BIOLOGY

TEACHER'S GUIDE

GRADE 8

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Preface

This teacher's guide is designed to assist your efforts in organizing the units and topics for grade 8 biology more effectively and to enable uniformity of instructions in all schools. At grade 8 students are learning biology for the first time as a separate subject.

The Biology subject for grades 7 and 8 is built upon the new curriculum framework for Ethiopian schools and on the needs assessment conducted prior to revision work. The subject has also considered international content standards for a similar age and grade level of learners.

The units and topics in the teacher's guide correspond to those in the student's text. Each unit in this teacher's guide includes, unit number and title, number of periods allotted for each unit, learning objectives (a list of objectives to alert teachers to what is expected of the lesson), unit overview (a helpful guide to the unit, mentioning concepts that provide, a framework of the facts presented in the unit), topic titles with forward planning, hints for teaching, activities, and possible methods of evaluation are provided.

Biology at grade 8 is designed to be given 3 periods per week for a total of 102 periods over 34 lesson weeks. In fact, the academic calendar is made up of 40 weeks, with additional 6 weeks to help students carry out tasks those require additional assistance and even for revision and student projects. Moreover, it is aimed at offering more relaxed time for activities and this also ensures that the curriculum be covered properly in the academic year.

The number of period allotted for each unit is indicated in this guide so that teacher can distribute periods for different topics & sub topics within each unit.

Introduction

Biology is a branch of science that studies life. It allows students to develop knowledge and understanding about themselves and other living organisms in their surroundings. It allows students to appreciate the harmony, contrast, and beauty of nature around them. Biology as an experimental science it enables pupils develop their critical thinking & reasoning abilities and problem solving skills in everyday contexts.

Knowledge, practical skills and a good attitude of biology is important so that students understand the life, the diversity and unity among living things and the natural world in its complete form. Students while learning biology they will comprehend how biology is related to everyday life activities including the wise use and conservation of natural resources.

The lesson of biology at level 7, consists of important units like biology and technology, cell biology, human biology, plants, animals and the environment. The under these units are the basis for understanding of biology as a subject. The lessons show the link between biology & technology and its relevance to the society, the significance of literacy in biology to solve problems preserve natural environment, and equally develop values.

The study of biology at this grade levels, is not only studying facts, rather it helps students to integrate knowledge and develop a broad range of scientific concepts and deal with daily activities in life. In actual fact, biology is a dynamic science that encourages students learn by being actively involved in the learning process. The active learning process is materialized by giving emphasis to learner-centered classroom, making the learning process activity based and designing activities that help students develop problem solving skills. The activities should involve students in *observation*, *questioning*, *discussion*, *prediction*, *analysis*, *exploration*, *investigation*, and *experimentation*, while the knowledge and skills they acquire may be applied in designing and making tasks. Learning biology helps students develop scientific enquiry skills; and the collaborative nature of its activities enable children to acquire social and co-operative skills. Moreover, learning biology plays a key role in promoting sensitivity to, and a personal sense of responsibility for, local and wider environments.

This teacher's guide very helpful for budgeting your teaching time when you plan and approach a topic. The guide suggests the appropriate teaching-time allocated for each

lesson that intend to. The guide also contains answers to the review questions at the end of each topic.

Each section of your teacher's guide includes student-assessment guidelines and use them to evaluate your students' work. ***Minimum requirement*** *level* is not the ***standard level of achievement***. To achieve the standard level, your students must fulfill all of their grade-level's competencies successfully.

Some helpful references are listed at the end of this teacher's guide. For example, if you get an access for internet it could be a rich resource for you. Searching for new web sites is worthy of your time as you investigate your subject matter. Use one of the many search engines that exist – for example, Yahoo and Google are widely accepted.

This guide provides many ideas and guidelines, it encourages you to be innovative and creative in the ways you put them into practice in your classroom So, use your own full capacity, knowledge and insights in the same way as you encourage your students to use theirs.

The approach for developing the biology learning competencies is based on the describe it domains of **knowledge**, **skills** and **values and attitudes**. These are defined as:

Competency Area	Broad competencies
Knowledge	Constructing biological knowledge The learner will know and be able to interpret and apply biological, technological and environmental knowledge.
Skills	Biological investigation The learner will be able to use confidently scientific methods to conduct biological experiments and to investigate biological phenomena and solve problems in biological, technological and environmental context.
Values & attitudes	Biology, Society and Environment The learner will be able to demonstrate interest and appreciation on the relationships between biology, technology, society and environment.

Teaching methods

The students' textbook is designed and prepared in such a manner to actively involve the students in the teaching-learning process, during which students are actively

engaged in the process. Student-centered teaching-learning process requires encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. During this method your roles are expected to give guidance and the necessary assistance, facilitate, harmonize concepts, provide students with materials required, create a favorable atmosphere for the teaching–learning process and evaluate students' performance. You need to assist students to discover facts, realize concepts, develop skills in performing experiments, solving problems etc. So, you could not dominate the teaching–learning process by giving lecture or explaining concepts throughout the period.

You, as a biology teacher, can possibly use a number of different teaching methods to get the best for the students. Applying different methods of teaching during your biology lessons can actively involve your students to understand the subject and develop the necessary values and scientific skills.

To start a given lesson and attract the attention of your students, it is possible to use brainstorming method in order to utilize prior knowledge of your students to introduce them to a new topic, and to build on their previous knowledge. As an alternative, you may bring live specimen to the class or take them to the field in order to relate biological lessons to the reality in nature. So, some of the methodologies that can be used to promote active learning in teaching biology at this level are suggested as follows.

a. Gapped Presentation

You can divide your presentation into small sections (presentation for a period of 15 minutes) and give the students a quick activity of 5 to 10 minutes. After the activity, you proceed with another 15 minutes lecture followed by another activity. The activities usually emphasize the concepts included in the lecture. For example, you can apply this methodology to teach the information on the relevance of biology to the society.

b. Cooperative (collaborative) learning

This is a form of group work and it is helpful in group project work and group assignments. This can be applicable for students in doing their group assignments or in doing suggested project work for example, designing and executing a tree growing project.

c. Group discussion

This is a simple interaction pattern in which 4 – 6 students work together on a given task and produce a written work or presentation. This method can be used in all sections and units at this level.

Group discussion is a simple interaction pattern in which 4 – 6 students work together on a given task and produce a written work or presentation. This method can be used in all sections and units at this level.

Good class discussion needs effective leadership for yours best outcomes. Sometimes some questions or topics can be better discussed in smaller sized groups. After small group discussion, it is frequently desirable to follow up with whole – class discussion or separate reports from each discussion group so that the entire class can share the thinking of each sub-group.

Small Group Discussion –

Discussion is best concerned with clarifications, alternatives, comparisons, reasons and the application of facts and generalizations previously acquired. Usually its basic purpose is not to acquire new information. Discussion has the advantage of helping students learn to function efficiently in a group setting and how to contribute, listen, and asses arguments and counterarguments.

In the text, students are asked to form groups, discuss issues and discover points. While students discussing issues:

- give assistance, hints and guidance when students are in need.
- be part of the discussion in some groups for a few minutes and see how the discussion among students is going on.
- ask questions related to the points in the activity and facilitate the interaction among students during discussion.
- follow up how every student participates in the discussion.

d. Demonstration

This is a method where you show the students how something is done. For example, testing for the presence of starch with iodine solution.

e. Experiments

It usually involves a very specific and controlled method of procedures, where results are usually recorded. This method is applicable in performing laboratory experiments throughout unit 2 – 6 at this grade level.

Allow students to carry out experiments reading the procedures given in the text. So, you are expected to accomplish the following tasks before or when students carry out the experiment.

a. Carry out the experiment by yourself before allowing students to do it.
b. Prepare chemicals and arrange apparatus required for the experiment.
c. Inform students how to handle chemicals and apparatus during every experiment.
d. Assist them whenever they have questions or difficulties in understanding the procedures suggested for the experiment.
e. Inform to perform the experiment following procedures suggested for it.
f. Make them write a laboratory report in groups, present their observation to the rest of the class or submit it to you for correction as suggested in the students' text.
g. Make sure that every student in each group participates in the experiment.

f. Concept map

It is a visual representation of ideas on any given topic. Students write the topic at the center of the page and then divide it into subtopics from which smaller branches will go off in different directions.

g. Question and answer (inquiry)

When this method is used, you present and ask questions periodically relating to the information being given. The method can be used in order to attract the attention of the students during the beginning of a new topic and/or to draw their attention to important points in the topic under discussion. It can also be used to make sure students follow up the lesson and/or to learn whether they understand the topic in progress.

h. Visual-based active learning

This method helps students learn using real object models, pictures, drawings and charts. For example, this method can help in teaching the main features of living things. This is a very useful way for visual learners to internalize, knowledge, concepts and information. For example, this method can be applied in units 2 to 6.

i. **Project:-** short-or long-term activity. Help students to develop project writing, presentation and data analysis skills. Students develop skills in using scientific methods.

ii. **Discovery:-** Teacher guides students to discover scientific facts for themselves. Help students develop skills such as, recording, making predictions, synthesis, analysis, drawing conclusions.
Students develop qualities such as self-confidence, curiosity, interest and co-operation.

i. Brain storming

This is an activity in which students write everything they know or think about a given topic. The ideas might be right or wrong. This can be done individually, in pairs, small groups or as a whole class with the teacher or a student recording the ideas on the board. This method is used to find out what students already know on a topic before you start teaching. For example, this method can be used while teaching the importance of biology to technological development.

j. Field work

Outdoor learning activity helps students develop skills such as identification, observation, collecting, measuring, data manipulating, recording, analyzing, report writing and verbal reporting, and students appreciate the environment.

k. Case study

This is an important activity which is carried out in the study of a given natural environment or organism in order to develop analytical and problem solving skills. It is a method during which students study a given case (situation, story) through discussion, a project work or field study. During case study students explore solution for seemingly complex problems.

l. Role play

This is a method during which students take different roles from different situations, professions and organisms and act accordingly.

You can use the following websites to get more information on active-learning methodologies.

- http://www.ntlf.com/html/lib/bib/91-9dig.htm
- http:ctl.byu.edu/active-learning-techniques/
- http:pdfcast.org/pdf/strategies-to-incorporate-active-learning-into-online-teaching
- http://ijklo.org/volume5/IJELLOv5p215-232Pundak669.pdf

Additional Information to the Teacher

Continuous Assessment

Students' work should be assessed throughout every topic, section and unit as well as during each period. So, you need to have a record of every student's work as a student performance list. You can make a record about each student in the performance list, based on the following points.

- Involvement in discussions.
- Participation during presentations after discussion.
- Participation in answering questions during the process of harmonizing concepts or stabilization.
- Role of the student in performing experiments.
- Role of the student in presenting concepts gained from the experiment.
- Presentation of the project work.
- Presentation of research and writing.
- Presentation of topics given to the group as homework.
- Answering questions accordingly given as
  - class work
  - homework
  - quizzes
  - tests
  - mid – semester and semester final examinations

Here, it is very important to note that the assessment system is continuous assessment, i.e., every performance of the student during the teaching-learning process should be given value and contribute its own share, as do quizzes, tests, mid-semester and semester final examinations, to the semester total. You are empowered to decide the percent of the contribution.

Note taking for students

Taking note is an important skill that students need to develop as they practice it. In general, the note is a record of their impression of biological facts, and principles that have been given during the lesson and as written materials from the student textbook. You should remind them how to take notes either from the student textbook or during the teaching learning process.

Taking notes during lessons

This is not an attempt of writing down all the things that have been said in a lecture or lesson. This is impossible, to do, and not important.

In order students to develop their skill of taking notes effectively you assist them to be:-

- good listeners or attentive to identify the most told points during presentation and summary.
- alert to listen for signal such as 'for example', used as supporters of points to be discussed. Also 'most importantly' and 'remember' are the signals for basic concepts.
- selective in what they write
- able to recheck their notes after the lesson.
- able to re-read their notes.

Taking notes from the textbook

It is not an attempt to copy out the whole written things directly from the text. It is so boring. This asks students

- to avoid direct copying from the text.
- to be clear what is actually required. This can be done by asking the teacher to specify the point.
- to emphasize on the specific topic and target so as to reduce what is going to be written.
- to write what they understand and can explain it.
- to summarize important points.
- to re-read and check for refining.

Answers to Exercise

In all units, the answers to the suggested exercise are given at the end of each section, and so are answers to the review exercises for each unit at the end of the unit. So you can refer to them whenever you are in need.

Motivation of students and its importance

Motivation of students means getting students to stimulate a high degree of effort in their learning activities. You are expected to motivate the students to create a better atmosphere for the teaching learning process. To motivate students, you need to encourage them to get ready for the lesson, appreciate students for their attempts in answering questions or any other activity they perform during the teaching-learning process and give them recognition. Motivating students helps you to:

- pass information to students according to the plan
- make students active participants
- make students realize concepts easily
- make your teaching interesting
- achieve the desired goals, etc.

Motivation also helps students to

- follow the lesson attentively
- increase their participation
- enhance their understanding
- develop interest in the subject
- achieve good results in their performance

Implementing active learning methodologies has a role of its own in motivating teachers as well. It is not as tiresome as that of lecturing, although you may have a lot of tasks to accomplish when applying the methods. Using active learning methodologies during the teaching learning process motivates you to:

- enjoy friendly and interesting relationships with students.
- develop new teaching skills by practicing the new teaching techniques, observing their results, and contrasting them with those of the old method of lecture-based teaching.
- become more interested in the teaching profession. For example, it is interesting and satisfying to develop new skills. The teaching-learning approach guides and helps you develop professionally.
- investigate each student's talents and creativity. In this way, the teacher learns more about the age group of the students he or she teaches. This process is interesting in itself and helps the teacher develop professionally.
- guide students individually as they learn on their own. In this way, the teacher learns more about the dynamics of learning and also of teaching.
- actively engage in furthering the students' development. Because the students develop important social skills and attitudes, as well as increasing their knowledge and learning skills, the teacher has the satisfaction of contributing to their community and therefore to the country as a whole.

- ❖ expand your own creativity by developing appropriate presentations and assembling the apparatus and the local materials required for demonstrations and experiments.
- ❖ develops a greater interest in the teaching profession. As he or she assumes direct responsibility for each student's development.

Planning

The new curriculum framework for Ethiopian schools has allotted three periods per week for grades 7 and 8 biology. Even though the academic calendar is made up of 40 weeks, the syllabus is prepared for 34 weeks (102 periods) creating a wider chance for you to use about six extra weeks for tasks of helping students that need further assistance and even for revision and student projects .

In addition to getting more relaxed time for activities this also ensures that the curriculum be covered rightly with in the academic year. The distribution of periods for each unit and sub-unit of each grade level is indicated in the table at the end of this introduction. It should be noted that periods allocated for the sub-units of each unit, throughout the syllabus, are proposed leaving a room for your freedom of using them flexibly. If you finish the content before the allocated time, you could freely use the remaining periods for the succeeding content and so on.

To help you plan, organize give hints what the students and you have to do as well during each activity in the student text, ***starter***, ***main*** and ***concluding activities*** are summarized in a table form in this guide.

Lesson plan

A lesson plan is your detailed description of your instructions of lessons for one class. A daily lesson plan is developed by you as a teacher to guide class instructions. Details will vary depending on your preference, subject being covered, and the need and/or curiosity of children. There may be requirements mandated by the school system regarding the plan.

The modern way of organizing a lesson plan includes, ***starter activity***, ***main activity*** and ***concluding activity***. The ***starter activity*** sets the stage for everything to come and is made up of three elements: ***attention***, ***motivation***, and an ***overview*** of what is to be covered.

The purpose of the ***attention*** element is to focus each student's attention on the lesson. The purpose of the ***motivation*** element is to offer the students specific reasons why the lesson content is important to know, understand, apply, or perform. An ***overview*** part of an introduction tells the group what is to be covered during the period. A clear and

concise presentation of the objective and the key ideas gives the students a road map of the lesson to be covered.

The ***main activity*** is the main part of the lesson. Here, you develop the subject matter in a manner that helps the students achieve the desired learning outcomes. You must logically organize the material to show the relationships of the main points. You can usually shows these primary relationships by developing the main points in one of the following ways: from ***past to present***, ***simple to complex***, ***known to unknown***, and ***most frequently used to least frequently used***.

Concluding activity summarizes the important elements of the lesson and relates them to the objective. This review and summary of ideas reinforces student learning and improves the retention of what has been learned. New ideas should not be introduced in the conclusion because at this point they are likely to confuse the students.

Developing a lesson plan

The lesson plan format that we use in our schools contains the following elements, typically in this order:

- topic of a lesson
- ***Rationale of the topic:-*** Describes the reason why the topic is important to daily life of each student and connects to further learning and importance to society.
- ***Pre-requisite knowledge:-*** Indicate the knowledge and skills expected from the students before studying the lesson.
- ***Learning objectives:-*** Includes the outcome expected from the students after completing the lesson and are written in the form of SMART.
- ***Starter activities:-*** activities related to the beginning of the lesson, like relating the lesson at a particular day to the previous lesson, motivating students and asking students some questions.
- ***Main activities:-*** It is a part of the lesson during which students are involved in practical activities and learn by their own. Clearly, defined activities of both you and students are specified.
- ***Concluding activities:-*** Is a part of lesson during which you will summarize the lesson while involving students actively.
- ***Resource:-*** Resources those are needed to complete the lesson should be specified.
- ***Learner support:-*** Students in the class and at different level of understandings are allowed to help one another.

A sample lesson plan is given on the following page. You need to employ this sample for writing your daily lesson plans.

SAMPLE LESSON PLAN

Name of the teacher_____ **Name of school** _____

Subject: Biology **Grade and section** **Grade 8**

Date of lesson_____ **Unit of lesson Unit 4: Plants**

Subunit lesson: 4.1 Food manufacturing in green plants **Topic of lesson:** Is oxygen a byproduct of photosynthesis? Activity 4.4 (Page 84)

Rationale of the topic:

Students will be aware that oxygen (0_2), which is essential for all living things on the earth, will be produced as a byproduct of photosynthesis by green plants and be aware the importance of taking care of our plants and natures.

Pre-requisite knowledge:

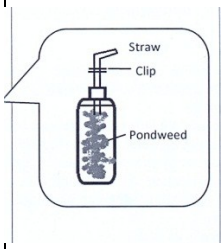
- Students have studied in previous lessons in this unit that photosynthesis is a process of production of food by green leaves using sunlight, water, carbon dioxide and chlorophyll (in chloroplasts). In this lesson, the students understand that in the process of photosynthesis, oxygen (0_2) will be produced as byproduct, which will be consumed by plants themselves as well as for the living of human beings and all other consumers (non-photosynthetic organisms)
- Students also have knowledge that flame grows further with the existence of extra 0_2 (helping burning) in chemistry.

