read load to other class.

Answer: Yes, because even though, we are resting on bed, our body require energy from food for different physiological activities and biological metabolism.

E. g protein production in the cell, digestion, circulation etc.

Feedback to Activity 5.7

Let the students form a group. Then, help them to discuss and write short note of their discussion.

Compare the daily energy requirements of the people shown in the table and explain what makes the difference in their energy requirement.

A pregnant woman should require more energy for the development and growth of her baby.

Ten years old boy has a greater energy requirement because he is on physical activity (Playing ball).

The male adult in the picture requires more energy because he is involving in some work which needs physical activity.

The eight years old girl requires less energy because she is in her early stage to require more energy.

5.5 Deficiency diseases

This section should take Approximately 2 periods of teaching time.

Learning objectives

By the end of this section, students should be able to:

- explain the meaning of deficiency diseases
- list the main deficiency diseases caused by shortage of different diets
- identify different diet as a source balanced diet

Teaching Notes

Your students can explain about deficiency diseases. Here they can relate balanced diet and deficiency diseases. Here it is important to list the main deficiency diseases occur in human.

Students can understand the important functions of taking a balanced diet food for normal functioning of the body; if food taken in human body doesn't contain the important nutrients, it results in deficiency diseases.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Deficiency diseases Kwashiorkor and marasmus		
SA	Brainstorm students by asking questions about deficiency diseases.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read their textbook about the meaning of deficiency diseases by relating it to a balanced diet. They should list examples of deficiency diseases. Students can observe the picture of people with protein and energy dietary deficiency diseases.	
CA	Students take a note on some deficiency diseases like kwashiorkor and marasmus.	
Deficiency diseases caused by lack of minerals and vitamins		Active learning
SA	Students can explain about deficiency diseases caused by minerals and vitamins.	Discussion Group work Individual assignment Think pair share Self test Practical activity
MA	Students read their textbook and write short note about minerals and vitamins deficiency diseases.	
CA	Students read the key notes about deficiency diseases scurvy, rickets etc.; they carry out the activity by observing picture from the text book.	

Feedback to Activity 5.8

What is the function of vitamin D in the human body?

What is the main source of vitamin D?

Let the students be in pair with their friends next to them; then let them discuss about vitamin D, write short note and read loudly to the other class.

5.6 Malnutrition

This section should take Approximately 2 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- explain the meaning of malnutrition
- differentiate problems relating to malnutrition.
- discuss how obesity is produced
- explain about body mass index (BMI)

Teaching Notes

This section explains about malnutrition. Here you should give emphasis that mal-nutrition is not only insufficient consumption of nutrient but it is also excessive or imbalanced consumption of nutrients. Your students can identify different types of diseases which are result of malnutrition

SA = starter activity MA = main activity CA = concluding activity		Active learning	
Malnutrition			
SA	Students are asked a brainstorming questions to list foods which are the source of carbohydrate and fats /oils	Discussion Group work Individual assignment Think pair share Self test Practical activity	
MA	Students read their textbook about the functions of carbohydrate and fats/oils food ; here, they can compare the energy obtained from carbohydrate and fats/oils. Students should read the notes in attention box in order to understand the energy amount obtained from these nutrients.		
CA	Students take a summary note and list food reach in carbohydrate and fats/ oils. They should state the compounds found in this nutrients. Students see the difference between fats and oils.		
Effect of malnutrition			
SA	Students can explain about different effects of malnutrition.		
MA	Students read their text book and write short note about the effect of wasting, stunting, underweight, Micronutrient deficiencies and obesity which is like starvation, coronary disease, obesity etc.		
CA	Students revise the key words about malnutrition.		

The most common form of malnutrition is caused by under-nutrition of protein and dietary energy(Carbohydrate, lipids).

Student should explain about the causes of malnutrition like poverty, famine due to drought or flood, soil erosion, wars, too little land for too many people, ignorance of proper nutritional requirements.

Feedback to Activity 5.9

Let the students work in pair and, then let them discuss, write short note and read it to the class.

Answer: Yes it causes malnutrition because of excessive feeding. This leads to obesity.