Learning objectives:

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

- Explain that oxygen (0_2) is produced during the process of photosynthesis;
- Give a summary equation of photosynthesis (review);
- Define the photosynthesis (review).

Stage	Time	Learning contents	Teacher's activities	Students activities	Assessment Activities
Starter Activities	7 min	Reviewing points from the previous lessons;	- By relating what students learnt and what they know, drawing interests of students toward today's topic as follows: ✓ In the previous lessons, we have learned a very important process in plants. Do you remember that? ✓ Do you remember what are produced after photosynthesis ? ✓ So, what are necessary materials to produce starch and oxygen? - During the Q & A, jotting down what the students answers, to make summary equation of photosynthesis. - Emphasize that <u>with the existence of CO_2, H_2O, light and chlorophyll, both sugar and oxygen will be produced</u>; - Giving outline of the day's lesson;	- Listening attentively and answering questions; - taking short notes;	- Confirming that students can give what are produced and what are necessary during photosynthesis;
Main Activities	18 min	- To confirm that oxygen is produced during the process of photosynthesis;	**Activity 4.4: To confirm an oxygen is a by-product of photosynthesis** - Explaining necessary materials by demonstrating: o Bucket/basin o Pet bottle and rubber cup o Test tube o Pondweed o Straw o Clip o Match & incent (3 min)	- Listening to the instruction attentively - Observing the teachers' demonstration with full attention; - Taking notes;	

Main activates (continued)			- Explaining the procedure with demonstration and Q & A: 1. Blowing into water in the pet bottle with straw and pinching the straw: 2. Putting pondweed into the bottle and put it under the sunlight for a few hours; 3. Collecting the produced air in the water in a bucket. 4. Bring the fired incent into the test tube where the gas is collected. 5. Observe what happen. (5 min) - Demonstrating the above (3-5) using the one which was already exposed to the light more than a few hours (Teacher prepares it in advance); - Before demonstrating 4, asking student to predict what is happening. Letting all of them write their prediction in their own notebook. - When conducing 4, letting them pay full attention to what happens on the incent; - Confirming the result and making conclusion in entire class; (10 min)	 - Watching the teachers' demonstration with full attention; - Writing down their prediction and its reason; - Observing what is happening; - Taking notes as a summary of activity;	- Do you know why we need to blow into water? - Confirming the result and making conclusion in entire class by Q & A: ✓ What did you observe? ✓ Why did it happen? ✓ What can we conclude?

Concluding Activities	15 min	- Summary on the photosynthesis.	**Assessment Activity** - Confirming the necessary condition of photosynthesis (3 min); - Giving the prepared quiz on: o Equation of photosynthesis (related to figure 4.3) o The internal parts of leaf (related to figure 4.4) o Produced sugar (8 min) - Asking the students to check their answer in pairs; - Giving the correct answers; - Giving chance to ask any questions to students. (5 min)	- Taking notes; - Trying the given test individually; - Checking the answers with that of friends; - Confirming the answers in entire class; - Forwarding the questions.	- Confirming that students can give the necessary condition of photosynthesis; - Checking students' performance on the quize;

T & L Materials (include the materials that you will use in your lesson):

Student's text book, Teacher's guide, Syllabus;

Bucket or basin (2), Pet bottle and rubber cup (2), Test tube (1), Pondweed/Any algae plants (necessary amount), Straw (2), Clip (2), Match & incent (1)

Learner support (for slow learner, fast learner, students with disability, etc.):

- *Fast learners will be given a chance of helping slow learners. This will help them to master the topic and they will be encouraged to read more and ask questions during their extra time.*
- *Slow learners will be given special attention throughout the period (pair them fast learners, encourage to ask and answer questions, checking their homework thoroughly and help them to correct, giving them extra time after class as well).*
- *Students with disabilities will be given special attention depending up on their problems.*

Comments and signature of department head:

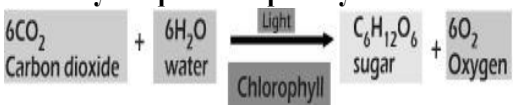
Chalkboard Plan

Date

Unit 4: plant

4.1: Food manufacture in green plants

Summary of equation of photosynthesis



Activity 4.4

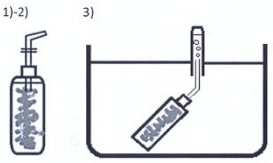
To confirm an oxygen is a byproduct of photosynthesis

Materials:

- Bucket/basin
- Pet bottle and rubber cup (with hole)
- Test tube
- Pondweed
- Straw
- Pinch
- Match and incent

Procedure:

1. Blowing into water in the pet bottle with straw and pinching the straw;
2. Putting pondweed into the bottle and put it under the sunlight for a few hours;
3. Collecting the produced air in the water in a bucket.
4. Bring the fired incent into the test tube where the gas is collected.
5. Observe what happen.



Prediction:

✓ ...

✓ ...

Result:

✓ The frame of the incent became big.

➔ There is oxygen in the test tube.

Conclusion:

✓ ...

Assessment activites:

The necessary condition of photosynthesis:

✓

✓

✓

Quiz:

1. Can you list: a. the raw materials of photosynthesis; and b. the by-products of photosynthesis?
2. In which part of the leaf does most of the process of photosynthesis takes place?
3. Is there a photosynthetic process in the upper and lower epidermis? Why so?
4. What are glucose and starch? How they are related in the process of photosynthesis?

Characteristics of a well-developed lesson plan

- A well-developed lesson plan reflects the interests and needs of students.
- It incorporates best practices for the educational field.
- The lesson plan correlates with the teacher's philosophy of education, which is what the teacher feels is the purpose of educating the students.
- The care taken when creating the objective for each day's lesson, as it will determine the activities that the students engaged in.
- The teacher also ensures that lesson plan goals are compatible with the developmental level of the students.
- The teacher ensures as well that student achievement expectations are reasonable.

Unit plans follow much the same format as a lesson plan, but cover an entire unit of work, which may span over several days or weeks.

UNIT 1 BIOLOGY AND TECHNOLOGY

Total Periods Allotted: 7 Periods

Unit Overview

This unit builds up on grade seven's unit 1 and the first sub-unit starts by explaining biology's contribution to development in various areas of activity.

The second sub unit focuses on the role of technology in biology, and list some technological products used in biology with their functions. Practical activities are the dominant feature of the unit in general and the second sub unit in particular. You are expected to arrange and plan ahead for the activities and allow smooth practical activities.

Unit outcomes

After completing this unit, students will be able to:

- *explain biology's contribution to development*
- *explain the role of technology in biology, list some technological products used in biology and tell the functions of these technological products.*

Main Contents

1.1 BIOLOGY FOR DEVELOPMENT

1.2 TECHNOLOGICAL PRODUCTS USED IN BIOLOGY

1.1 BIOLOGY FOR DEVELOPMENT

Periods allotted: 3periods

1. Competencies

After completing this sub-unit students will be able to:

- *explain how biology contributes to our country's development*
- *explain the role of technology for the progress of biology*

2. Sub-unit Overview

This sub-unit deals with the role of biology in community health, agriculture, food production and other areas in order to show the contribution of biology for development.

3. Forward Planning

- Prepare charts and enlarged diagrams showing how biology is linked to development.
- Prepare materials required for the lesson and activity requirements.

4. Suggested Learning-Teaching Approach

4.1 Teaching Aids

- Enlarged chart showing the relationship of botany with development pictures showing biological activities in health, agriculture and environment.

4.2 Suggested Teaching Methods

Discussion and brainstorming are the methods suggested to use in all lessons supplemented with question and answers.

4.3 Suggested presentation

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Role of Biology in Health care (Activity 1.1)	
SA	Students brainstorm on the importance of biological knowledge.
MA	Students identify and discuss important role of biology in community health care. Students work on activity 1.1 and discuss in class.
CA	Students conclude that biology contributes to community health and write notes.

Role of Biology in Agriculture and food production (Activity 1.2 and 1.3)	
SA	Students recap previous lesson on the role of biology
MA	Students discuss the importance of agriculture for Ethiopia and investigate the contribution of biology to agriculture. Students explain the importance of food production and discuss the role of biology. Students do activity 1.2 and Activity 1.3 and discuss on their activities.
CA	Students Summarize the main points of their discussions and utilization of natural products. (Activity 1.4 and 1.5)
Role of Biology to the Environment and natural products	
SA	Students recap previous lessons and appreciate contribution of biology.
MA	Students brainstorm ways of improving the environment and discuss the role of biology in the processes including how biology contributes in using natural products. Students conduct discussion on Activity 1.4 and Activity 1.5.
CA	Students summarize the role of biology in areas of environment and natural products.

Activities are the main methods to enhance learner centered active learning.

Additional activity to be considered

Tree planting project

Arrange an area for a tree planting project in collaboration with the school community and the nearby kebele. Try to get seedlings and technical advices from agriculture extension workers. Organize discussions on the effects of cutting trees in the environment and debate on the importance of tree planting. Then ask students to contribute to their locality by planting trees and taking care of them. Let them suggest how they go about the project and how they take care of the planted trees for their growth.

Assessment

You should conduct continuous assessment throughout each unit in the form of classroom exercises (written or oral), tests, homework/assignments, assessment of practical and field works, reports of project activities and personal inventories.

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard.
Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Answers to Exercise 1.1

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

1.2 TECHNOLOGICAL PRODUCTS USED IN BIOLOGY

Periods allotted: 4periods

1. Competencies

After completing this sub-unit, students will be able to:

- *explain the role of technology for the progress of biology*
- *list at least seven technological products used in biology*
- *tell the functions of some technological products used in biology*
- *Microscope, thermometer, binoculars, stethoscope, sphygmomanometer, incubator, refrigerator.*

2. Forward planning

Arrangement for observation sites and source of equipment required for activities.

4. Suggested presentation approaches

4.1. Teaching Aids

Microscope, thermometer, binoculars, stethoscope, sphygmomanometer, incubator, refrigerator and this accessories are required.

4.2 Teaching methods

The sub-topic can be dealt using discussion method with questions and answers to facilitate the active learning process.
Demonstration should be used to introduce instruments as a guide to practice them. Then practical activities are the major components in this sub-unit.

Visits and report writing are also suggested to wrap up the sub-unit.

4.3 Suggested presentation

This section is entirely practical. Planning, time allocation, grouping, etc. are very important. If materials for a specific activity are not available, try to replace with a similar activity using available materials, so that you can address the given objectives.

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Technological products used in Biology:- Microscope: Binoculars Activity 1.6, 1.7 and 1.8	
SA	Students reflect their previous knowledge of instruments used in biological studies, recalling from Grade 7.
MA	Students brainstorm and list technological devices and explain their use. Students identify and label instruments by name and conduct activities 1.6, 1.7 and 1.8. Students observe using microscope and binoculars.
CA	Students write the use of microscope and binoculars.
Technological products used in Biology: 2 Thermometer, Stethoscope, and sphygmomanometer (Activity 1.9 and 1.10)	
SA	Students recap the previous lesson
MA	Students discuss the use of thermometer; stethoscope, and sphygmomanometer. Students do activity 1.9 and activity 1.10. Students know how to use the instruments and describe their function.
CA	Students states the use of thermometers, stethoscope, and sphygmomanometer
Technological products used in Biology : 3 Incubator, and refrigerator, (Activity 1.11)	
SA	Students reflect the previous lesson
MA	Students discuss the use of incubators and freezers and conduct activity 1. 11
CA	Students describe the use of incubators and refrigerator.
Technological products used in Biology: 4 Balance and centrifuge (Activity 1.12 and 1. 13)	
SA	Students recap previous lesson
MA	Students discuss the use of balance and centrifuge and do activity 1.12 on measuring weight. Students do activity 1. 13 and present a report. They identify type of instruments and their functions.
CA	Students do activity 1. 13 and summarize their lessons on technological instruments used in biology.

Additional Notes- MICROSCOPES

How is it possible for something right in front of your eyes to be completely invisible? It's possible when that thing is too small to be seen with your eyes.

We can see drops of water from a pond or lake. But we cannot see the thousands of tiny

creatures that live in the water. Drops of blood contain tiny structures called cells, but we can't see them either. It is through the microscope that we can see invisible small things.

Microscopes are one of the most important tools for scientists. Medical scientists use them to see the germs that make people sick. Biologists use them to see how plants and animals are constructed. Geologists or scientists who study about the Earth, use them to find out the rocks that it is made of. Some microscopes are so powerful that they enable us to see individual atoms, the tiny building blocks of non-living things.

When Were Microscopes Invented?

Historians agreed that the compound optical microscope was invented by a Dutch eyeglass maker, Zacharias Janssen, in the late 1500s. But, most microscopes were not very good until the early 1800s. That was the time when lens makers first learned how to make lenses that produce really clear, sharp images. It was during this time period that German scientists developed the first electron microscope in the early 1930s. The first scanning probe microscope was created by Swiss and German scientists in 1981.

Microscope

Microscopes enable us look at things that are too small to see with our eyes. The one that is shown in Fig 1.6 of the text book here is the most common type of microscope, the optical microscope. Optical microscopes can magnify objects up to about 1,000 times.

'Early Microscope

English scientist Robert Hooke created the microscope in the 17th century and used it to conduct pioneering research. He discovered plant cells by looking at a thin slice of cork through the microscope.

Assessment

You should assess each student's work continuously over the whole unit and compare it with the given description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard.

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Answers to Exercise 1.2

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

Answers to Review Questions on Unit 1

Part I: Multiple Choices

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

Part II: Matching

9.	E	10.	C	11.	D	12.	B	13.	A

Part III: Fill in the blank

14. Balance
15. Thermometer
16. Professionals, the field of biology
17. Cosmetics
18. Natural Products

Part IV: Short answers

19. Areas that are generally practiced for the society and that require biological knowledge include medicine, nutrition, agriculture and environment.

20. Appropriately consuming and conserving natural resources, minimizing or replacing harmful chemicals used for agricultural and other activities by the society.

Part IV: Word Puzzle

C	E	N	T	R	I	F	U	G	E			
			H									
			E									S
			R									T
			M	I	C	R	O	S	C	O	P	E
			O									T
			M									H
	F	R	E	E	Z	E	R					O
			T									S
			E									C
			R									O
												P
												E

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UNIT 2 CELL BIOLOGY

Total Periods Allotted: 23 Periods

Unit Overview

In this unit students should be aware that a cell is the basic functional unit of living organisms and identify the nature of unicellular organisms and multicellular organisms. Every living thing from the tiniest bacterium to the largest whale is made of one or more cells. Many of the chemical reactions that keep organisms alive (metabolic functions) take place in cells. Organisms are divided, based on the number of cells from which they are formed, as unicellular and multi-cellular organisms.

In this unit you should facilitate the teaching and learning process so that students know the nature of cells in unicellular and multi-cellular organisms by using biotechnological tools. Furthermore, students will differentiate the similarities and difference between unicellular and multi-cellular cells in different kingdoms of classification.

Unit outcomes

After completing this unit, students will be able to:

- *use hand lenses and microscopes to observe unicellular organisms and name some unicellular organisms;*
- *describe the structure, habitat, locomotion, nutrition, reproduction and importance of some unicellular organisms;*
- *name different types of cells, tissues, organs, and systems and state their functions;*
- *describe organism as the highest level of organization;*
- *demonstrate scientific enquiry skills: observing, comparing and contrasting, drawing conclusions, communicating, inferring, problem solving, comparing and contrasting.*

Main Contents

2.1 LOOKING AT UNICELLULAR ORGANISMS

2.2 SINGLE CELLED ORGANISMS

2.3 LEVELS OF ORGANIZATIONS IN MULTI-CELLULAR ORGANISMS

Planning for the unit

In general the unit requires the teacher to plan so that students will be able to examine and observe the structure and nature of cell both in unicellular and multicellular organisms through a hand lens or microscope. You should facilitate the practical activities by preparing all the required materials ahead of the session and relate to the day to day life. Resources such as diagrams of different types of cells, permanent slide, lens and microscopes should be prepared and identify particular active learning techniques for each types of activity ahead of the session.

2.1 LOOKING AT UNICELLULAR ORGANISMS

Period allotted: 5

1. Competencies

At the end of this section you should be able to:

- *use hand lenses and microscopes to observe unicellular organisms;*
- *name amoeba, paramecium, euglena, bacteria and yeast as unicellular organisms.*

2. Sub-unit overview

This subunit familiarizes students how technological inventions help geological studies. The subunit introduces tools such as hand lens and microscope in studying microscopic features of a living organism. The subunit provides opportunity to explore how unicellular organisms looks like using first hand exposure to the students.

3. Forward Planning

The teacher before hand should prepare the different cell diagrams, preserved specimens and fresh samples from the environment in order to give first hand experience of the existence and structures of unicellular organisms.

In this subunit, students should be able to differentiate the traditional versus modern way of classification of unicellular organisms to which kingdom unicellular organisms belong: kingdom Protista.

4. Suggested Teaching – Learning Approaches

4.1 Teaching Aids

- Hand lens
- Compound light microscope
- Water samples from pond, river, lake, well or standing water
- Slides
- Beakers (container)
- Diagrams of unicellular organism

4.2 Suggested teaching methods

- Discussion on the similarities and differences between unicellular and multicellular organisms. Also on the classification of unicellular organisms.
- Laboratory experiments on the examinations of different water samples for the presence of unicellular organisms.

5. Presentation of the lesson

SA = Starter activity MA= Main activity CA= concluding activity	
How technology inventions help biological studies?	
SA	Students brainstorm on how technological inventions facilitate effective biological studies on Cell.
MA	Students discuss on the characteristics of unicellular organism and how is it possible to identify using a hand lens or a microscope.
CA	The teacher summarizes how technological invention helped in studying unicellular cell.
Unicellular and multicellular organisms	
SA	Recap on the previous lesson by asking questions **"Can you see unicellular organisms with your naked eyes?"**
MA	Students discuss on the characteristics difference between unicellular organisms and multicellular organisms. Students identify examples of unicellular and multicellular organisms
CA	Students summarize the difference in the characteristics of unicellular and multicellular organisms.
Define unicellular organisms	
SA	Students define what unicellular organism in their own words.

MA	Students examine and draw a number of unicellular organisms including: Amoeba, Paramecium, Euglena, Yeast, Bacteria.
CA	Students identify the difference between unicellular organisms (size, structure...)
Examining different water samples for the presence of living organisms.	
SA	Students list down the characteristics of unicellular organisms
MA	Students carry out activity 2.1 based on the procedures on the students text
CA	Students draw their microscopic observation and compare their drawing with the picture on the student text.
Classification of unicellular organisms	
SA	Students discuss on how to classify unicellular organisms.
MA	Students identify classification of unicellular organism in a different kingdom, Protista.
CA	Summary of the unit will be reviewed by the teacher and students perform exercise 2.1

Summarize the lesson using the following points:

- Definition of unicellular organisms
- Hand lenses and microscopes
- Classification of unicellular organisms
- Naming the different types of unicellular organisms

Assessment

You should conduct continuous assessment throughout each unit in the form of classroom exercises (written or oral), tests, homework/assignments, assessment of practical and field works, reports of project activities and personal inventories.

Answers to Exercise 2.1

1. Because they are made up of one cell.
2. They are similar because they all are unicellular and they are different in their shape structure movement feeding and way of reproduction.
3. Paramecium, Euglena, Yeast, Bacteria, Amoeba.

2.2 SINGLE CELLED ORGANISMS

Periods allotted: 12 Periods

1. Competencies

After completing this sub-unit students will be able to:

- *describe the structure, habitat, locomotion, nutrition, reproduction, and importance of amoeba, paramecium, euglena, bacteria and yeast.*

2. Sub-unit overview

This sub-unit familiarizes students with some unicellular organisms with regard to their cellular structures, the way of their feeding, movement, reproduction, their habitat and importance. This lesson enables students to observe these unicellular organisms through a microscope, by which they develop the skill of using a microscope and conducting an experiment. It also helps them to draw and label what they see under a microscope.

3. Forward planning

Planning ahead of time helps to arrange materials in conducting experiments.

4. Suggested teaching-learning approach

4.1 Suggested teaching aids

Prepared slides, samples of water from ditches or rivers or lakes and diagrams or pictures of different single celled organisms.

4.2 Suggested teaching methods

- Students brainstorm on some microscopic organisms such as bacteria, amoeba, euglena, paramecium, and yeast.
- Discussion on the characteristic and reproduction of amoeba, paramecium, euglena, bacteria and yeast.
- Laboratory experiment to observe the locomotion and reproduction of the unicellular organism.

4.3 Presentation of the lesson

Begin the lesson by reminding students of the previous lesson (sub-unit 2.1) that dealt with looking at unicellular organisms.

SA = Starter activity MA= Main activity CA= concluding activity	
What does Amoeba look-like?	
SA	Students brainstorm on the characteristics of unicellular organisms and mentions few examples for unicellular organisms.
MA	Students discuss on the characteristics of amoeba (structure, habitat, nutrition, reproduction, locomotion, importance). Students draw the picture of amoeba from the text and identify its structures with functions.
CA	Students make notes on the structure, habitat, nutrition, reproduction, locomotion, importance of ameba.
Examining unicellular organisms : Amoeba	
SA	Students prepare all the tools to examine unicellular organisms, Amoeba cell.
MA	Students carry out activity 2.2, examining different water samples for the presence of living organisms. Students identify the structure of amoeba among other unicellular organisms and be able to draw and label the parts of amoeba including Nucleus, Cytoplasm, Contractile vacuoles, Food granules and compare with the given drawing on the student text.
CA	Students recap the structure and movement of amoeba.
Types of Reproduction in Amoeba Cell	
SA	Students analyze how reproduction looks like in amoeba cell.
MA	Students discuss the sexual and asexual types of reproduction which follows under favorable and unfavorable conditions respectively. Students analyze the sequence of events pictures of binary fission and sporulation based on Fig 2.5 and 2.6
CA	Students brief the asexual and sexual reproduction of amoeba.
What does a Cell of Paramecium look-like?	
SA	Students look into the picture of Paramecium cell and compare it with the structure of amoeba. What does its structure looks like?
MA	Students repeat activity 2.2 to look for Paramecium using a fresh water samples. Students identify the characteristics of Paramecium, such as, structure, feeding, movement, reproduction using microscopic observation. Students draw and label the parts of paramecium including: Nucleus, Cytoplasm, Contractile vacuoles, Oral groove
CA	Students make notes on the structure, habitat, nutrition, reproduction, locomotion, importance of paramecium.

Types of Reproduction in Paramecium Cell	
SA	Students recap how reproduction looks like in an amoeba cell.
MA	Students compare the similarity and difference between the reproduction pattern of paramecium and amoeba cell. Students carry out activity 2.3; draw the sequences of events that occur in both asexual and sexual reproduction. Asexual reproduction – binary fission and Sexually reproduction – conjugation. Students analyze the reproduction process by using figure 2.8, reproduction in paramecia.
CA	Students summarize the type asexual and sexual reproduction of paramecium.
What does a Cell of euglena look-like?	
SA	Students look in to the picture of Euglena and compare it with the structure of amoeba and paramecium. What does Euglena looks like?
MA	Students discuss on the characteristics of euglena (structure, habitat, nutrition, reproduction, locomotion, importance) and compare it with other unicellular organisms. Students discuss the unique characteristics of euglena; having a chloroplast and produces its own food by photosynthesis. Students carry out activity 2.4; examining the movement of euglena under the microscope. Students observe the movement of euglena by the whipping of the flagellum with the aid of a microscope and draw the picture to compare with the picture shown on the student text.
CA	Students make notes on the structure, habitat, nutrition, reproduction, locomotion, importance euglena.
Reproduction in euglena Cell	
SA	Students recap how reproduction looks like in amoeba and paramecium cell.
MA	Students discuss the way euglena reproduces (only asexual – binary fission). Students compare the different types of reproduction among the different types of unicellular organisms.
CA	Students recap the asexual reproduction of euglena.
What are Bacteria?	
SA	Students discuss the characteristic of bacterial cell and compare with other unicellular organisms.
MA	Students discuss on the characteristics of Bacteria (structure, habitat, nutrition, reproduction, locomotion, importance). Students carry out activity 2.5 to examine the different characteristics such as structure, feeding, movement, reproduction by refereeing books from library. Students could research the different bacterial forms: Cocci, Bacilli, Vibrios, Spirilla. Students present their findings to the class and discuss with friends. Students memorize the picture of a bacterial cell and parts of a bacterium including: Nuclear material, Cell wall, Cytoplasm, Slime envelope, Flagellum

CA	Students make notes on the structure, habitat, nutrition, reproduction, locomotion, importance of bacteria.
Activity 2.6, Library study on some bacteria diseases of humans.	
SA	Students brainstorm on the characteristics of bacteria
MA	Students carry out activity 2.6, to study on some agents responsible for human bacterial diseases such as Cholera, pneumonia, tuberculosis, typhoid and syphilis. Students report their findings and discuss in the class room. Students discuss on how to prevent bacterial diseases.
CA	Students summarize some of the bacterial diseases of humans and their prevention.
What does a yeast cell look-like?	
SA	Students discuss the characteristic of yeast cell and compare with other unicellular organisms.
MA	Students discuss on the characteristics of yeast cell (structure, habitat, nutrition, reproduction, locomotion, importance). Students identify the different structure and functions of a yeast cell using the figure 2.12. Students draw and label the parts of a yeast cell including: Nucleus, Cell wall, Chromosome, Plasma membrane and Cytoplasm.
CA	Students make notes on the structure, habitat, nutrition, reproduction, locomotion, importance of yeast cells.
Reproduction and importance of yeast cell.	
SA	Students should know that yeast is a single-celled fungus. It is found naturally on the skins of fruit such as grapes and is also found in fermented dough.
MA	Students carry out activity 2.7, looking at yeast cells under a microscope and analyze how it reproduce, asexually by budding. Students discuss on the importance of yeast such as the process of fermentation and its commercial importance
CA	Students highlight the importance of yeast cell in alcohol and baking industry.
Summary of Unicellular organisms	
SA	Students identify the different types of unicellular organisms and their characteristics.
MA	Students review the five unicellular organisms described in this section and comment on any similarities and differences that are apparent. Students compare and contrast based on their structure, habitat, nutrition, reproduction, locomotion and importance.
CA	Students draw and label parts of Amoeba, Paramecium, Euglena, paramecium and yeast cell. Students perform exercise 2.2 to evaluate the minimum learning competences.

Consolidate this sub-unit by giving particular emphasis on the diversity in structure, habitat, nutrition, movement, reproduction of and the need to study these unicellular organisms.

4.3 Assessment and follow up

You should asses each student's work whilst carrying out the experiments throughout this sub-unit. You should record students' performance in every activity.

Students performing above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to work more.

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Answers to Exercise 2.2

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

2.3 LEVELS OF ORGANIZATION IN MULTICELLULAR ORGANISMS

Periods allotted: 6 periods

1. Competencies

After completing this sub-unit, students will be able to:

- *name different types of cells;*
- *state the functions of different types of cells;*
- *name some plant and animal tissues;*
- *state the functions of some plant and animal tissues;*
- *name some plant and animal organs;*
- *state the functions of some plant and animal organs;*
- *name some plant and animal systems;*
- *state the functions of some plant and animal systems;*
- *describe organism as the highest level of organization in multi-cellular organisms.*

2. Sub-unit Overview

This sub-unit introduces the students to levels of organization in multicellular organisms. In this subunit the students begin to examine that multicellular organisms are not a mere collection of cells, rather they are complex organisms in which the tasks of many cells are organized and coordinated at five different levels so they can perform activities as an organism. The students start examining the levels of complexity and organization in multicellular organisms, first by looking into the types (in animals [muscle cells, blood cells, bone cells, nerve cells, skin cells, etc.] and in plants [epidermal cells, palisade cells, guard cells, etc.]) and functions of cells that exist in

multicellular organisms. Then, they will inspect that in multicellular organisms many similar cells (in shape, size and function) are grouped together and perform their duties in a coordinated manner as tissues (like in animals [muscle tissue, connective tissue, epithelial tissue, and nerve tissue] and in plants [dermal tissue, ground tissue, vascular tissue, and photosynthetic tissue]). Then after, they will further examine that different cells that are grouped and formed various tissues are coordinated to a higher level of organization to conduct a given task as an organ (such as in animals [heart, skin, eye, lung, stomach, ear, kidney, liver, etc.] and in plants [root, stem, leaf and flower in flowering plants]). Furthermore, they will analyze those different organs in the body of an organism are coordinated as biological system (organ system in animals [circulatory system, respiratory system, musculoskeletal system, digestive system, etc.] and in plants [shoot system and root system]) to carry out organized functions. Finally, they will comprehend that the organ systems in the body of an organism are organized, interconnected and coordinated to function as a unit, an organism. Keep in mind that this sub-unit which introduces the students to diversity of plants will be given within 6 periods (240 minutes). As usual, to actively involve your students prepare and plan ahead of time.

3. Forward planning

Since this is the sub-unit in which you are going to illustrate the complex levels of organization, interconnection, and coordination of cells (many in number, type and function) in the body of a multicellular organism, you need to plan ahead of time to cover the sub-unit and to achieve its objectives. The followings are activities you are expected to carry out before you start treating the sub-unit.

- Since the students are going to list down different types of plant cells, make sure you have drawings/posters portraying different parts of a plant body (to expose your students to as many different types of cells as possible that exist in bodies of plants it is good if you consider a flowering plant).
- Since you are going to allow your students to observe prepared slides of various types of cells in the body of animals particularly of human, check in advance whether you have the slides in your school or do any type of arrangement to get them ahead of time.
- Because students are supposed to examine tissues in animals (especially in human body) and plants, ensure that you have pictures/drawings/models depicting different tissues from the body of the organisms.
- For the reason that students are heading to study organs in animals and plants; especially examination of organs in plants will be made using real samples, and students need to collect plant samples (small-sized) by themselves and locate where the students can easily get these plants. Regarding animals (particularly human), make sure you have pictures/drawings/models of different organs of human.

- Regarding the analysis of organ systems of animals (principally of humans) and plants students are going to make library study. So make certain if the library in your school has the relevant materials or not, if not suggest where the student may go as an alternative site.

4. Suggested Teaching-Learning Approach

4.1 Suggested Teaching aids

As teaching resources, use real plants and their parts, pictures, drawing, and model of plants and animals to cover this sub-unit. Use the textbook and library as well.

4.2 Suggested Teaching-Learning approaches

- Discussion on the classification of plants and animals also how living things are organized.
- Reflection on the level of organization of living things.
- Library reading on the importance of amoeba, bacteria, yeast, paramecium and euglena.

4.3 Presentation of the lesson

You can introduce the lesson by asking students about the difference between unicellular and multicellular organisms, and the different types of cells found in multicellular organisms. You can give them hints like mentioning the type of cells in their own bodies. You can ask them questions like, "is your heart a tissue, an organ or an organ system?"

SA = Starter activity MA= Main activity CA= concluding activity	
Different types of Cell in multicellular organisms	
SA	Students recap the definition of unicellular and multicellular organisms. Students discuss on the nature of cell both in unicellular and multicellular organisms.
MA	Students discuss on the characteristics of multicellular organisms. Students discuss how multicellular organisms are classified in the kingdoms (plants and animals). Students discuss the different types of cells in multicellular organisms both in plants and animals.
CA	Students review the definition, classification and characteristics of multicellular organisms.
What types of cells are found in plants?	
SA	Students recap the previous session, how plants and animals are grouped as multicellular organisms.
MA	Students discuss on the different types of cells, each having a particular function. Students carry out activity 2.9 and 2.10; identify the different types of plant and animal cells.

CA	Students make notes on the types of plant and animal cells.
What are tissues?	
SA	The teacher asks students with a brainstorming question such as "How do cells of multicellular organisms build together to form a tissue?
MA	Students discuss on the definition and types of tissues in plants and animals. Students analyze how tissue formation takes place to perform a certain function in a living organism. Students required carrying out activity 2.11 and 2.12 and reflect their observation in the class room. Students draw and identify the different types of plant and animal tissues based on the figures 2.17 and 2.18.
CA	Students make notes on the types of plant and animal tissues.
What are organs?	
SA	Students recap on the previous two sessions how cells and tissues are formed and to give examples of plants and animal tissues.
MA	Students discuss how tissues are grouped together to form a functional unit called an organ. Students the different types and functions of organ in plants and animals. Students list out examples of organ for plants and animals. Students' analyze pictures of plants and animals organs using figure shown in the student text and identify their functions accordingly.
CA	Students makes notes on the types of plant and animal organs.
What is Organ System?	
SA	Students build a multicellular organism from cell to organ and to give examples for each level or organization in plants and animals
MA	Students discuss how organ system is formed and identify some of the systems present in plants and animals. Students draw pictures of plants and animals organ systems using figure shown in the student text.
CA	Students make notes on the types of organ systems in plants and animals.
What is Organism?	
SA	Students discuss how living organisms are organized from a single cell to form an organism.
MA	Students identify the different types of plants and animals as an organism and carry out activity 2.14, comparison of different living organisms.
CA	Students build the sequences of levels of organization in an organism and perform exercise 2.3 and review questions to evaluate the minimum learning competency.

You can give them a short note on the five levels of organization of cells in multicellular organisms. You can use real samples, pictures, drawings and models to cover the sub-unit.

4.4 Assessment and follow up

You can assess your students: by asking them the following:

- How do you compare unicellular and multicellular organisms?
- Why is the need of organizing cells at different levels in a multicellular organism?
- What are the different types of tissues in animals? State their functions.
- What are the different types of tissues in plants?
- What are the different types of organs and organ systems in multicellular animals? State their functions.
- What are the different types of organs and organ systems in multicellular plants? State their functions.

Answers to Exercise 2.3

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

Answers to Review Questions on Unit 3

Part I: Multiple choices

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

Part II: Matching

11.	D	12.	A	13.	B	14.	E	15.	G

Part III: Fill in the blanks

16. Pseudopodia
17. Cilia
18. Coccus, bacillus, and spiral
19. Contractile vacuole
20. Cells, tissues and organs

Part IV: Short answer questions

21. Unicellular organisms are organisms that are made up of only once cell and multicellular organisms are organisms that are made up of many cells that work together.
22. Examples of unicellular organisms are Amoeba, euglena, paramecium, bacteria, yeast cell and example for multicellular organisms are plants and animals.
23. Tissue is a group of cells that have same shape and size which carry out the same function. Examples: muscle tissue, blood tissue, nervous tissue.
24. Organ is a functional unit which is made up of different types of tissues that work together. Example: leaf, stem, root, brain, lung, eye, ear.
25. Cell is the basic unit of living organisms.

Part V: World search (puzzle)

1.	Organism	2.	Cell	3.	Organ
4.	Tissue	5.	System		

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UNIT 3 HUMAN BIOLOGY AND HEALTH

Total Period Allotted: 24

1. Unit overview

Since the previous unit has dealt with the reproduction of some unicellular organisms, you can remind students about section 2.2, and proceed to introducing the process of reproduction as one of the systems found in animals. As a result of the age of the students, the unit is very relevant to the students, and it requires special emphasis.

The unit begins with the reproductive system of humans that focuses on the primary and secondary sexual characteristics, male and female reproductive organs with their functions, birth control methods, and reproductive health. This is followed by another sub-unit which depicts the distribution, impacts of HIV and AIDS together with the care and support to PLWHA, and life skills needed to fight against HIV.

In these topics discussions, investigations, training and practices with role play are strongly recommended to achieve the unit objectives. The unit demands the pursuit of every activity of each student to enable attain the expected behavioral changes.

Like other units in this unit, too review questions are given based on the underlying competencies, which help you focus on students continuous assessments and make sure whether the required competencies are achieved or not.

Always remember to offer special consideration for those who are performing above and below the standard levels. Encourage the one who work the most, and give extra attention for those who work the least.

2. Unit outcomes

After completing this unit, students will be able to:-

- *explain the primary and secondary sexual characterstics of males and females;*
- *label the reproductive structures and give their functions;*
- *explain the menstrual cycle and the cares that girls should take before and during menstruation;*
- *define fertilization and explain its process;*

- *mention pills and condoms as birth control methods and explain how they are used;*
- *trace some common reproductive health problems, describe how they affect humans and how they could be prevented;*
- *show the local, national and global distribution of HIV/AIDS, explain its impacts in the society and express willingness to give care and support to PLWHA; and*
- *demonstrate assertiveness, decision making, and problem solving skills that help prevent HIV.*

3. Main Contents

3.1 THE REPRODUCTIVE HEALTH

3.2 HIV AND AIDS

4. Planning for the Unit

You can read the contents of this section thoroughly and prepare your own plan on how to cover the contents within the given number of periods. Your plan should be prepared in such a manner to show the sub-topics and activities to be treated during each period. You also need to prepare how to budget your time during each period for students to make discussions, conduct activities, research and make presentations, role play, harmonize concepts, stabilize and evaluate students' achievement.