Activity 5.10 Obesity

This activity explains how obesity is formed which is the imbalance between the energy stored and released by the body. An increase in consumption of high-energy foods without an equal increase in physical activity leads to an unhealthy increase in weight. In other way, decreased levels of physical activity can also result in an energy imbalance and leads to weight gain.

In this activity, you can make a discussion

Group work: Let the students to form a group; then, help them to discuss in groups and write short note of their discussion.

Sitting and watch TV: This may leads to obesity because there is a formation of stored energy because energy is saved as a result of sitting to watch TV.

Playing football in the field: this may not lead to obesity because playing football can result the releasing of much energy

Playing computer games: This may leads to obesity because energy is reserved as a result of less activity; therefore energy is stored and leads to obesity.

Going to school by Walking: this may not produce obesity because it release excess energy because of walking

Going to school by taxi: this may lead to obesity because energy preserved because of going to school by taxi

Eating breakfast with high fats and sugars contents: this may leads to obesity because of eating foods with high fats and sugars.

Feedback to Activity 5.11

Class work /Individual assignment

This activity is important to develop students' skill to calculate BMI.

Discuss with your friend next to you and share your idea with the other classmate. Calculate the BMI of a person who has a body mass of 80 kg and is 1.85 m tall. Is he likely to be obese?

Answer: The BMI of the person is 23.4. The person is not obese because BMI between 18.5– 24.9 is a normal weight.

5.7 Substance abuse

This section should take Approximately 5 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- describe the effects of tar and carcinogens in tobacco smoke on the gas exchange system, with reference to lung cancer and chronic obstructive pulmonary disease (COPD).
- describe the short-term effects of nicotine and carbon monoxide on the cardiovascular system.
- explain the social and psychological effects of chewing Khat.

SA = starter activity MA = main activity CA = concluding activity		Active learning
Substance abuse , Cigarette smoking		
SA	Ask students brainstorm questions and they read their textbook about the meaning of substance abuse.	Discussion Group work Individual assignment
MA	Students read about smoking cigarette, substances found in cigarette (Tar, Carbon-monoxide and nicotine), the effect of these substance.	
C	Students take a note and list the diseases caused by cigarette smoke.	
Alcohol drinks		
SA	Asking brainstorm questions about Alcohol drinks.	Self test
MA	Students mention some alcohol drinks in their community. Here, students should read the a note in the attention box to study about the action of enzymes in our body. Students should realize the role of liver in neutralization of alcohol.	Practical activity Discussion
CA	Students revise the key notes.	Group work
Heroin		
SA	Students revise the previous lesson about substance abuse.	

MA	Students read and write about the effect of heroin; they can compare the natural endorphins, a group of chemicals that are found in the brain and substances in heroin. Students should understand effects of heroin in human health, social and economic aspects.	Individual assignment Think pair share Self test Practical activity
CA	Students revise the key words and complete the activity questions.	
Cannabis		
SA	Let students discuss the effect of cannabis in human health.	
MA	Student should read and take a short note about the effect of cannabis in human health. They should state social and economic problems of cannabis.	
CA	Students revise the important point.	
Chewing Khat		
SA	Students revise the previous lesson about substance abuse.	
MA	Students should explain about the effect of Khat on human health, social and economic aspects.	
CA	Students revise the summary.	

Students should understand substance abuse which is using of legal or illegal drugs (substances) in the wrong way or in the excess amount. Students should identify some of the drugs which are medical drugs taken legally to reduce a symptom and pain of diseases. These drugs are designed to suppress pain, treat and cure diseases. In addition, students should list other legal substances which are present in many products such as:

- tea, coffee and ‘energy drinks’ (caffeine)
- tobacco(nicotine)
- alcoholic drinks (alcohol) which, although legal, can cause serious effects when taken excessively or over long periods of time.

Cigarettes smoking

Student should know the main components of cigarette or tobacco which are tar, carbon monoxide and nicotine. Tar is the black sticky substance found in cigarette that is accumulated in the lungs when the smoke cools. The health effect of tar can be chronic bronchitis, lung cancer etc.

Feedback to Activity 5.12

Let the students be in pair with their friends next to them, and then let them discuss and write short note and read loudly to other classmates. A drug is any substance taken into the body that change and affects chemical reactions in the body.