3.1 THE REPRODUCTIVE SYSTEM

Periods allotted:14

1. Competencies

After completing this unit, students will be able to:

- *explain the primary and secondary sexual characterstics of males and females;*
- *label the reproductive structures and give their functions;*
- *explain the menstrual cycle and the cares that girls should take before and during menstruation;*
- *define fertilization and explain its process;*
- *mention pills and condoms as birth control methods and explain how they are used; and*
- *trace some common reproductive health problems, describe how they affect humans and how they could be prevented.*

2. Sub-unit overview

This sub unit allows students to appreciate and freely discuss the primary and secondary sexual characteristics of males and females, reproductive organs of males and females with their functions, menstrual cycle and the care females take before and after its occurrence, fertilization, birth control methods, the factors that affect reproductive health, and how to prevent the factors.

3. Forward planning

First check the availability of the respective charts or models in your school. If they are not, allow students to make them using locally available materials ahead of time. Prepare long range lesson plan to make an arrangement for the activities and library readings suggested in the student's textbook.

4. Suggested Learning-teaching Approaches

4.1 Suggested Teaching aids

⇨ Use the necessary charts, enlarged diagrams and posters that show the male and female rep. systems menstrual cycle etc. recommended in the student's textbook so that you can animate the lesson.

4.2 Suggested Teaching methods

Brainstorming on the functions of male and female reproductive organs, the factors affecting reproductive health of a woman.

Discussions on

- the menstrual cycle
- personal hygiene needed during menstruation
- how fertilization takes place
- the need for birth control methods and their role
- the problem of over population.

Reflections on

- Primary and secondary sexual characteristics
- Male and female reproductive organs

Project work on how to educate people against harmful practices.

4.3 Presentation of the lesson

You can begin the topic by reminding students the lesson of section 2.2 that dealt with unicellular organisms particularly on their reproduction. Tell students that reproduction is one of the systems in animals and a means of producing offsprings for survival of their species. Then, outline the contents to be followed.

- Primary and secondary sexual characteristics
- The male and female reproductive organs
- Structures and functions of the male and female reproductive systems
- The menstrual cycle
- Fertilization
- Birth control methods
- Reproductive health

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Primary and secondary sexual characteristics	
SA	Question and answer session on primary and secondary sexual characteristics of human males and females.
MA	Students carry out activity 3.1 to identify primary and secondary sexual characteristics.
CA	Students make notes on primary and secondary sexual characteristics in males and females.
The male reproductive organs	
SA	Students explain primary secondary sexual characteristics
MA	Students perform activity 3.2 to label the parts of the male reproductive organs using the model /drawings and explain their functions. Penis — Testes Epididymis — Urethra Cowper's gland — Scrotum Vas deferens — Seminal vesicle Prostate glands
CA	Students make notes on the male reproductive organs their functions.
The female reproductive organs	
SA	Students recap the male reproductive organs and their fraction
MA	Students perform activity 3.3 to label the parts of the female reproductive organs using the model /drawings explain their function. Vagina — Fallopian tube — Cervix Ovaries — Uterus — Clitoris
CA	Students review the female reproductive organs and their function.

Functions of the male and female reproductive structures	
SA	Students recap the male and female reproductive organs.
MA	Students describe the functions of the male and female reproductive structures as it is stated in the text.
CA	Students review the male and female reproductive structures.
The menstrual cycle	
SA	Students brainstorm their previous knowledge and experience.
MA	Students discuss, with the teacher the occurrence and phases of the menstrual cycle.
CA	Students make note on the events and phase of menstrual cycle.
The menstrual cycle	
SA	Students review the menstrual cycle.
MA	Students do activity 3.4 and discuss on the personal hygiene taken during its occurrence.
CA	Student summarizes the cares taken during menstrual cycle.
Fertilization	
SA	Students brainstorm on fertilization.
MA	Students discuss with the teacher on when and how fertilization takes place.
CA	Students summarize the process of fertilization.
Birth control methods	
SA	Students brainstorm on the importance of birth control methods
MA	Students do activity 3.5 -to compare the cost, availability, and side effects of condom and pills.
CA	Students make notes on the benefits of using condom and pills.
Birth control methods	
SA	Students review the benefits of using condom and pills.
MA	Students complete activity 3.5 to discussion the need for birth control and its role. - to discuss on the problem of over population.
CA	Students make notes on the need and role of birth control methods.

The effect of female genital mutilation on the reproductive health of a woman	
SA	Students explain what female genital mutilation is and how it is done in different parts of Ethiopia.
MA	Students discuss how female genital mutilation might affect the reproductive health of a woman and complete activity 3.6.
CA	Students present their findings to the class.
The effect of early marriage on the reproductive health of a woman	
SA	Students explain early marriage and tell the experiences in their locality.
MA	Student carryout activity 3.7 and discuss the effect of early marriage and the reproductive health and present their finding to the class
CA	Students make notes on the effects early married on reproductive health.
The effect of rape on the reproductive health of a woman	
SA	Students barnstorm on rape and tell the experiences in their locality.
MA	Students perform activities 3.8 and discuss the effect of rape on the reproductive health of a woman and present their findings.
CA	Students make notes on the effects of rape on reproductive health.
The effect of illegal and unsafe abortion on the reproductive health of a woman	
SA	Student brainstorm on illegal and unsafe abortion and tell the experiences in their locality.
MA	Students do activity 3.9 and discuss the effect of illegal and safe abortion on the reproductive health of a woman present their finding to the class.
CA	Students make notes on the effect of if illegal and unsafe absolution on reproductive health.
The effect of sexually transmitted infections on the reproductive health of a woman	
SA	Students brainstorm sexually transmitted infections.
MA	Students carryout activities 3.10 and discuss on the effect of sexually transmitted infections the reproductive health of a woman then present their findings to the class.
CA	Students make notes the effect of sexually transmitted infections on the reproduction health.
Project work how to educate people against harmful practices	
SA	Students recap all the factors affecting reproductive health of a woman.
MA	Students do project work based on activity 3.11and present this suggestions how to educate people against harmful traditional practices.
CA	Students summarize their findings

Additional notes

Types of contraceptives or birth control methods

Table 3.1 Common Birth Control Methods

Name	Procedure	Methodology	Effectiveness	Side effect
Abstinence	Absence of sexual inter course	No sexual contact	100%	None so far
Coitus interrupts	Withdrawal of penis before ejaculation	Prevents entrance of sperm cells to vagina	75%	None so far
Rhythm method	Limiting sexual intercourse to the safe period	Avoiding intercourse on few days of ovulation	About 70%	None so far
Oral pills	Tablets taken through mouth	Prevention of ovulation	About 100%	Breaking of blood vessels
Male condom	Rubber cover fitted to erect penis	Block entrance of sperm cells to uterus	About 85%	None so far
Female condom	Rubber liner fitted inside vagina	Block entrance of sperm cells to uterus	About 85%	None so far
Diaphragm	Plastic cap fitted to cervix	Block entrance of sperm cells to uterus	With jelly about 95%	None so far
Spermicidal foam	Foam inserted to vagina before intercourse	Killing sperm cells	About 75%	None so far
IUD (Intra Uterine Device)	Plastic coil inserted and retained in the uterus	Prevention of implantation	>90%	Pelvic inflammation
Vasectomy	Cutting vas deference	No sperm cell in seminal fluid	About 100%	Irreversible sterility
Tubal ligation	Cutting fallopian tube	No egg in the oviduct	About 100%	Irreversible sterity

Female Genital Mutilation (FGM)

FGM results in serious long term health effects of the victim. The health complications due to FGM include the followings:

a. Agonizing pain due to lack of anesthesia.
b. Excessive hemorrhage (bleeding) due to cutting; if bleeding remains uncontrolled, it can result in death.
c. Shock because of the sudden blood loss and/or the unexpected pain.

d. Tetanus can occur due to the use of non-sterile equipment.
e. Trauma to the adjacent structures (the urethra, urinary bladder, anal sphincter, and vaginal walls).
f. Fever and septicemia.
g. Group circumcisions using the same unclean cutting instruments are still common, and can spread HIV infections.
h. Eventually, death can occur due to hemorrhage or septic shock, tetanus and lack of availability of medical services or delay in seeking help.
i. Rectum-and vaginal fistula during birth.
j. Infertility (loss of the ability to conceive a baby).

Fistula is an abnormal, usually ulcerous channel like formation between two internal organs or between an internal organ and skin. This abnormal duct or passage with pus and ulcer resulting from injury, disease or congenital disorder. It mostly occurs at rectum and urinary organs when there is sexual intercourse by deep penetration or immature reproductive organ. Fistula may cause mixing up of the body organs such as the anus and urinary structures.

Early marriage

- There is no doubt at all that child marriage is a fundamental violation of human rights. However, it is a practice in a society and is directly or indirectly related to cultural, religious and economic activities of a community.
- Poverty forces many families to withdraw their daughters from school and arrange an early marriage for them. Then these girls are exposed to all negative consequences of early marriage. Moreover, they will be denied all the benefits of education, improved health, lower fertility, and increased economic productivity. In Ethiopia, only three percent of married girls aged 15–19 are in school, compared to 34 percent of unmarried girls (Population Council, July 2004). In addition to girls that are exposed to risks of HIV/AIDS and fistula due to early marriage, adolescent girls may also develop fistula while giving the first birth from prolonged or obstructed labor.

STIs

These factors cause various complications if not treated early. They may cause sterility, and giving birth to defective children. Some of them end up with the death of the victim.

Rape

The factors that influence rape are different and are controversial, because of personal, social, cultural beliefs as well as economic status that are, in some ways, contributing to the problem. But, the major causes of rape are gender inequality and the anger and sadism of the rapists. Studies indicated that sex is not the primary motive underlying

rape, as most people might tend to think. The involvement of married men and men with partners showed that the sexual aspect of rape is secondary. On the other hand, poverty that forced women and children into commercial sex and the streets played a significant role in making these victims vulnerable to sexual exploitation, abuse and rape.

Illegal and unsafe abortions

Evidence shows that young women who gave birth before the age of 20 are at greater risks of complications of pregnancy and delivery than older women. This fact is further aggravated when women give birth without the assistance of a trained health worker.

You are requested to give emphasis to these points.

Primary sexual characteristics are the features that show reproductive organs are non-functional. They are the first appearances to enable one distinguish males from females.

Secondary sexual characteristics are the features that show reproductive organs are functional. They are the second appearances that make the distinction between male and female more visible.

The **male reproductive** system consists of the penis (erectile organ), scrotum (testes case), testes (male gonads), epididymis (sperm duct), vas deferens (semen duct), and urethra (urine and semen duct).

The **female reproductive** system consists of the vagina (organ of intercourse and child birth), uterus (organ of pregnancy), ovaries (female gonads), fallopian tube (organ of fertilization), and cervix.

The menstrual cycle is a 28 day cyclic change that takes place in an adult female reproductive system. It is a sign of no pregnancy, and menopause stage, if the woman is healthy.

Fertilization is the union of male gamete (sperm cell) and female gamete (egg cell) to form a one celled stage zygote. It occurs in the fallopian tube if there is sexual intercourse during the few days of ovulation.

Birth control methods are methods that prevent fertilization or conception. They are useful to prevent unwanted pregnancy in limiting the number of children in a family and the number of people living in a country or the world.

Reproductive health refers to the physical, mental and social wellbeing of an individual, in relation to his/her. It is needed for responsible, satisfying and safe life, capability to reproduce and the freedom to decide when and how often to reproduce.

Fistula is an abnormal passage between two internal organs or from an internal organs to the body surface.

4.4 Assessment and follow up

Make sure that the students working at the minimum requirements have fulfilled the competencies suggested in the section. For students performing below the minimum requirements level, give additional lesson time. Appreciate the students working above the minimum level of requirements.

Additional Questions

1. Why is reproduction possible during secondary sexual characteristics?
2. What is puberty?
3. What are the functions of the following reproductive organs?
   a. testes and ovaries
   b. vas deferens and fallopian tube
   c. uterus and urethra
4. What are the two processes happening in menstrual cycle?
5. Why is additional personal hygiene needed during menstruation?
6. How and when does fertilization take place?
7. Why are contraceptives needed?
8. Who is responsible to use birth control methods within a family?
9. What is the importance of reproductive health?
10. What are the benefits of using natural methods of birth control methods?

Answers to Additional questions

1. Because of the matured reproductive structures that are capable producing of sex cells.
2. The age (11-15) when secondary sexual characteristics are attained.
3. a. Both produce gametes or sex cells and sex hormones.
   b. Both transport gametes or sex cells.
   c. Uterus is to develop embryo during pregnancy, while urethra is to pass urine (in female but semen and urine in males.)
4. Ovulation and menstruation.
5. Because neatness and carefulness avoid spoilage of body parts and wears by the blood.
6. Fertilization takes place by the union of the sperm cell and egg cell nucleus. When there is sexual intercourse within the few days of ovulation.
7. Contraceptives are needed to limit the number of children in a family and people living in the country or in the world.
8. Both male and female partners.

9. Reproductive health is very important to decide the time to choose and have a partner
   - for marriage
   - for giving birth
10. To minimize the risk of side effects.

Answers to Exercise 3.1

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

3.2 HIV/AIDS

Periods allotted:10 Periods

1. Competencies

After completing this sub-unit, students will be able to:

- *show the local, national and global distribution of HIV and AIDS, explain its impacts in the society and express willingness to give care and support to PLWHA; and*
- *demonstrate assertiveness, decision making, and problem solving skills to help prevent HIV.*

2. Sub-unit overview

This sub-unit describes the local, national and global distribution of HIV/AIDS, explains the impacts of HIV/AIDS on the society. The students will take training and begin to express willingness to give care and support to PLWHA. Moreover, it enables students to develop life skills in protecting oneself from HIV/AIDS.

3. Forward planning

Prepare graphs and maps for interpretation of data. Then make arrangement of a site visit of an institute, and training on how to give care and support to PLWHA.

4. Suggested Learning-teaching approach

4.1 Suggested teaching aids

⇨ use the graphs and maps needed to teach this sub-unit.

4.2 Suggested teaching methods

- Brainstorming on the impacts of HIV /AIDS on a person, a person's family and a country.
- Discovery on prevalence of HIV / AIDS globally, locally and nationally.
- Fieldwork on visiting institutions giving care of support to PLWHA.
- Discussions on giving care and support to PLWHA

- Inviting a guest speaker on giving care and support to PLWHA
- Case study on practicing self-assertiveness and decision making skills
- Role plays on practicing problem solving skills.

4.3 Presentation of the lesson

You can start the sub unit by reminding students the causes of HIV/AIDS by asking questions; the mode of its transmissin and prevention. Then proceed with the provision of the curent data on the prevalence of HIV and AIDS at the local, regional and global levels.

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Distribution of HIV/AIDS	
SA	Students explain the causes and transmission of HIV/AIDS
MA	Students are asked to interpret the provided current data on the prevalence of HIV/AIDS nationally and globally.
CA	Students make notes on the national and global distribution of HIV/AIDS.
Distribution of HIV/AIDS	
SA	Students brief the local ,national and global distribution of HIV/AIDS
MA	Students carry out Activity 3.12 and present their findings to the class.
CA	Students make notes on the prevalence of HIV/AIDS in the locality.
Impacts of HIV/AIDS on society	
SA	Students describe the distribution of HIV/AIDS locally, nationally, and globally.
MA	Students perform Activity 3.13 to discuss and explain the impact of HIV/AIDS on - a person - a person's family - a country
CA	Students summarize the impacts of HIV/AIDS on the society.
Care and support to PLWHA	
SA	Students make preparation to present their findings to the class. Visit local governmental, non-governmental institutions working on giving care and support to PLWHA.
MA	Students carry out activity 3.14 and present their finding to the class
CA	Students recap the services rendered by the institutions.

Discussion on giving care and support to PLWHA (Guest speaker)	
SA	Students prepare questions concerning giving care and support to PLWHA.
MA	Students discuss with the invited guest speaker from the institutions on the issues of giving care and support to PLWHA.
CA	Students report on if/how the discussion has changed their views to give care and support to PLWHA.
Learning how to give care and support to PLWHA	
SA	Students make preparations to practice how to give care and support to PLWHA.
MA	Students practice giving care and support to PLWHA in safe ways.
CA	Students express their willingness in giving care support to PLWHA
Life skills	
SA	Students describe what life skills are and how to use them in protecting oneself from HIV/AIDS.
MA	Students discuss on how individuals can show self-assertiveness, decision making and problem solving skills in protecting themselves from HIV.
CA	Students recap how life skills are helpful to solve problems in life situations.
Practicing self- assertiveness and decision making skills	
SA	Students review how life skills are useful in life situations.
MA	Students perform activity 3.15 discuss on the case study.
CA	Students summarize the presentation.
Practicing problem solving skills (1)	
SA	From the case study students plan a role play.
MA	Students carry out activity 3.16 to act out a role play that shows how to help the character mentioned in the text to be tested for HIV. The play should be completed within 15-20 minutes. The remaining 15 minutes will be to forward and debate on the situation
CA	Students summarize the presentation
Practicing problem solving skills (II)	
SA	From the case study students plan a role play.
MA	Students carry out their own role plays to show how to live with HIV/AIDS. The play should be completed within 15 – 20 minutes. The remaining 15 in each period will be to forward and debate on the situations.
CA	Students summarize the presentation.

Additional notes to the teacher

1. The general features of HIV.

HIV is a member of the genus *Lentivirus*, which is a member of the family *Retroviridae*. The *Lentiviruses* are RNA viruses which are commonly characterized by having single stranded RNA. The virus has envelope and a unique enzyme called the **reverse transcriptase** (Fig 3.1).

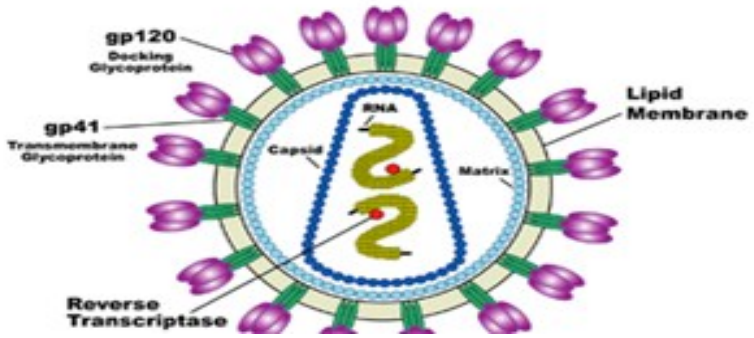

Figure 3.1

The reverse transcriptase converts the RNA of *Lentiviruses* into double stranded DNA, a provirus form. The double-stranded DNA is then integrated into the host cellular DNA by the virally encoded **integrase**. So, the integrated viral genome is transcribed. There are two possibilities, after the virus has infected the cell.

1. The provirus becomes latent (integrated but dormant).
2. The provirus becomes active and replicates within the infected cell, and a large number of viruses that can then infect other cells are liberated.

There are two subspecies of HIV known as HIV-1 and HIV-2.

1. HIV-1 is the virus that was initially discovered and is more **virulent** (infective). It causes the majority of HIV infections globally.
2. The less virulent is HIV-2 as compared to HIV-1, because of the fact that fewer of those exposed to HIV-2 will develop the **symptoms** of the disease. HIV-2 is largely confined to West Africa probably because of its origin (Table 3.2, below).

Table 3.2 Comparison of the two subspecies of HIV

Sub species of HIV	Virulence	Prevalence	Inferred origin
HIV-1	Higher	Global	Common chimpanzee
HIV-2	Lower	West Africa	Sooty Mangabey monkey native of west Africa

Different body fluids like blood, genital fluids (semen, vaginal and cervical fluids), lymph, saliva, tears, urine, cerebrospinal fluid, urine, mother milk, ear secretions, etc. contain free HIV or HIV infected immune cells. But, of all these body fluids, those found practically important for the transmission of HIV are genital fluids, blood and mother milk.

Another equally important factor in the transmission of HIV is the nature of the mucous membrane that covers both of the male and female genitalia. The male and female genitalia, like the mouth are lined by a very thin mucous membrane on which immune cells are present on the surfaces. So, any practices that facilitate the intimate contact of genital fluids or blood to this surfaces or the blood system assist the easy access of the virus to the immune cells.

Infection with HIV occurs by the transfer of blood, semen, vaginal fluid, pre-ejaculate fluid, or breast-milk. These are the body fluids in which both free HIV particles and virus infected immune cells are present quite in good numbers. The four major routes of transmission are: unsafe sex, contaminated needles, breast milk, and transmission from an infected mother to her baby at birth.

Impacts of HIV and AIDS on society

HIV and AIDS epidemic is causing debilitating illness, and premature deaths among the young and productive ages of society. It has devastated countless families and communities. In developing countries like ours, it has compromised the nation's efforts to fight poverty, improve on food security and health care by:

- Generally reducing productivity by reducing a person's ability to work, reducing incomes and the ability to support one's family.
- Increasing medical cost.
- Disrupting socioeconomic orders (more orphans, widows, etc.) and gender disparities, namely, increasing the risk of women to HIV/AIDS infections.
- Straining the resources of communities by diverting its efforts to fighting the epidemics rather than concentrating on development.

Impacts of HIV/AIDS on a country

- HIV/AIDS epidemics is continuing to have an enormous impact on the global level, and having much more impact on sub-Saharan Africa to which we belong. The region is characterized by poor social services, poor production system and generally by underdeveloped economy. On the other hand, the region is recently characterized by fast rate of urbanization and construction. In this region the impact is clearly visible on households, communities, businesses, public services and national economies.

- Unlike other infectious diseases, HIV/AIDS has the potential to create severe economic impacts in African countries, particularly to sub-Saharan Africa. This is because it attacks primarily the young productive age group, which is the largest sector of the population of the region. The other important reason is that it is essentially 100 percent fatal. If this large sector that is supposed to move the economy of the Sub-Saharan region is affected at epidemic scales, it is then removed from the productive sector and put into the dependent groups, which then automatically becomes disastrous for the development of the nations of the region in view of the rampant overall poverty.
- In other words, because this has to be emphasized very clearly, AIDS epidemic has the direct impacts on the economy (household, community and country) and social services (agriculture, health, education, transport, industry, and other sectors) of a country. By mercilessly killing and weakening the young, the very productive age group, the epidemic changes the age structure of a country. This shift in the age structure of a nation to a lesser number of productive age group has serious effects on the economy and social aspects of a country.

Care and support to PLWHA

In Ethiopia over 3 million people are living with HIV/AIDS (PLWHA) and more than 0.23 million children are infected with HIV/AIDS and the same number of children are orphaned because of HIV/AIDS. In general the HIV/AIDS prevalence in the country in the year 2001 was 6.6% whilst the prevalence in Addis Ababa was 15.6%. These figures indicate that large numbers of families are affected and the epidemic causes a significant impact in the socioeconomic development of the country; for instance, it stretches the health system of the nation. In specific terms, the involvement of the community together with the government and non-governmental organizations in raising the awareness of the general public on preventing the spread of the epidemic, treating the patients, and, moreover, caring and supporting PLWHA have paramount impacts in diverting the resources and time of the nation away from development.

Together with strategies of fighting the spread of HIV/AIDS, care and support practices to PLWHA are very important. The community-based social mobilization strategy which is inclusive of people living with HIV/AIDS and volunteers (youth, women and all other segments of the community) to provide treatment, support and ensure referral for HIV testing and counselling services have significant contributions to the efforts of stopping the spread of the pandemic. This strategy emphasizes the paramount importance of getting community members to discuss the issues of HIV/AIDS prevention, treatment and care for the infected people.

Aspects of community HIV/AIDS interventions performed by community volunteers are mainly done through door-to-door sensitization and awareness campaigns at public gatherings (at schools, colleges, burial ceremonies, and at different meetings like *idir* and *equb*). The door-to-door sensitization activities include counselling and referral to HIV testing centres, basic nursing care, calming care, antiretroviral therapy (ART), literacy and support to PLWHA (like providing meals, shelter, treatment, counselling for treatment adherences and particularly raising awareness in terms of bringing people to internalize the situation and confirm to them that it is possible to live with the infection and achieve one's aims and goals. On the other hand, work must also be done on non-infected part of the population that they should avoid the **stigma** of alienating PLWHA, since HIV is not transmitted by just shaking hands or by living together.

How can life-skills education assist the fight against the spread of HIV infection?

Life-skills education helps communities in raising awareness on the situation of HIV pandemics and changing that awareness into practical actions. These actions are measured in terms of:

- Changes of behavior such as respecting one another between the opposite sexes.
- Learning and practicing the nature of the pandemic and breaking the cycles of transmission.
- Accepting the infected people as part of the society and helping them contribute to the development of the nation.
- Raise the motivations of PLWHA so that they continue in life.
- Most of all, the action should bring people together to discuss about themselves, their own sexual lives, the process of mate selection and the values of leading responsible families that build a nation.

Realize that countries like ours need the contribution of every individual, as they have to come out of poverty and continue in development and transformation in this competitive world.

You are strongly recommended to focus on these points

Briefly tell students that HIV/AIDS is disributed all over the world and specially rampant in Sub-Saharan African countries in which our country Ethiopia is included. At the same time you should empahsize that PLWHA suffer from the stigma of discrimination and fear of family separation. Therfore, healthy citizens especialy the young ones as community member should care and support PLWHA to be hopeful in their life. Finally, you can wind up the lesson by emphasizing that life skills are very important in solving problems in all real life situations. Therefore, inform students to

develop and practice these life skills so that they will be self assertive, problem solving and decision making citizens that benefit themselves and the country at large.

4.4 Assessment and follow up

You should assess and record each student's work continuously over the whole unit and compare it with the competencies to determine whether the student has achieved the minimum required level.

Make sure that the students working at the level of minimum requirements have fulfilled the competencies suggested in the section. For students below the level of minimum requirements, give additional lesson time. Appreciate the students working above the level of minimum requirements.

Additional questions

1. Why is HIV /AIDS rampant in sub Saharan African countries?
2. Why is HIV/AIDS prevalence high among youngsters?
3. Why are you asked to be involved in caring and supporting PLWHA?
4. What are the impacts of HIV/AIDS on children?
5. Why are life skills needed?

Answers to additional questions

1. Because youngsters in Sub-Saharan African countries occupy the largest sexually active group of the population. It is also attributed to poor social services, poor production and weak economy.
2. Because they are sexually more active and engaged with different partners.
3. Because you are part of the community and should participate in solving societal problems.
4. Orphanage, withdrawal from school, street life.
5. Because life skills are useful to solve problems, to be self-assertive and to make decision in life situations.

Answers to Exercise 3.2

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

Answers to review questions on Unit 3

Part I: Multiple choice

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

Part II: Matching

11.	E	12.	J	13.	D	14.	I	15.	H
16.	C	17.	A	18.	G	19.	F	20.	B

Part III: Fill in the Blanks

21.	Rape	22.	14 th	23.	Cotraceptive
24.	PLWHA	25.	Skills		

Part IV: Short answers

26. Because of the production of sex hormones.

27. She is suspected of pregnancy.

28. Contraceptive pills are usefull to couples to avoid unwanted pregnancy and limit the number childrens with in a family.

29. The youngster between 15 – 49 years of age.

30. Life skills can be developed by practicing them through participation in community services and public organiations.

Part V: Puzzle

Across

2. UTERUS
3. VAS DEFERENS
5. CERVIX
7. SCROTUM
8. FALLOPIAN TUBE
10. PROSTATE GLAND

Down

1. PENIS
4. TESTIS
6. OVARY
9. CLITORIS

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UNIT 4 PLANTS

Total periods allotted: 17 periods

Unit Overview

Students are by now well familiar with plants as multicellular and photosynthetic, i.e that makes their own food. This unit will introduce the students to the process of photosynthesis in plants and to the science of tree growing. Photosynthesis is the process of food making reaction during which plants incorporate atmospheric carbon dioxide into their organic molecules using sunlight energy. It is a process in which low energy in-organic molecules are converted into high energy organic compounds in plant cells using sunlight energy. It is also known as the master reaction on Earth, because all organisms that do not produce their own food entirely depend on the product of photosynthesis as their source of energy.

Generally, plants use CO_2 and release O_2 during the process of photosynthesis. This process is important in balancing the level of two gases of the atmosphere. In addition to serving as a source of energy for heterotrophs, they are also involved in reducing the global warming. As a result, it is advisable to plant trees in our surroundings. In fact, trees are important in providing timber, fire wood, and production of paper, construction of shelter and to preserve soil fertility. As population size increases, the pressure on these natural renewable resources will be intensified and goes beyond the natural recovery rate of trees. This leads to deforestation and to all the ugly sides of it (soil erosion, reduction of agricultural productivity, change of the climate, loss of wild life, etc.). Thus, understanding the importance of trees and planting them is necessary to restore fertility of the soil, increase agricultural productivity and to restore changes in the climate. While growing trees, it is necessary to pay attention to stages of tree development, care to seedlings and care to planted trees till they get mature and able to fully support themselves.

Unit outcomes

After completing this unit, the student will be able to:

- *define photosynthesis, explain its light and dark phases and give a summary equation of photosynthesis;*
- *conduct a simple experiment to confirm that plants produce food by photosynthesis;*
- *demonstrate the steps followed in growing trees and in caring for them as they grow;*
- *explain the advantages of indigenous trees over exotic trees and show willingness to participate in tree growing projects.*

Main contents

Planning for the unit

As you are going to familiarize the students the concepts of photosynthesis and the biology of tree growing, you need to organize materials for different practical activities and notify the students ahead of time. You are also expected to collect plant samples, notifying students to develop seedlings, dig holes for planting trees, and to carry out other activities in advance. Discussing the general formula of photosynthesis, confirmation of the necessity of light during photosynthesis, the production of carbohydrate, and the evolution of O_2 are important points of the unit. The selection of trees, the stages of growing, developing and caring for the seedlings, caring for planted trees, and setting a tree planting project are also important portions of the unit. Please read pieces of information given in this guide before you start covering the unit.

4.1 FOOD MANUFACTURING IN GREEN PLANTS

Periods allotted: 7 periods

1. Competencies

After completing this sub-unit, students will be able to:

- *define photosynthesis as the production of food by leaves using sunlight, water and chlorophyll.*
- *give a summary equation of photosynthesis.*
- *explain the major events in the process of photosynthesis.*
- *confirm that plants produce food by photosynthesis by conducting a simple experiment.*

2. Sub-unit overview

This sub-unit introduces the students to the very important and unifying characteristics of all organisms grouped under plants, which is food manufacturing process. The students will begin learning about the process of photosynthesis by letting them to explain how plants prepare their own foods. This will give the students the opportunity to clarify the concept of the process. During photosynthesis light is absorbed by chlorophyll pigment and then in chloroplasts of plant cells raw materials such as CO_2

and H_2O (inorganic and low energy molecules) are converted into carbohydrate (high energy organic molecule), O_2 and H_2O. The student will discuss the simplified summary equation of photosynthesis. Then, they are allowed to confirm the necessity and intensity of light, the formation of carbohydrate, the importance of chlorophyll pigment, and the evolution of O_2 during the process of photosynthesis. Keep in mind that this sub-unit which introduces the students to diversity of plants will be given within 7 periods (280 minutes). As usual, to actively involve your students prepare every lesson using 5E-learning model, which includes five phases: engage, explore, explain, elaborate and evaluate.

3. Forward planning

Since this is the sub-unit in which you are going to discuss the process of photosynthesis, the food manufacturing process in plants. During this treatment your students are going to confirm the importance of light, the need of chlorophyll pigment, the formation of carbohydrate, and the release of O_2 as a byproduct. Thus, you need to plan ahead of time in order to cover the sub-unit and to achieve its objectives. The followings are activities you are expected to carry out before starting to deal with the sub-unit.

- Since you are going to grow plants in a complete darkness, prepare in advance that you can grow plants in pots in a complete darkness.
- Grow bean plants in pots (some plants growing in to sunlight and the other half growing in complete darkness) much earlier than the day, on your semester plan, that you are supposed to conduct the experiment.
- Make sure you have iodine solution, ethanol, heating apparatus and other materials in your laboratory.
- Make sure *Elodea* (pondweed) is available in your area; if not, plant a substitution.
- Check for the availability of variegated leaves in your school compound or around your school.
- Mask leaves 48 hours prior to conducting the experiment on masked leaves.
- For activity 4.7 you need to collect data on the effect of the intensity of light on photosynthesis.

4. Suggested Learning-Teaching Approach

4.1 Suggested Teaching aids

As teaching resources, use the real plants and their parts to cover this sub-unit. Use the textbook as well.

4.2 Suggested teaching – learning methods

- Brainstorming on photosynthesis, thesis plant string photosynthetic products, variegated leaves.
- Discussions on definition of photosynthesis, photosynthesis and variegated leaves.
- Group activities on how plants store photosynthetic products, analysis of data on intensity of light.
- Laboratory activities on straightest, importance of light test on the formation of O_2 during photosynthesis.

4.3 Presentation of the lesson

You can introduce the lesson by asking students (by reminding them) the unifying characteristic of all plants, which is the ability to make their own food through the process of photosynthesis. You can inform them that this process is believed to be the master reaction on Earth, because it serves as source of food for every life. You can tell the students that one of the purposes of animals moving from place to place is to search for food; how do plants that do not move like animals get their own food? What is the reason for a plant to expose its leaves to the sunlight? And showing them through a window a huge tree, ask them 'what do they think that this mass comes from (soil/air)?'

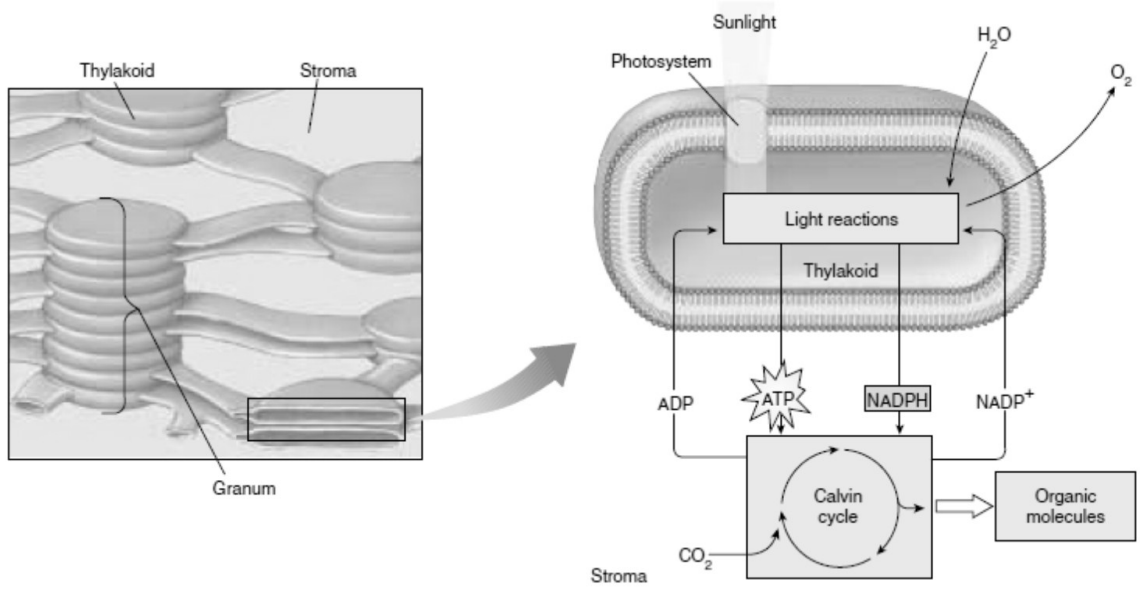
The minute you start the lesson, ask your students 'what do they think about photosynthesis?' What are the raw materials for photosynthesis? Allow them to discuss the role of light in the process of photosynthesis. You can write the summary equation of photosynthesis on the blackboard and let them to explain it. But, do not forget to let the students think that CO_2 and H_2O are not directly combined to form carbohydrate in the cells of leaves of plants. Rather, inform them that the light energy is used to incorporate the carbon from CO_2 to form carbohydrate molecules and H_2O as a source of O_2 and energy.

SA = Starter Activity MA = Main Activity CA = Concluding Activity	
Introduction to photosynthesis	
SA	Students give possible answers to what they know about photosynthesis.
MA	Students in pairs discuss the definition of photosynthesis and critically observe the summary equation of photosynthesis given in Figure 4.3.
CA	Students summarize their discussion and explain the equation in Figure 4.3.