Help them to list some drugs which can from food like tea, coffee, tella, katicala etc. Recreational drugs like alcohol, tobacco, Khat , Shisha etc.

Feedback to Activity 5.13

Group work

Let the students to form a group of three and help them to discuss in groups and write short note of their discussion.

Answer: the common smokers reaction or their habits during smoking is coughing

Feedback to Activity 5.14

Let the students be in pair with their friends next to them, and then let them discuss and write short note and read loudly to other classmates.

Answer: the function of hemoglobin in red blood cell is to carry oxygen. In the case of smokers, carbon monoxide from the cigarette reacts to hemoglobin. If carbon monoxide reacts to hemoglobin; it results in no more oxygen is carried by hemoglobin.

Drinking Alcohol

Students should discuss about alcohol drinks. Alcohol is a socially acceptable drug in many countries including Ethiopia. In Ethiopia, there are different types of alcohol drinks such as Tella, Arekie(Katicala), Beer,Wine.

Feedback to Activity 5.15

Let the students be in pair with their friends next to them, and then let them discuss and write short note about some reactions like lose body balance, lose of self control.

The effects of alcohol misuse vary greatly, putting the person at risk for causing an accident or injury. This is because when a person take a larger quantities of alcohol he may lose the ability to concentrate, make good judgments and quickly react to situations.

Heroin

Students should understand heroin is a powerful depressant that slows down the nervous system. It has a chemical structure that is similar to endorphins, a group of chemicals that are found in the brain. Endorphins are made naturally in the brain and provide relief when the body experiences pain or stress.

Cannabis

Student should understand about Cannabis is the most commonly used illegal drug in the world. It

is drug from Cannabis plant. Mostly, it is the flower of cannabis plant, harvested, dried, and used as drug. Some People named this drug as weed; some call it pot; and others call it marijuana. This drug contains a stimulant or psychoactive component called Tetrahydrocannabinol (THC).

Chewing khat

Khat (*Cathaedulis*) is bushy plant whose leaves are chewed for its stimulant effect. This plant is grown in southern Arabia and Eastern Africa including Ethiopia, Somalia, and Kenya. Khat is usually supplied as a bundle of leaves and fresh shoots wrapped in banana leaves.

Feedback to Activity 5.16

Let the students to form a group of three and help them to discuss in groups and write short note of their discussion on the social, economic and behavioral problems of chewing chat.

The common reaction of a person after chewing chat is becoming energetic to do work and increased alertness and stimulation . At the end its consequence results in a depressed mood, irritability, loss of appetite, gastritis and peptic ulcer, disease and difficulty sleeping.

5.8 Infectious and noninfectious diseases (modes of transmission and prevention)

This section should take Approximately 4 periods of teaching time.

Learning objectives

By the end of this section students should be able to:

- identify infectious and non-infectious diseases,
- list the major infectious diseases,
- explain about modes of transmission and prevention of infectious diseases,
- explain about COVID-19

SA = starter activity MA = main activity CA = concluding activity		Active learning
Infectious and non-infectious diseases		Discussion Group work Individual assignment
SA	Ask students brainstorming questions. Students read their textbook about the meaning of infectious and non-infectious diseases, their transmission and control.	
MA	Student read and writes the note about infectious and non-infectious diseases, their transmission and control. They should read the note in attention box to study about epidemic, endemic and pandemic diseases.	
CA	Students take a note and list the infectious and non-infectious diseases.	

HIV-AIDS and TB		Discussion Group work Individual assignment Think pair share Self test
SA	Asking brain storm questions.	
MA	Students read and write about HIV and TB infection. They should read notes in attention box.	
CA	Students revise the notes.	
Malaria		Discussion Group work Individual assignment Think pair share Self test
SA	Students revise the previous lesson about HIV-AIDS and TB	
MA	Students read and write about malaria and its effect. They should study about vectors.	
CA	Students take a short notes and complete the activity questions.	
COVID-19		Discussion Group work assignment Think pair share Self test
SA	Let students discuss about the important emerging infection, COVID-19	
MA	Student should read and take a short note about the effect of COVID-19 in human health, social and economic problems.	
CA	Students revise the important points by reading the key notes.	