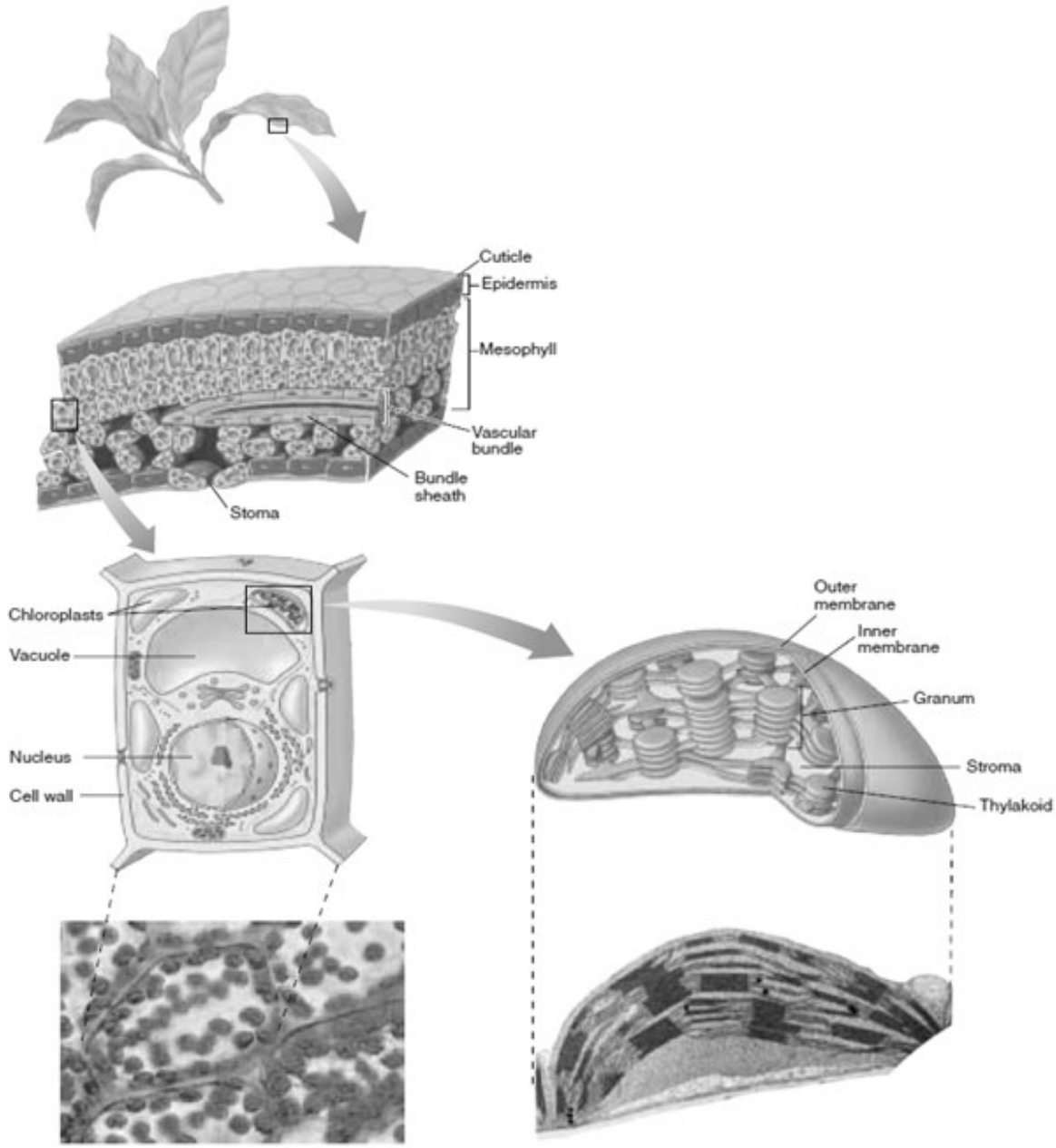
Importance of light (Activity 4.1)	
SA	Students mask half part of a leaf on a plant before 48 hours; and they collect the masked leaf.
MA	Students following the procedure given for the activity they carry out the experiment. They discuss their results.
CA	Students summarize their results in relation to the importance of light to photosynthesis.
Storing photosynthetic product in the form of starch (Activity 4.2)	
SA	Students give their responses on how photosynthetic sugar products in plants stored.
MA	Students discuss how plants store their photosynthetic products in the form of starch rather than in the form of glucose.
CA	Students summarize their discussion on the form of storage of photosynthetic products.
Starch test and variegated leaf (Activity 4.3)	
SA	Students obtain variegated leaf from school compound.
MA	Students carry out the test for starch and critically evaluate Figure4.5.
CA	Students confirm that proper pigment development is necessary for plants to carry out the process of photosynthesis.
Test for the formation of oxygen during the process of photosynthesis (Activity 4.4)	
SA	Students obtain the necessary material for testing the evolution of oxygen during the process of photosynthesis.
MA	Students carry out the test using *Elodea* (a pondweed) or any other freshwater small plants in beaker with water and by placing an inverting a funnel over the plant. Guidance of a teacher is important to carry out the experiment following the protocol and referring Figure 4.7.
CA	Students confirm that oxygen is produced during the process of photosynthesis.

Analysis of data (Activity 4.5)	
SA	Students in groups work on a data obtained on the effect of the intensity of light on photosynthesis from research center.
MA	Students discuss and organize the data they are provided with. Teacher's guidance on how to organize and analyze the data is necessary.
CA	Students summarize the effect of the intensity of light on the rate of photosynthesis.

During the process of photosynthesis atmospheric CO_2 is included into the organic molecules of the cell and then used to form carbohydrate molecules; whereas H_2O molecules split by light energy into $2H^+$ + 2 electrons and O_2 gas. The $2H^+$ + 2 electrons from water are used for production of ATP and $NADPH_2$, the types of energy molecules used in the second phase of photosynthesis to combine CO_2 with *Ribulose bi-phosphate* (five carbon sugar, from cellular reserve to which is CO_2 is added to) molecules of the cell and then carbohydrate molecules are formed. See the summary below.



You can trigger off your students to discuss why is photosynthesis known as a master reaction on Earth? Then, you can forward to the students where the site of photosynthesis in plants takes place?



You can give them a short note on the process of photosynthesis.

You can use real samples and let them carry out experiment on necessity of light, pigment molecules, production of carbohydrates, and evolution of gas (O_2) during the process of photosynthesis.

Answers to Exercise 4.1

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

4.2 TREE PLANTING

Periods allotted: 10 periods

1. Competencies

After completing this sub-unit, students will be able to:

- *demonstrate the steps followed in growing trees*
- *demonstrate the steps followed in caring for trees as they grow*
- *show willingness to participate in tree growing projects*
- *explain the advantages of indigenous trees over exotic trees*

2. Sub-unit overview

This sub-unit introduces the students to the importance of tree growing in our surroundings, the stages in a tree development, the necessary steps in tree growing, the cares to be given for developing trees, and to designing an indigenous tree planting project. The students will start investigating the importance of trees to the environment (in reducing global warming, climate change), in reducing soil erosion, increasing agricultural productivity, serving as shelter, providing firewood, construction materials, for industries (paper making) and for beautification of an area. This will give them the chance to be conscious about the contributions of trees to the environment and the society, and thereby the need to study the biology of trees, growing trees, caring for them and the practical significance of growing indigenous trees. While covering this sub-unit, students will be allowed to discuss what is/are reason(s) to consider growing indigenous trees rather than exotic ones? Then after, the students will begin to organize planning and executing a tree growing project in their locality, mobilizing finance and the community for this very purpose. They will also include in their project organization the importance of caring for grown plants by educating the nearby community on how to give care to the growing seedlings until they become matured and be fully able to support themselves. During this project, the students will develop skills on how to plan a project work, organize and execute it. Be aware that this sub-unit that introduces the students to different features of tree growing will be treated within 10 periods (440 minutes).

3. Forward planning

Because this is the sub-unit within which you are going to introduce the importance of tree growing, caring for growing trees and indigenous tree growing project to students; thus planning in advance is necessary to cover the sub-unit and to achieve its objectives. The followings are activities you are expected to carry out before starting working on the sub-unit.

- Select the tree that can grow in your area and check for the possible source(s) of seedlings.
- Check for indigenous trees available at your locality.
- Identify a possible area (could be your school) where you are going to grow the trees.
- Make ready a sample project plan which the students perhaps can follow to develop their own.
- Look for possible sources of digging tools.

4. Suggested teaching –learning approach

4.1 Suggested Teaching aids

As teaching resources use indigenous trees and realistic tree growing project to cover this sub-unit. Use the ***textbook*** as well.

4.3 Suggested teaching – Learning methods

- Brainstorming on characteristics of trees, importance of tree drawing, steps and stage of drawing trees and importance of indigenous plants.
- Reflection characteristics of trees, forest cover in Ethiopian in 1990s and now, tree growing project, and indigenous trees.
- Discussion on stages of tree development, researching on area of forest cover in Ethiopia, tree growing project, and indigenous tree.
- School compound and surrounding area survey visit
- Group activity on characteristics of trees, steps required to growing trees, cares required during growing trees, tree growing project and researching on indigenous trees.
- Library reading on developing seedlings for wanza, researching on areas of forest cover in Ethiopia.

4.3 Presentation of the lesson

You can introduce the lesson by asking students: ‘What is a tree?, What are the actual significance of tree to a given locality (like in the school), to the country and to the globe? What are the major stages of a developing tree? Why is the need to care for a growing tree? What are indigenous trees? What is/are need(s) of growing indigenous tress? You can ask them to make a survey visit in their locality including their school regarding the type and distribution of trees. During their survey visit you may ask them to pay attention to indigenous types of trees in their local area. You can give them a hint, by asking them ‘why is the focus given on indigenous trees rather than the exotic types?’

The moment you begin the lesson, ask your students what are trees and what are their main stages. Then, ask them whether it is necessary to care for the root ball during transportation and planting the seedling.

You can activate your students to discuss whether it is advisable to grow indigenous trees at their locality or not. Then, you can forward to the students what is/are the important features of indigenous trees.

During tree growing project you need to give them clue on how they should plan their project. You may consider the following:

- specifying their objectives,
- selecting appropriate tree to be grown in a given locality,
- identifying the source of seedlings to be grown, by consulting the appropriate personnel at the local representative bureau of the Ministry of Agriculture,
- specifying the place where they are going to plant the seedlings,
- specifying how to transport seedlings and the community that is going to participate in planting the tree,
- spelling out how many seedlings they have to plant; this is necessary to decide how much money is required for the project.
- Specifying how to educate the nearby community about the importance of tree growing and caring for the newly planted seedlings, so that the project will be a success.

SA = Starter Activity MA = Main Activity CA = Concluding Activity	
Characteristics of trees	
SA	Students give responses from what they previously know to what are the characteristics of perennial trees.
MA	Students in groups, identify the characteristics of perennial trees from what they previously know and from their text.
CA	Students summarize their results and present it to their teacher.
Stages of tree development	
SA	Students read page 88-89, discuss and identify the steps included during a tree development and go round through the school.
MA	Students identify the steps of growing trees and discuss if there is a possibility of growing trees other than from seeds.

CA	Students recap the stages of growing trees.
Growing trees from seeds.	
SA	Students read the text on page 89 and 90.
MA	Students discuss on how to grow plants from seeds taking into consideration their own experiences
CA	Students summarize their discussion in relation to growing trees from seeds..
Discussion on steps required to grow trees (Activity 4.6).	
SA	Students brainstorm the major steps needed to grow trees in their school compound.
MA	Students conduct activity 4.6
CA	Students summarize their discussion in relation to growing trees.
Developing seedlings for *wanza* (Activity 4.7)	
SA	Students read material in the library and collect information on developing seedling for *Wanza* before the lesson and present it now.
MA	Students organize pieces of information on how to develop seedlings and transfer seedlings to their permanent places.
CA	Students summarize the pieces of information they organized.
Cares required during growing trees.	
SA	Students give their responses to possible cares that should be exercises while growing trees.
MA	Students discuss in groups the major cares that should be exercised when growing trees.
CA	Students summarize their discussion in relation to cares to be done while growing trees.
Researching on areas of forest cover in Ethiopia in 1900s and now (Activity 4.8)	

SA	Students read their text and carefully compare the forest coverage of Ethiopia in 1900 and at present
MA	Students collect information on the forest coverage of the country compare the secondary data they obtained from the library resources.
CA	Students summary their data and present it to the class.
Tree growing project (Activity 4.9)	
SA	Students design and organize a tree growing project paying attention on trees grown in their local areas.
MA	Students develop a tree growing project that involves the local community in the process and execute the project. The guidance of the teacher is very important from the time of planning to the execution of the project.
CA	Students submit their report after completing the project.
Indigenous trees.	
SA	Students give their responses to what is indigenous trees and what are the importance of these trees.
MA	Students in groups, discuss the definition and the significance of indigenous trees; they also mention their differences with the exotic trees in their localities (like *Bahirzaf*).
CA	Students summarize their discussion in relation to indigenous trees.
Researching indigenous trees in a given locality (Activity 4.10)	
SA	Students list down indigenous trees grown in their local areas.
MA	Students in groups present their finding on activity 4.10.
CA	Students submit their report after identifying the indigenous trees in their locality.

The Necessary 9 Steps to Planting a Tree

Why plant trees?

There are many reasons as to why we plant trees; one for instance could be trees produce large amount of oxygen (0.4 hectare trees produce 4 tons annually, which is

enough to provide oxygen to sustain 18 people for one full year). Trees also act as carbon sinks by absorbing or sequestering carbon dioxide from the air and involve in reducing global warming. Leafy tree canopies intercept fine-particulate pollution and absorb pollutants such as nitrogen dioxide, ammonia, carbon monoxide and sulfur dioxide. Here are nine steps that are useful to transplant a sapling (young) tree from a nursery, as opposed to starting with seeds.

1. Determine the planting site.

- Choose a location 4.6 to 6.1 m. from the house, sidewalk, driveway and other trees.

2. Mark the planting location.

- Measure the diameter of the tree's root ball at its greatest dimension.
- Prepare an area two to three times wider than the root ball, which represents the radius of the hole you will have to dig.

3. Measure the height of the root ball.

- Measure the height of the root ball from the ground to the bottom of the exposed root. This distance will be the depth of your hole--the idea is to keep the root flare exposed.

4. Dig the hole.

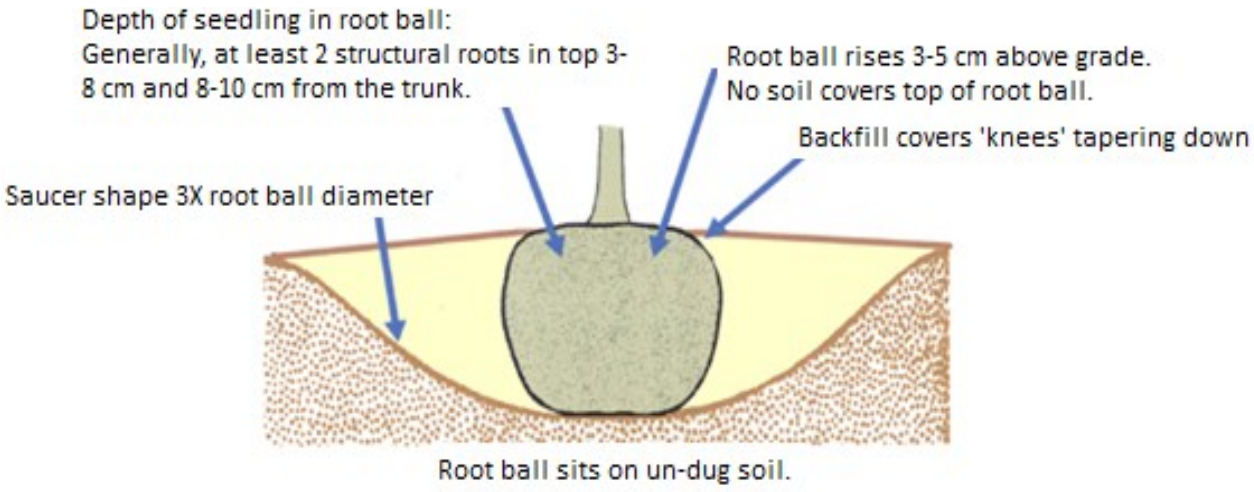
5. Measure the hole depth

- While preparing a hole for planting a seedling, it is generally important to measure the width and the depth of the hole.

In digging, measure the depth of the planting hole with a straight board (like rake handle) and a measuring tape.

Checking depth of root ball in planting hole with a straight board (like a rake handle).

Summary: Planting Hole Specifications



Planting hole criteria to promote rapid root establishment, reducing post-planting stress.

6. Set the tree into the hole.

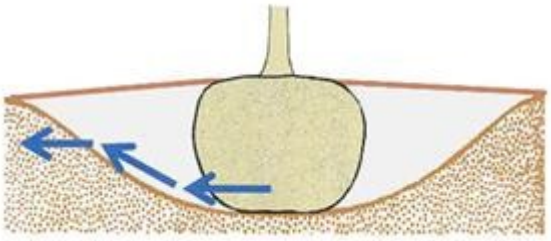
- Carry or roll the tree into the hole, making sure to support its upper branches.
- Stand it upright, then step back and look at the tree.

7. Prepare the root ball.

- If the root ball is enclosed in a plastic bag remove the plastic bag.
- Scratch at the soil around the ball; this helps loosen tightly packed soil and expose the tiny roots.

Generally, at least two structural roots should be found in the top 3-8 cm of soil, 8-10 cm out from the stem. Regarding the species related to trunk circling roots, the top structural root should be within the top one 3 cm of the root ball.

When roots cannot penetrate the site soil (due to low oxygen levels), the saucer-shaped planting hole directs the roots upward and outward into soils with higher oxygen levels.



8. Backfill the hole.

- Make sure you do not bury the structural root at the top (the root flare).
- When the hole is full, form a 15 cm high curb of soil around the seedling; this forms a crater to retain water.
- Fill the crater with water. Wait for the water to be absorbed by the soil, then knock down the curb.

Watering tree during planting; notice how soil has settled.

9. Water regularly or drip-irrigate.

♦ Spread 8 cm of mulch over the exposed dirt around the seedling. Be sure to keep the mulch away from the trunk where mulch can trap moisture and promote rot.

- Water the seedling every day for at least six weeks to give the roots enough time to become fully established. Or arrange the planting during the rainy season.

Trees that take in atmospheric CO_2 and release O_2 during the process of photosynthesis are necessary to reduce the pace of global warming. In addition to having aesthetic value, the significance of planting trees at a given locality or the whole nation include reducing the degree of soil erosion, increasing agricultural productivity, supplying resources for industrial and household activities, providing shelter, and serving as financial income resource. However, due to population pressure and increasing need of land for agricultural practices, Ethiopia's forest resource was reduced to about 3% from about 40% only during the last century. Therefore, there is no doubt on the necessity to grow trees in our country. Hence, it is the responsibility of every individual as a citizen of the country to participate in tree growing project in any form and contribute to solve the problem.