Feedback to Activity 5.17

Group work

Let the students form a group, discuss in groups and write short note of their discussion.

Infectious diseases like cholera, Pneumonia etc. Non-infectious diseases like chronic bronchitis, diabetics etc. Help them to fill the table, which can be different diseases in different area.

Feedback to Activity 5.18

Let the students be in pair, discuss and write short note of their discussion and read loudly to other classmates.

Being HIV positive means the human body carry the virus but there is no symptom of disease because the T-lymphocytes are not reduced in their amount.

Having AIDS means: When the body of human starts to produce symptom when it carries HIV and reduced in its disease resistant mechanism. This is because of reduced in the amount of T-cells. It causes acquired immunodeficiency syndrome (AIDS). AIDS is the result of opportunistic diseases like pneumonia.

Feedback to Activity 5.19

Let the students be in pair, discuss and write short note of their discussion and read loudly to other classmates.

The cause of malaria is a protozoa called plasmodium.

Here you should help your student to relate the vector (mosquito) with pathogen(plasmodium). It is important to tell them about the transmission of malaria by vector called female anopheles mosquito.

The malaria control mechanism specifically the vector control mechanism like reducing the population of mosquitoes, a voiding mosquitoes bite should be mentioned in the discussion.

Feedback to Activity 5.20

Disease	causes	method of transmission,	Control methods
Ameba	Parasitic-Protozoa (Entameba histolotica)	by eating or drinking food or water contaminated with infected feces which has the parasite	Washing hands before m using toilet Avoid under cooked food Washing raw foods like t socking them in vinger for some minutes.
Giardia	Protozoa (Giardia lambella)	By drinking contaminated water and food . The most common way is by drinking contaminated drinking water .	practice good hand hygiene water that might contaminated
Typhoid fever	bacteria Salmonella typhi	By eating salmonella, contaminated food and	Washing hands before me using toilet, Washing hand meal and after using toilet

Feedback to Activity 5.21

Let the students work in pair; then, let them discuss and write short note and read loudly to the class.

Pandemic is an epidemic that spreads far more widely throughout the whole world. It affects a huge number of people. Example, COVID-19.

Feedback to Activity 5.22

Homework / Individual assignment

Make the student to refer to a book and write a paragraph on known nutritionists in Ethiopia.

5.9 Renowned Nutritionists in Ethiopia

This section should take Approximately 1 period of teachingtime.

Learning objectives

By the end of this section students should be able to:

- List and appreciate renowned nutritionists in Ethiopia

Answer for Review Questions.

I. Choose the correct answer for the following questions.

1. C 2. B 3. C 4. C 5. D 6. D 7. D 8. D 9. A 10. A

II. Write true or false

1. False 2. True 3. False 4. True 5. True 6. False 7. True

III. Fill in the blank space with appropriate words

1. Mycobacterium tuberculosis 2. Rickets 3. Pandemic

Unit 6: Ecology (15 Periods)

Contents	Competencies	Learning Strategies	Assessment
6.1. Ecology 6.1.1. Definitions of ecology 6.1.2. Ecological levels 6.1.3. Biotic and abiotic components 6.1.4. Ecosystems (terrestrial and aquatic) 6.1.5. Biomes 6.1.6. Fauna and flora of biomes 6.1.7. Ecological succession 6.2. Ecological relationships (mutualism, predation, parasitism, competition, commensalism, amensalism, proto-cooperation)	1. Define ecological terms (Biotic, abiotic, biome, niche, trophic level) 2. Describe the ecological levels 3. Explain the biotic and abiotic components of an ecosystem 4. Explain the terrestrial and aquatic ecosystems 5. Describe the major terrestrial and aquatic biomes 6. List the fauna and flora of each biome 7. Describe ecological succession 8. Discuss ecological relationships in ecosystems	1. Reflect on what they know about ecology, ecosystem, community, habitat, niche, biotic, abiotic, population, biome as their further introduced to these topics through pictures, examples, and the school field. Students are encouraged to have meaning and define the terms in their own words as they finally led to relate these with the standard textbook definitions. 2. Being in groups of 4-5, they describe different ecological levels 3. Take the students in the school compound and let each of them record what they observe as biotic and abiotic. Each individual's description is fact-checked by other students and major disagreements are shared with another peer group, if not settled brought to whole-class discussion for validation of their criteria for classification. 4. Sit in groups, discuss and classify ecosystems 5. Let the students differentiate biomes on the basis of their geographic locations, temperature and altitudinal gradients 6. In groups of 4-5, let the students list down fauna and flora of biomes. In the end, the teacher summarizes and uses this to introduce students to the fauna and flora of biomes using visual example and pictures. Let the students discover invasive species in their localities (e.g. <i>Water hyacinth</i> , <i>Lantana camara</i> , <i>Prosopis juliflora</i> , <i>Parthenium hysterophorus</i>) 7. Search photographs showing ecological succession and then lead them to describe in their word what they saw in the photograph, helped to define the term using their own words and prior experience, and then describe what ecological succession is. 8. Let students be in groups of 4-5 and discuss on the types and effects of ecological relationships in the ecosystems and report to the class	1. DA: Competency 1 E: verbal/ written AI: observation of their reflection and journal writing of their meaning concerning ecological terms. 2. DA: Competency 2 E: verbal/written AI: Observation of their description and writing 3. DA: Competency 3 E: verbal/ written AI: observation of their learning and discussion and written evidence of their classification and presentation. 4. DA: Competency 4 and 5 E: verbal/ written AI: observation of discussion, verbal statement, and written documentation of their classification of major biome types and fauna and flora of each biome. 5. DA: Competency 6 E: verbal/ written AI: observation of their motivation and discussion and written evidence from group report 6. DA: Competency 7 E: verbal/ written AI: observation of their description of picture and wording in their definition and written documentation 7. DA: Competency 8 E: verbal/ written AI: Observation, presentation/ Written assignments and tests

Learning Outcomes: At the end of this unit, a student will be able to:

- Explain ecological term
- Differentiate between the biotic and abiotic components of an ecosystem
- Describe the major terrestrial and aquatic ecosystems and the fauna and flora of each biome
- Discuss the ecological levels
- Differentiate between terrestrial and aquatic ecosystems
- Describe what is ecological succession
- Tell ecological relationships in ecosystem

6.1 Ecology

6.1.1 Definition of ecology

Learning objectives

At the end of this section, students will be able to:

- define ecology

SA = start Activity	A= Main activity	CA = concluding activity	Active learning methods
definitions of ecology			
SA	Ask what they know when hear the word ecology? Ask them to list of some of the topics you think you will learn about as you study ecology?		Question and answer /Brain storming, Gapped/enhanced lecture.
MA	Let students read section 6.1.1 and make a note. Let them prepare a poster of ecology. Provide books, access to computers, and any other resources for students to help them produce their oral presentation ecology.		
CA	Students watch each other's presentation and make notes on ecology. Students may answer review questions. Ask students the definition of ecology. Raise oral questions on ecological terms and give feedback to students' response. Give quiz		Suggested Formative Assessment:

Feedback to self-test

1. **Answer:** Birds, fish, amphibians, reptiles, mammals, insects, etc.

2. **Answer:** Ecologists study individual organism, population, biological community, ecosystems etc. They could study at the field as well as in the laboratory.

6.1.2 Biotic and abiotic components

Learning objectives

At the end of this section, students will be able to:

- explain the biotic and abiotic components of an ecosystem
- discuss the effects of biotic and abiotic factors on the distributions of species

SA = start Activity	MA= Main activity	CA = concluding activity	Active Learning Methods
Biotic and abiotic components			
SA	Ask students about biotic and abiotic components and let students brainstorm.		Question and answer/Gapped/enhanced lecture, Group Discussion, Cooperative learning
MA	<p>Let students read section 6.1.2 and make notes on and, checking how accurate their ideas were in the brainstorming exercise.</p> <p>Students plan an oral poster presentation on the biotic and abiotic components. They can either make a single poster divided between biotic and abiotic components or two groups can work together, one making a poster on biotic components and the other on abiotic components.</p>		
CA	<p>Students watch each other's presentation and make notes on biotic and abiotic components. Students may answer review questions.</p> <ul style="list-style-type: none"> ▪ monitoring group discussion and cooperative learning ▪ give students quick and relevant feed back ▪ peer assessment and reflection on group paired work 		Suggested Formative Assessment:

Feedback to Activity 6.2: Discussion

- Abiotic: solar energy, temperature, water, inorganic nutrients, pH, oxygen dissolved etc.
- Biotic: predators, herbivores, parasite, decomposers, competing organisms

Feedback to Activity 6.3: Field observation

- Task1: arrange the necessary material for the field visit
- Task2: go to the field in your village or school compound study the various abiotic factors (e.g., temperature, water, pH, salinity, etc.)
- Task 3: For example, measure the temperature of a soil, pH, and salinity
- Task 4: take a note of the parameters
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feedback to Activity 6.4: Field observation

- Task 1: arrange the necessary material/tools for the field visit
- Task 2: go to the field in your village or school compound study various biotic factors that affect the distribution of organisms (e.g., predators, herbivores, parasite, decomposers, competing organisms etc.)
- Task 3: make observation the various types of biotic factors
- Task 4: take a note the relationships between organism (e.g., grass & cattle, insects & birds etc.).
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feedback to Self-Test

1. **Answer:** It is a limiting factor for photosynthesis
2. **Answer:** Water

6.1.3 Ecological levels

Learning objective

At the end of this section, the students will be able to:

- describe the ecological levels

SA = start Activity	MA= Main activity	CA = concluding activity	Active Learning Method
Ecological levels			
SA	Write the terms Ecological levels on the board and students brainstorm the meaning of the words.		Gapped/enhanced lecture,
MA	Let students read section 6.1.3 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral poster presentation on the Ecological levels.		Group Discussion, Cooperative learning
CA	Students watch each other's presentation and make notes on Ecological levels. <ul style="list-style-type: none">○ monitoring group discussion and cooperative learning○ give students quick and relevant feedback○ peer assessment and reflection on group paired work○ give class work		Suggested Formative Assessment:

Feedback to Activity 6.5: Jigsaw groups

- To make it easier to examine the biotic and abiotic interactions, ecologists have organized the living world into levels. The levels are the organism itself, populations, communities, and ecosystems.
- **Organism:** the individual plant or animal
- **Population:** group of organisms that belongs to the same species
- **Community:** different populations in a certain area at a certain time
- **Ecosystem:** community plus the abiotic component

Feedback to Activity 6.6: Field observation

- Task 1: arrange the necessary material/tools for the field visit
- Task 2: go to the field nearest national park or sanctuary
- Task 3: make observation and ask ecologist about **population**
- Task 4: take a note about the properties a plant/animal **population**
- Task 5: prepare a field report the properties
- Task 6: make a presentation to your classmates

Feedback to Activity 6.7: Field observation

- Task 1: arrange the necessary material/tools for the field visit
- Task 2: go to the field nearest national park or sanctuary
- Task 3: make observation and ask an ecologist about the properties of biological community
- Task 4: take a note about the properties of biological community
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feedback to self-test

1. **Answer:** They feed different food sources
2. **Answer:** Composed of the living components of the ecosystems

6.1.4 Ecosystems (Terrestrial and aquatic)

Learning objective

At the end of this section, the students will be able to:

- explain the terrestrial and aquatic ecosystems

SA = start Activity MA= Main activity CA = concluding activity		Active learning methods
Ecosystems (terrestrial and aquatic)		
SA	Ask students about Ecosystems and let students brainstorm	
MA	Let students read section 6.1.4 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral poster presentation on terrestrial and aquatic ecosystems. They can either make a single poster divided between terrestrial and aquatic ecosystems or two groups can work together, one making a poster on terrestrial ecosystems and the other on aquatic ecosystems.	Inquiring and researching/ Brainstorming Cooperative learning
CA	Students watch each other's presentation and make notes on terrestrial and aquatic ecosystems. Students may answer review questions. <ul style="list-style-type: none">○ give students quick and relevant feedback○ peer assessment and reflection on group paired work○ give quiz/test	Suggested Formative Assessment:

Feedback to Activity 6.8: Inquiring and researching

- **Ecosystem:** Is community of organisms in a habitat, plus the non-living part of the environment (e.g., air, water, soil, light, etc.). Each ecosystem has its characteristic flora (plant life) and fauna (animal life) plus climatic feature.