Assessment and follow up

You can assess your students:

- by evaluating the group report after discussion,
- by assessing their participation during the planning and execution of the tree growing project.

Answers to exercise 4.2

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

Answers to Review Questions

Part I: Multiple choices

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

Part II: Matching

11.	D	12.	G	13.	I	14.	B	15.	H

Part II: Matching

16.	N	17.	P	18.	M	19.	K	20.	L

Part III: Fill in the blanks

21. Photosynthesis
22. Woody, perennial and big
23. Snag

Part IV Give short answers

24. $CO_2 + H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Sugar} + O_2 + H_2O$

Photosynthesis is a cellular process during which plants absorb light energy with chlorophyll pigments and convert inorganic and low energy substances (CO_2 and H_2O) into high energy and organic substance (sugars)

25. Indigenous trees are important building, shades, firewood, medicines, foods (fruits) fodder to keep hives and prevent soil erosion.

Part V Word puzzle

Photosynthesis		
Raw material	**Additional energy source and site where it is done**	**Products**
Carbon dioxide	Chloroplast	Glucose
Water	Sun light	Oxygen

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UNIT 5 ANIMALS

Total Periods Allotted: 13 Periods

Unit overview

This unit explain the importance of caring for farm animals and their products. The methods of preparing and storing food and sheltering for farm animals are discussed.

In keeping farm animals the special care given to pregnant animals and their young are included. Finally some common diseases of farm animals including the causes, symptoms, transmission and prevention are explored.

Activities and key terms should be given attention as this will assist to grasp the main points in the unit. This unit is dealt as one sub unit. The teacher should follow the sequence of contents stated here and in the student textbook in the context of the community in which the school is found. Farm animals kept by Ethiopian farmers should be discussed with special attention to the dominant type of farm animals in the community where the school is found.

Unit outcomes

After completing this unit, students will be able to:

- *explain the importance of caring for farm animals, list down their products, and state the methods of preparing and storing food and sheltering for farm animals*
- *compare the ruminant stomach with the human stomach and explain why farm animals regurgitate*
- *list the pregnancy periods of some farm animals and describe the special care given to their young*
- *explain the causes, symptoms, transmission and prevention of some common diseases of*
- *farm animals.*

Main Contents

5.1 KEEPING FARM ANIMALS

Periods allotted: 13 Periods

1. Competencies

At the end of this sub-unit, students will be able to:

- *explain the reasons for caring for farm animals*
- *list down the products of farm animals*
- *compare the ruminant stomach with the human stomach*
- *explain why farm animals regurgitate*
- *state the methods of preparing and storing food for farm animals*
- *state the methods of sheltering farm animals*
- *list the pregnancy periods of some farm animals*
- *describe the special care given to young farm animals*
- *state some of the symptoms seen on sick farm animals*
- *name some common diseases of farm animals*
- *explain the causes, symptoms, transmission and prevention of some common diseases of farm animals*

2. Sub-unit Overview

This unit is presented as one section and the teacher should divide it into lessons as appropriate to deal with the following contents.

- The reasons for caring for farm animals, and products of farm animals
- Feeding (the ruminant stomach and regurgitation) farm animals, preparing and storing food (silage hay, fodder) for farm animals, and sheltering farm animals
- Pregnancy periods (cattle, sheep, goats, camels, horse, donkey), Care for pregnant farm animals, Care for young farm animals
- Common diseases of farm animals (liver fluke, anthrax, trypanosomiasis) - causes, symptoms, transmission and prevention.

3. Forward planning

Prepare lesson plan, Arrange for observation sites when applicable, Prepare insect collection apparatus, charts and drawings should be prepared.

4. Suggested Learning-Teaching Approach

4.1 Teaching aids

Pictures of various farm animals, animal's products, functions

4.2. Teaching Methods

Brainstorming on farm animals carrying products, preparing food, sheltering, pregnancy and common diseases.

Discussion on farm animals carrying, products, feeding, preparing and storing feeds, sheltering, pregnancy period and common diseases.

Reflection on care and products of farm animals.

Exercise(Group or individual) on pregnancy periods and care for pregnant and young animals.

Guided reading on common diseases of farm animals.

4.3 Suggested Presentation Approach

This section should be dealt in the context of the community in which students are living. Questions and answer can be used to introduce what farm animals are, why farmers keep and take care of them, and what product and services are provided by different farm animals.

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Using farm animals	
SA	Students brainstorm the list of names of farm animals from their locality.
MA	Students discuss why farm animals are kept in the community. Students work on activity 5.1 and discuss on the subject in class.
CA	Students summarize their discussion and present it to their class.
Feeding farm animals	
SA	Students read page 103 – 105 and carefully observe Figure 5.3 and 5.5.
MA	Based on their reading and observation of Figure 5.3 and 5.5, students explain in groups the stomach of ruminants.
CA	Students summarize their activity by drawing the stomach of a cattle and labeling it.
Comparing ruminant's and human stomach (Activity 5.2)	
SA	Students tell the parts of ruminant's stomach and from their previous knowledge the stomach of human.
MA	Students compare the stomach of ruminant's to that of human's. If possible they may observe stomach of cattle's, sheep or goat from nearby abattoir.

CA	Students summarize their comparison in the form of a table and submit to their teacher. They draw stomach of cattle and human and label them.
Hay and silage?	
SA	Students brainstorm on possible feed types provided farm animals. They can read page 106 – 108.
MA	Students discuss on how hay and silage are prepared.
CA	Students summarize their discussion by listing down the major steps for preparation of hay and silage.
Visiting the nearby agricultural center or animal farm (Activity 5.3)	
SA	Students recall the types feeds given to farm animals.
MA	Students visit the nearby agricultural center or animal farm center and collect pieces of information on types of farm animal feeds, how farm animals are fed, locally available types of feeds and on how to prepare farm animal feeds.
CA	Students submit their report to their teacher on individual bases. They need to include in their report on how they incourage the community to make hay or silage.
Storing feeds for farm animals	
SA	Students brainstorm on types of feeds prepared for farm animals and on how to store them for sometimes.
MA	Students in group discuss on how to store feeds for animals.
CA	Students summarize their discussion by listing down means or ways of storing feeds prepared for farm animals sometime.
Pregnancy of farm animals	
SA	Students brainstorm on the pregnancy of farm animals.
MA	Students discuss in groups on pregnancy of farm animals and work on Activity 5.4. Students may use table 5.3 during their discussion.
CA	Students summarize their discussion in a table form as table 5.3.
Caring for farm animals	
SA	Student tell from their previous experiences cares to be given for farm animals.
MA	Student discuss in groups on reasons for caring for farm animals.
CA	Students summarize their discussion by listing down the reasons for caring for farm animals and types of care to be provided to farm animals.
Caring for pregnant and young farm animals	
SA	Students brainstorm on why the needs to care for the pregnant and young farm animals. Student read page 109 – 111.

<table>
<tr><td>MA</td><td>Students discuss in groups the types of cares to be given for pregnant and young farm animals.</td></tr>
<tr><td>CA</td><td>Students summarize their discussion by listing down the cares to be exercised for pregnant and young farm animals. They present their list to the class.</td></tr>
<tr><td colspan="2">Visiting and identifying the feeding and sheltering of young farm animals</td></tr>
<tr><td>SA</td><td>Students tell the feed type and the shelter of young farm animals from their experience.</td></tr>
<tr><td>MA</td><td>Students report their visit of a nearby farm that they carried out in activity 5.5 previously.</td></tr>
<tr><td>CA</td><td>Students identify the feed type and kind of shelter of young farm animals. Also, students include in their summary the age at which a calf stop sucking milk.</td></tr>
<tr><td colspan="2">Visiting a nearby poultry farm (Activity 5.6)</td></tr>
<tr><td>SA</td><td>Students brainstorm how to keep chicken and read page 112 – 113.</td></tr>
<tr><td>MA</td><td>Students visit in groups the nearby poultry farm or agricultural center and carry out activity 5.6.</td></tr>
<tr><td>CA</td><td>Students write a report.</td></tr>
<tr><td colspan="2">Common farm animal diseases</td></tr>
<tr><td>SA</td><td>Students brainstorm disease of farm animals and read page 113 – 115.</td></tr>
<tr><td>MA</td><td>Students in groups examine different diseases of farm animals that are indicated on page 113 – 115.</td></tr>
<tr><td>CA</td><td>Students summarize transmissible diseases of farm animals in the form of a table as indicated below.
<table>
<tr><th>Disease type</th><th>The agent that causes the disease</th><th>Main symptoms of the disease</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td colspan="2">Common disease of farm animals (transmission and control)</td></tr>
<tr><td>SA</td><td>Students recall the previous lesson related to diseases of farm animals.</td></tr>
<tr><td>MA</td><td>Students read related books in the library regarding the transmission of liver fluke, Anthrax and trypanosomiasis and controlling methods. They carry out activity 5.7.</td></tr>
<tr><td>CA</td><td>Students complete the table given in activity 5.7.</td></tr>
</table>

Additional notes are included on same aspects of the unit to assist & instruction.

The ruminant stomach

Cattle are ruminants, meaning that they have a digestive system that allows use of otherwise indigestible foods by regurgitating and re-chewing them as "cud". The cud is then re-swallowed and further digested by specialized microorganisms in the rumen.

These microbes are primarily responsible for decomposing cellulose and other carbohydrates into volatile fatty acids that cattle use as their primary metabolic fuel. The microbes inside the rumen are also able to synthesize amino acids from non-protein nitrogenous sources, such as urea and ammonia.

As these microbes reproduce in the rumen, older generations die and their carcasses continue on through the digestive tract. These carcasses are then partially digested by the cattle, allowing them to gain a high quality protein source. These features allow cattle to thrive on grasses and other vegetation.

Feeding farm animals

Forage

Forage *is plant material (mainly plant leaves and stems) eaten by grazing livestock.*

Historically the term forage has meant only plants eaten by the animals directly as pasture, crop residue, or immature cereal crops, but it is also used more loosely to include similar plants cut for **fodder** and carried to the animals, especially as **hay or silage**.

Plants used for forage include:

Grasses

Herbaceous Legumes

- Alfalfa or legumes
- Bird's-foot trefoil
- Clovers

Tree Legumes – used to prepare silage

- Corn (maize)
- Alfalfa
- Grass-legume mix
- Sorghums
- Oats

Crop residue

- Sorghum
- Corn (maize) Stover
- Soybean Stover

Feeding hay

Hay is usually fed to an animal in place of allowing the animal to graze on grasses in a pasture, particularly in the winter or during times when drought or other conditions make pasture unavailable.

Animals that can eat hay vary in the types of grasses suitable for consumption, the ways they consume hay, and how they digest it. Therefore, different types of animals require hay that consists of similar plants to what they would eat while grazing, and likewise, plants that are toxic to an animal in pasture are also toxic if they are dried into hay.

One of the most significant differences in hay digestion is between ruminant animals, such as cattle and sheep; and nonruminant, hindgut fermentors, such as horses.

Both types of animals can digest cellulose in grass and hay, but do so by different mechanisms.

Because of the four-chambered stomach of cattle, they are often able to break down older forage and have more tolerance of mold and changes in diet.

The single-chambered stomach and cecum or "hindgut" of the horse uses bacterial processes to break down cellulose that are more sensitive to changes in feeds and the presence of mold or other toxins, requiring horses to be fed hay of more consistent type and quality.

Making and transporting hay

Hay production and harvest, known as "making hay", "haymaking", or "doing hay," involves a multiple step process:

- Cutting,
- Drying or "curing,"
- Processing, and
- Storing

Whether done by hand or by modern mechanized equipment, tall grass and legumes at the proper stage of maturity must be cut, then allowed to dry (preferably by the sun),

then raked into long, narrow piles known as windrows.

Next, the cured hay is gathered up in some form (usually by some type of baling process) and placed for storage into a haystack or into a barn or shed to protect it from moisture and rot.

During the drying period, which can take several days, the process is usually speeded up by turning the cut hay over with a hay rake or spreading it out with a tedder.

Once hay is cut, dried and raked into windrows, it is usually gathered into bales or bundles, then hauled to a central location for storage.

Hay stored outside must be stacked in such a way that moisture contact is minimal.

Hay is also stored under a roof when resources permit.

It is frequently placed inside sheds, or stacked inside of a barn.

On the other hand, care must also be taken that hay is never exposed to any possible source of heat or flame, as dry hay and the dust it produces are highly flammable.

Making silage

Introduce the term silage and ask students what they know about it. Let them discuss how silage is prepared and its importance in feeding farm animals. If there is no experience of using silage in their area, make an outline of its preparation and conduct discussions.

Let you organize students to conduct activity 5.3 in groups. Follow up and assist them.

Silage must be made from plant material with suitable moisture content, about 50% to 60%, depending on the means of storage, the degree of compression, and the amount of water that will be lost in storage.

For corn (maize), harvest begins when the whole-plant moisture is at a suitable level. For pasture-type crops, the grass is mowed and allowed to wilt for a day or so until the moisture content drops to a suitable level.

The plant material is collected, chopped into pieces about 0.5 in (1.3 cm) long packed and fed into a stationary machine called” silo filler" that would chop the stalks and blow them up a narrow tube to the top of a tower silo.

Current technology uses mechanical forage harvesters that collect and chop the plant material, and deposit it on trucks or wagons.

These forage harvesters can be either tractor-drawn or self-propelled. Harvesters blow the silage onto the wagon via a chute at the rear or side of the machine.

Silage may also be emptied into a bagger, which puts the silage into a large plastic bag that is laid out on the ground.

Silage is placed in large heaps on the ground and rolled to push out the air, then wrapped in plastic covers.

The silo or "pit" is often a bunker built into the side of a bank, usually made out of concrete or old wooden railroad ties (railway sleepers).

The chopped grass can then be dumped in at the top, to be drawn from the bottom in winter.

This requires considerable effort to compress the stack in the silo to cure it properly.

Again the pit is covered with plastic sheet and weighed down with tires.

The grass or other forage is cut and partly dried until it contains 30–40% moisture (much drier than bulk silage, but too damp to be stored as dry hay).

It is then made into large bales which are wrapped tightly in plastic to exclude air.

The plastic may wrap the whole of each cylindrical or cuboid bale, or be wrapped around only the curved sides of a cylindrical bale, leaving the ends uncovered.

In this case, the bales are placed tightly end to end on the ground, making a long continuous "sausage" of silage, often at the side of a field.

The wrapping may be performed by a bale wrapper, while the baled silage is handled using a front-loader, either impaling the bale on a spike, or by using a special grab. Holes made by a spike are re-sealed to avoid spoilage.

Fermentation

Silage undergoes anaerobic fermentation, which starts about 48 hours after the silo is filled.

In the past, the fermentation was conducted by indigenous microorganisms, but, today, some bulk silage is inoculated with specific microorganisms to speed fermentation or improve the resulting silage.

The process converts sugars to acids and exhausts any oxygen present in the crop material. Fermentation is essentially complete after about two weeks.

Silage inoculants contain one or more strains of lactic acid bacteria, and the most common is *Lactobacillus plantarum*.

Other bacteria used in inoculants include *Lactobacillus buchneri*, *Enterococcus faecium* and *Pediococcus* species.

Figure 5.1 Modern fermentation tank used to prepare silage.

Storing silage

Silage must be firmly packed to minimize the oxygen content, or it will spoil. Four major stages silage goes through in a silo:

- Presealing, which, after the first few days after filling a silo, enables some respiration and some dry matter (DM) loss, but stops.
- Fermentation, which occurs over a few weeks; pH drops; there is more DM loss, but hemicellulos is broken down; aerobic respiration stops.
- Infiltration, which enables some oxygen infiltration, allowing for limited microbial respiration; available carbohydrates (CHOs) are lost as heat and gas.
    - Emptying, which exposes surface, causing additional loss; rate of loss increases.
    - Silage underneath plastic sheeting, held down by scrap tires. Concrete beneath the silage prevents liquor leaching out.

Animals Diseases

Anthrax

Anthrax, caused by *Bacillus anthracis*, is world-wide and is characterized by sudden death with black tar-like exudates from natural orifices.

Following incubation of 1-2 weeks, muscle tremors, mucosal congestion and fever may precede collapse and terminal convulsions followed by the dark bloody discharge.

In less acute cases, listlessness, haemorrhage of the mucosa membranes, abortion, swelling of the perineum, throat and abdomen can last for about 2 days.

Sudden death of animals in the area of known outbreaks is cause for suspicion of anthrax.

The soil around an infected carcass becomes heavily infected with spores which can remain viable for re-infection for 20 years.

Carnivores readily spread the spores to forage in the surrounding area.

Although antibiotics are effective in the treatment of anthrax, the usually rapid course of the disease limits their effectiveness.

When confirmed, stringent regulations prescribe burying carcasses at 2 meters or complete burning and quarantine of the area for 6 months.

Vaccination of cattle in areas of known outbreaks is recommended for three successive years.

Vector control consists of two practical interventions, trapping and spraying the Tsetse fly.

Traps constructed of black cloth with a blue centre were found to be attractive to the flies. These are placed near the corals where dung and urine also attract the flies.

Insecticide baited jars are placed at the centre of the trap to dispose of those which enter.

Also animals are treated to discourage flies by spraying or pouring on insecticides.

Clearing of brush and trees destroys the flies' habitat in the highland but can hardly be encouraged on a large scale for environmental reasons.

Faciolasis

The liver fluke, *Fasciola hepatica* mainly in sheep and *Fasciolagigantica* mainly in cattle, causing the disease called Fascioliasis

The liver fluke inhabit the bile duct or intestine

Fasciola hepatica cause damage to the liver which is characterized by anaemia, jaundice and swelling of the liver.

Each mature fluke develops into many eggs in the intestine which are then passed in the droppings. A ***miracidium*** develops which penetrates the snail and multiplies 7-9 weeks in the snail before developing into ***cercariae*** **encysting** on grasses where the cattle graze. **Cysts** ingested take 10 weeks to mature in the intestine.

There are a number of drugs **to treat liver flukes** which are administered either as a **drench** (forcible swallowing) or intramuscularly. Because of the remarkably prolific breeding habits of the snail and the number of cercariae which may be carried by one snail it is impractical to try to eliminate the snail or the disease.

Assessment

You should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day

This can be done by continuously following their performance, class activity, practice, and review questions.

Assist students with low performance and encourage those with good performance.