Feedback to Activity 6.9: Field observation

- Task1: arrange the necessary material/tools for the field visit
- Task2: go to the field nearest national park or sanctuary or lake, or forest etc
- Task 3: make observation and ask ecologist how the different components of ecosystem interact
- Task 4: take a note on how the different components of ecosystem interact.
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feedback to self-test

1. **Answer:** Home of organisms
2. **Answer:** Living(community of organisms) and non-Living (e.g., air, water, soil, light, etc)
3. **Answer:** It has the necessary components to sustain itself - the biotic and abiotic components
4. **Answer:** Rain forest, desert, savannah, lakes
5. **Answer:** The highest hierarchy of ecological level (earth).

6.1.5 Biomes

Learning objectives

At the end of this section, the student will be able to:

- define biome
- describe the major terrestrial and aquatic biomes
- mention the fauna and flora of each biome
- express love and respect to fauna and flora and their biomes

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Exploring major terrestrial biomes			
SA	Ask students about Biomes and let students brainstorm.		Reflective discussion /Discovery, Question and answer
MA	Let students read section 6.1.5 and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral poster presentation on terrestrial biomes they can either make a single poster on terrestrial biomes or groups can work together, one making a poster on major terrestrial Biomes.		
CA	Students watch each other's presentation and make notes on major terrestrial biomes. <ul style="list-style-type: none"> ○ Students may answer review questions. ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work 		Suggested Formative Assessment:

Feedback to Activity 6.10: Reflective discussion

- A **biome** is a major terrestrial or aquatic life zone, characterized by **vegetation type** in terrestrial biomes and the **physical environment** in aquatic biomes.
- The major territorial and aquatic biomes:
 - tropical forest
 - Desert biome
 - Savanna biome

Feedback to Self-test questions:

1.E	2. C	3.F	4. B
5.A	6. D	7. G	

Exploring Aquatic biomes

Learning objectives

At the end of this section, students will be able to:

- describe the major aquatic biomes
- describe the chemical and physical properties of aquatic biomes

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Biomes: Exploring Aquatic biomes			
SA	Ask students about Aquatic biome and let students brainstorm.		Problem solving, Question and answer
MA	<p>Let students read section aquatic biome and make notes on and, checking how accurate their ideas were in the brainstorming exercise.</p> <p>Students plan an oral poster presentation on aquatic biomes they can either make a single poster divided between freshwater and marine aquatic biomes or two groups can work together, one making a poster on freshwater aquatic biomes and the other on marine aquatic biomes</p>		
CA	<p>Students watch each other's presentation and make notes on freshwater and marine aquatic biomes. Students may answer review questions.</p> <ul style="list-style-type: none"> ○ Students may answer review questions. ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work 		Suggested Formative Assessment:

Feedback to Activity 6.12: Sharing observations and reflections

- Task 1: arrange the necessary material for the field visit
- Task 2: go to the field nearest lakes biome
- Task 3: make observation and ask ecologist about the physical and chemical features; plants and animals; and human impacts
- Task 4: take a note about the physical, chemical features; plants and animals, and human impacts
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feed back to self-test

1. Salinity, oxygen concentration, and nutrient content differ greatly among lakes and can vary with season.
2. Runoff from fertilized land and dumping of wastes lead to nutrient enrichment, which can produce large numbers of algae (an algal "bloom") oxygen depletion, and fish kills.
3. Are the major producers in estuaries.
4. Runoff from fertilized land and dumping of wastes lead to nutrient enrichment, which can produce large numbers of algae (an algal "bloom") oxygen depletion, and fish kills.
5. Tide, salinity, nutrients etc

6.1.6 Ecological succession

Learning objectives

At the end of this section, students will be able to:

- describe ecological succession

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Ecological succession			
SA	Ask students about Ecological succession and let students brainstorm.		Collaborative learning groups /Problem solving, Question and answer
MA	Let students read section Ecological succession (6.1.6) and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral poster presentation on aquatic succession they can either make a single poster divided between primary & secondary ecological succession or two groups can work together, one making a poster on primary ecological succession and the other on secondary ecological succession.		
CA	Students watch each other's presentation and make notes on primary & secondary ecological succession. Students may answer review questions. <ul style="list-style-type: none"> ○ Students may answer review questions. ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work 		Suggested Formative Assessment:

Feedback to Activity 6.13: Collaborative learning groups

- Disturbed area may be colonized by a variety of species, which are gradually replaced by other species, which are in turn replaced by still other species—a process called **ecological succession**. When this process begins in a virtually lifeless area, such as on a new volcanic island or on the rubble (moraine) left by a retreating glacier, it is called **primary succession**. In contrast to primary succession, **secondary succession** involves the recolonization of an area after a major disturbance has removed most but not all of the organisms in a community.

Feedback to self-test

1. Secondary succession
2. **succession**: the orderly, natural changes that take place in the communities of an ecosystem

6.2 Ecological relationships

Learning objectives

At the end of this section, students will be able to:

- discuss ecological relationships in ecosystems

SA = start Activity	MA= Main activity	CA = concluding activity	Active learning methods
Ecological relationships			
SA	Ask students about ecological relationships and let students brainstorm.		Reflective discussion /Brainstorming, Question and answer; Cooperative learning
MA	Let students read section ecological relationships (6.2) and make notes on and, checking how accurate their ideas were in the brainstorming exercise. Students plan an oral poster presentation on ecological relationships they can either make a single poster.		
CA	Students watch each other's presentation and make notes on ecological relationships. Students may answer review questions. <ul style="list-style-type: none"> ○ give students quick and relevant feedback ○ peer assessment and reflection on group paired work ○ give quiz/test 		Suggested Formative Assessment:

Feedback to Activity 6.14: Reflective discussion

- **Interspecific interactions** include competition, predation, herbivory, parasitism, mutualism, and commensalism. Interactions could have positive (+) or negative (-) effects on the survival and reproduction of individuals engaged in the interaction. For example, **predation** is a +/- interaction, with a positive effect on the survival and reproduction of members of the predator population and a negative effect on members of the prey population. **Mutualism** is a ++ interaction in which the survival and reproduction of individuals of each species is increased in the presence of the other.

Feedback to Activity 6.15: Field observation

- Task 1: arrange the necessary material for the field visit
- Task 2: go to the field nearest national park, forest
- Task 3: make observation & ask ecologist about how the various ecological interactions influence the distribution organisms
- Task 4: take a note about the competition, predation, herbivory, parasitism, mutualism, commensalism etc. Make observation for example on grass vs. cattle, insects vs. birds; plants vs. insects; gazelle vs. lion
- Task 5: prepare a field report
- Task 6: make a presentation to your classmates

Feedback to Self –test

1. D	2. B	3. A	4. C	5. E
------	------	------	------	------

Feedback to Review questions

Part I: Matching

1.D	2.B	3.A	4.E	5.C
6.F	7.J	8.H	9.G	10.I

Part II: Fill in the blanks

1. Rain forest	2. Tundra	3. Desert	4. Photic zone	5. Plankton
----------------	-----------	-----------	----------------	-------------

IV. Critical thinking questions

1. Interspecific interactions include competition, predation, herbivory, parasitism, mutualism, and commensalism. Interactions could have positive (+) or negative (-) effects on the survival and reproduction of individuals engaged in the interaction. For example, predation is a +/- interaction, with a positive effect on the survival and reproduction of members of the predator population and a negative effect on members of the prey population. Mutualism is a ++ interaction in which the survival and reproduction of individuals of each species is increased in the presence of the other.
2. Wildebeests and zebras, and predators, including lions and hyenas, are common inhabitants
3. Cattle ranching and overhunting
4. Many species are nocturnal. Water conservation is a common adaptation, with some species surviving solely on water obtained from breaking down carbohydrates in seeds.
5. Yes, west of the country