Answers to Exercise 5.1

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

Answers to Review Questions on Unit 5

Part I: Multiple choices

1.	B	2.	C	3.	A	4.	B	5.	C
6.	A	7.	C	8.	A	9.	C	10.	C
11.	B	12.	D	13.	D	14.	A	15.	C

Part II: Short answers

16. See table 5.2 in the student textbook.
17. Stage is fermented high moisture fodder that can be fed to ruminants.
18. Anthrax is a disease of cattle caused by bacteria.
19. The signs of sick animals include loss of appetite, lack of strength and energy, and unusual behavior.
20. Farm animals can be used for sloughing, thrashing, and transporting yield. Their manure can be used as fertilizer.

Part III: Matching

21.	A, B, E	22.	A, B, D	23.	A, B, C, E
24.	B	25.	A, B, D, E		

Part IV: Fill in the blanks

26. Camel 27. Rumen 28. Pregnancy

29. Hay and Silage

Part V: Word Puzzle

A	N	T	H	R	A	X							
			E				P	O	U	L	T	R	Y
			R					M				U	
			B		F	O	R	A	G	E		M	
			I					S				E	
	C		V					U				N	
	A	B	O	M	A	S	U	M	C				
	R		R						A				
	N												
	I								E				
	V								L				
	O												
	R	E	T	I	C	U	L	U	M				
	E												

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Encarta premium 2009 DVD

en.wikipedia.org/wiki/cattle_feeding

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UNIT 6 ENVIRONMENT

Total Period Allotted: 18 periods

Unit overview

The first sub-unit is a continuation of the previous grade of the same unit by defining ecosystem and its attributes.

The first subunit focuses on a broader concept of environment. Students are expected to define ecosystem, types of ecosystem and how organisms are adapted to different types of ecosystems.

The second subunit focuses on the biological associations, which are common within an ecosystem. Students should know and differentiate the different types of biological associations using examples.

The third and the last subunit of this unit describes the two main (nonliving) physical factors of an ecosystem. i.e. soil and water. The first part of this subunit deals on how soil is formed, its types and how it can be depleted (eroded) due to natural and manmade problems. Lastly the first part concludes on how to deal about conservation of the natural resources particularly on soil conservation methods. The second part of the physical factor of the ecosystem deals with water, its importance for living organisms, its cycle in the ecosystem and how to be concerned to conserve as a natural resource.

The organization of each subunit starts with unit objective, brief overview on facts and definitions through active student-teacher interaction. Each subunit is designed with discussion and activities so that effective learning can take place. At the end of each subunit there are review questions that help to evaluate the learning objectives, against the minimum learning competencies that students are expected to achieve.

Unit outcomes

After completing this unit, students will be able to:

- *define ecosystem, give examples of ecosystems, distinguish between them, and explain the adaptations of plants and animals to each ecosystem;*
- *list some types of biological association, explain them and give examples of organisms for each type;*

- *describe soil as a physical factor of the ecosystem, explain how it is formed, and explain its different types;*
- *describe the causes and methods of prevention of soil erosion;*
- *investigate the water humus and air contents of soil and particle size and water retention through simple experiments;*
- *describe water as a physical factor of the ecosystem;*
- *state the importance of water, explain the water cycle and describe the methods of conservation.*

Main Contents

Planning for the Unit

The unit requires the teacher to assess the environment for appropriate group work and field work around the school environment and/or village before the session starts depending on the specific need of the sessions.

6.1 ECOSYSTEM

Period allotted: 3 periods

1. Competencies

After completing this sub unit, students will be able to:

- *define ecosystem;*
- *distinguish between forest, grassland, desert and aquatic ecosystems;*
- *explain the adaptations of plants and animals to each ecosystem;*

2. Sub-unit overview

This subunit familiarizes students with the definition of an ecosystem, its attributes like the aquatic and terrestrial ecosystem and its scope with examples. Furthermore, the student will explain the adaptations of plants and animals to each ecosystem.

Students could research the conditions in other ecosystems. Students could be given information on unknown animals and plants, and be asked to suggest what conditions the animal or plant is adapted to.

3. Forward Planning

In each subunit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach.

4. Suggested Teaching - Learning Approaches

4.1 Suggested Teaching Aids

You should demonstrate with pictures and diagrams related to the topic such as types of ecosystems.

4.2 Suggested teaching methods

- Brainstorm on habitat species, community and population.
- Discussions on the biotic and abiotic components of the environment.
- Reflection on the size, scope and types of ecosystem.

4.3 Presentation of the lesson

Facilitate group discussion on the following question:

- Do you remember the term habitat?
- The difference between aquatic and terrestrial habitat?
- What is the definition given for the following terms: environment, habitat, species, population and community?
- Have you heard about the term ecosystem?

Take few minute to listen from the students and reflect based on their response.

SA = Starter Activity MA= Main Activity CA= Concluding Activity	
What is Ecosystem? (Activity 6.1)	
SA	Students recap on the previous grade of the same chapter: Environment; habitat, species, population and community. Let students brainstorm how these living species interrelate with nonliving things within an environment.
MA	Students discuss to identify the abiotic (living) and abiotic (nonliving) systems and how they do interact within an ecosystem. students carry out activity 6.1 based on the procedures given on the student text and reflect on the findings of the activity
CA	Students summarize the abiotic and biotic components of an ecosystem.

How big is an Ecosystem? (Activity 6.2)	
SA	Students recapitulate the definition and types so that they can imagine the size and types of an ecosystem.
MA	Students discuss on the size and scope of an ecosystem both in the case of aquatic and terrestrial ecosystem. Students carry out activity 6.2 using the procedures given on the student text. The teacher facilitates as students trying to differentiate the abiotic and abiotic factors of an ecosystem.
CA	Students make notes on the categories of the abiotic factors.
Types of ecosystem?	
SA	Recap the previous session with brainstorming questions.
MA	Students discuss on the types of ecosystems such as forest, grass land, desert, freshwater and marine ecosystem using pictorial representation and the explanation given on table 6.1
CA	Students make notes on the types of ecosystems.

From the group discussions and the lectures summarize the concepts how the living and nonliving things interact one another.

Summarize on the unit objectives based on the topic:

- An ecosystem is a complex relationship among the living resources, habitats, and residents of an area. It includes all of the living things in an area, plus their surroundings, plus all the ways in which they interact with each other.
- Differences between aquatic and terrestrial ecosystem
- The scope and differences between the various types of ecosystems, such as forest, grassland, desert and aquatic ecosystems.
- Living organisms adapt to a given ecosystem through time, if not they will die out.

Assessment

The students should further study about the concept of ecosystem by taking extra assignment. Let students take assignment Exercise 6.1.

Answers to Exercise 6.1

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

6.2 BIOLOGICAL ASSOCIATIONS

Period allotted: 3 periods

1. Competencies

After completing this sub unit, students will be able to:

- *list some types of biological association;*
- *explain the types of biological association listed; and*
- *give examples of organisms for each type of biological association.*

2. Sub-unit overview

This subunit familiarizes students with the different types of biological associations among living organisms within the ecosystem.

All living organisms are directly or indirectly related. Some relationships are helpful and some are harmful for existence. In some relationships one organism provides food and/or a habitat for another. The general biological term for such types of biological association is called symbiosis. In this subunit, the student will identify and sort out the different types of biological associations within the ecosystem.

Students will make mini researches on the various types of biological associations based on the planned group activities.

Sometimes a symbiotic relationship benefits both species, sometimes one species benefits at the other's expense, and in other cases neither species benefits.

3. Forward Planning

In each subunit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach.

4. Suggested Learning-Teaching Approaches

4.1 Suggested Teaching Aids

1. The teacher should get the different pictures and diagrams on the subunit. (or an large the diagrams shown in the student text)
2. Fresh specimens for laboratory experiment

4.2 Suggested teaching methods

- Brainstorm on biological associations.
- Facilitate laboratory experiments for activity 6.3
- Facilitate group discussions and laboratory experiments on parasites

4.3 Presentation of the lesson

Start the session by defining the term symbiosis.

All living organisms are directly or indirectly related. Some relationships are helpful and some are harmful. In some relationships one organism provides food and/or a habitat for another. The general biological term for such types of biological association is called **symbiosis.**

Sometimes a symbiotic relationship benefits both species, sometimes one species benefits at the other's expense, and in other cases neither species benefits.

SA = Starter Activity MA= Main Activity CA= Concluding Activity	
What are Biological Associations?	
SA	Brainstorming on questions related to biological associations based on the observation in their environment. Facilitate discussion to sort out the association are either between animal to animal or animal to plants and identify the relationship whether it is helpful or harmful.
MA	Students identify the types of biological associations and define symbiosis. Students list out the different types of biological associations and examine either of parasitism, Predation, Mutualism and Commensalism.
CA	The teacher helps the students to explain and distinguish ecological terms of biological relationships: Parasitism (+,-), predation (+,-), Mutualism (+, +), Commensalism (0, +).
What is Parasitism and Predation? (Activity 6.3 and 6.4)	
SA	Students define parasitism and predation in their own terms. List out examples for each type of biological association and their characteristics.
MA	Examine the similarity and difference between parasitism and predation. Students required to carry of activity 6.3 and activity 6.4 to know more about the characteristic difference between parasitism and predation
CA	Students distinguish between parasitism and predation.
What is Mutualism and Commensalism?	
SA	Students try to figure out what mutualism and commensalism looks like based on the figures shown on the student text book and list out the characteristics of each type of biological associations.

MA	Students define and identify the characteristic difference between mutualism and commensalism and give additional examples for each types of association. Students required carrying out activity 6.5 and discussing on other types of biological associations such as decomposers and scavengers.
CA	Students differentiate between mutualism and commensalism.

Additional Notes

A. Parasitism: A symbiotic relationship between organisms of different species in which one organism benefits while the other is harmed. It is an association of a parasite and its host. The parasite lives in or on the body of a single host individual during its development and eventually kills the host.

Parasites are classified into ectoparasites and endoparasites depending on where they are living either externally or internally.

- Bugs, ticks, fleas are parasites that live on the surface of their host and are known as **ectoparasites.**
- Tapeworm, ascaris, amoeba are parasites that live inside the bodies of their hosts and are known as **endoparasites.**

Tape worm is one of the intestinal parasites (endoparasites) that lives in pigs, cows and even humans. A tapeworm gets into its host by laying its eggs in the host's food source. The host eats this food, and the eggs develop and grow into tapeworms, which attach themselves to the intestines of their host. Tapeworm feed of the food that the host eats, and sometimes a tapeworm has been known to live in a human for ten years without being detected. The tapeworm has a safe, warm home and a constant food source, but the host does not benefit from the relationship. In some rare cases, the tapeworm can make the host sick or even cause death.

Give example of ectoparasites and endoparasites.

- Bugs, ticks, fleas are parasites who live on the surface of their host are known as ectoparasite
- Tapeworm, ascaris, amoeba are parasites that live inside the bodies of their hosts are known as endoparasites.

Parasites are adapted to attach themselves and pierce the skin of their host for food. Eg. A tapeworm attaches itself to the intestine of the host through a head, with suckers or hooks, called.

Answer for Activity 6.3

1. Parasites enter into human body mainly through the mouth and through the skin.
   - ♦ Through the mouth; if a man eats using unwashed hand the eggs of the parasite might be eaten together with the food.
   - ♦ Eating raw meat also is a cause for tapeworm to enter into the human intestine.
   - ♦ In the case of hookworm, if a man walks on its bare foot, the worm can penetrate the skin and enter into the blood stream
2. Food and Shelter
3. Through hygiene and sanitation
4. Parasites can shorten the life of its host unless early treated and get rid of the parasites from the host's body. This requires going to the nearby medical center and getting proper diagnosis of the parasite by taking the necessary laboratory test and takes the necessary medication. Taking medicine without proper medication can bring a serious effect on the host than the parasite. It is not advised to take medicine without proper medication.

B. **Predation:** is the process by which one animal, the predator, kills and feeds on another animal, the prey.

- ❖ **Parasitism:** The symbiotic relationship between two organisms where one species, the parasite, benefits, but the other, the host, is harmed. If the parasite kills the host it endangers its own survival.
- ❖ **Predation:** It is the process by which one animal, the predator, kills and feeds on another animal, the prey.
- ❖ **Mutualism:** A symbiotic relationship between organisms of different species in which both organisms benefit.
- ❖ **Commensalisms:** one of the forms of symbiosis. In this case, one organism benefits and the other is not affected.

1. Example of predator prey relationship
   a. Fox (predator) and domestic animals (prey).
   b. Tigers (predator) and Gazzel (prey).
2. The characteristics between the predator and prey
   a. The predator always take advantage by killing its prey for food and territory control.
   b. The prey is the victim of the relationship and always try to hide itself from its predator.
3. Usually the number of prey exceeds the number of its predator. Whenever the number of predators exceeds the number of preys there will be tough competition among predators for survival. If the number of prey is greater than their predators the competition for food becomes less.

4. The predators are much strong to attack their prey and developed sharp teeth and claws and the prey are usually fast runners to escape from their prey.

Additional Notes

C. Mutualism is a form of symbiosis where two organisms mutually affect each other in beneficial ways.

Such relationships could be:

- Animal-animal relationship e.g. Crocodile and bird
- Animal-plant relationship e.g. Insects and flowers
- Plant to plant relationship e.g. Lichens (association between algae and fungi)
- Microorganisms and animals or plants: This could be further seen as the mutual relationship between micro-organisms that live in the alimentary canal of herbivorous mammals and break down cellulose, which help the herbivores during digestion through regurgitation.
- Nitrogen-fixing bacteria which live in root nodules of leguminous plants.

During mutualism, organisms get the different types of benefits depending on the need and nature of the relationship. For instance in the case of Fig 7 showing a crocodile and a bird in the student's book (*The Egyptian Plover bird and the crocodile*) have a mutual relationship. The bird gets food while the crocodile gets its teeth cleaned and get relief of its pain. In the case of insects and flowers, insects get food while flowers get the opportunity to move and reproduce with another flower using insects' feet.

Animal-plant relationships

***Mutualism among Animal-animal relationships*: when** Crocodiles get food stuck in their teeth and feel the need for a good tooth cleaning they will sit with their mouth wide open. Birds recognize the invitation, and if one is nearby it will fly into the mouth of the crocodile, eat the food stuck in the crocodiles teeth, and fly away. The plover gets a meal and the crocodile gets a valuable tooth cleaning: **they both benefit.**

Microorganisms and animals or plants: This could be further seen in the mutual relationship between micro-organisms that live in the alimentary canal of herbivorous mammals that break down cellulose, which helps the herbivores during digestion through regurgitation.

Summarize the different types of biological relationships, symbiosis using the table shown below

- Symbiosis: is a biological association between two organisms or species within a habitat. The relationship could be helpful or harmful.

- Some of the major types of biological associations are parasitism, predation, mutualism, and commensalism.

Try to summarize biological associations as shown in the following table:-

Type of association	Characteristics
Mutualism (+, +)	♦ both species benefit
Commensalism (0, +)	♦ one species benefits, the other is unaffected
Parasitism (-, +)	♦ one species benefits, the other is harmed
Competition (-, -)	♦ neither species benefits
Neutralism (Ø,Ø)	♦ both species are unaffected

4.4 Assessment and follow-up

The student should be evaluated in continuous assessment method based on the objectives set. The teacher should observe students during group discussion and encourage all to participate during the discussion.

Reward and praise for active participation and provide assistance for the slow learners, accordingly.

Answers to Exercise 6.2

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

6.3 PHYSICAL FACTORS OF THE ECOSYSTEM

Period allotted: 12 periods

1. Competencies

After completing this sub unit, students will be able to:

- *describe soil as a physical factor of the ecosystem;*
- *explain how soil is formed;*
- *explain the different types of soil;*
- *describe the causes of soil erosion;*
- *describe the methods of prevention of soil erosion;*
- *investigate different characteristics of soil using simple experiments;*
- *describe water as a physical factor of the ecosystem;*
- *state the importance of water;*
- *explain the water cycle with the help of a diagram; and*
- *describe the methods of conservation of water.*

2. Sub-unit overview

This subunit is designed to familiarize students on the physical factor of the ecosystem particularly on soil and water. The subunit is designed to provide knowledge and skills by describing what soil is all about, its importance for the existence of living organisms and how soil is formed. Furthermore, the subunit describes the different types of soil suitable for agriculture and some other purposes. It also discusses the causes of erosion and the methods to prevent soil erosion. The second part of this subunit focuses on the importance of water, how it is cycled and introduces the methods of water conservation.

3. Forward Planning

In each subunit the teacher is expected to develop a daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach.

4. Suggested Learning-Teaching Approaches

4.1 Suggested Teaching Aids

Diagrams and pictures showed in the students book, and (field) site visits to look at topography and soil type within the environment and sample of soil type, tools to demonstrate on soil erosion.

4.2 Suggested teaching methods

- Brainstorm on soil formation and water cycle.
- Discussion on the formation of soil, soil erosion, soil conservation, importance of water and water conservation.
- Discovery on the characteristics of soil.

4.3 Presentation of the lesson

☑ Do you remember the non-living (abiotic) factors of an ecosystem? How did you define soil? What are the types of soil in your surrounding?

Soil is one of the nonliving (abiotic) physical factors that has a critical importance for living organisms. Identify its characteristics and importance which helps to maximize from the natural resource. Lack of proper understanding about the natural resource will have short term and long-term negative impacts on the overall ecosystem.

Soil is formed as a result of the interaction of the following five factors; Parent materials, climate, organisms, relief (topography), and time. Describe and elaborate the different factors that contribute to the formation of soil through examples.

Its formation is enhanced by various processes such as weathering, decomposition and humification, leaching and translocation.

Facilitate Group Activity: 6.6: Identifying types of soil.

SA = Starter Activity MA= Main Activity CA= Concluding Activity	
Soil and its importance	
SA	Students brainstorm on the biotic and abiotic factor of an ecosystem. Students mention soil and water as part of abiotic factors of an ecosystem.
MA	Students define soils in their own words. Students analyze the importance of soil and water for living organisms. Students discuss the importance of soil for living organisms. The soil provides a plant with stability as well as water and minerals essential for growth. Students know soil creates a habitat for living organisms.
CA	Students mention other abiotic factors that can contribute towards the balance in the ecosystem. Students mention other importance of soil from different profession perspective such as agriculture, engineering, construction… Summary of the key points will be given by the teacher.
Soil and its formation?	
SA	Students brainstorm how soil is formed and its importance to the ecosystem.
MA	Students discuss on the contributing factors of soil formation. Students using the figure 6.11 analyze on the contributing factors of soil formation. Students distinguish between factors and process of soil formation.
CA	Students review what soil is and how soil is formed.
Formation of soil (Activity 6.6)	
SA	Students arrange themselves in groups and summarize the concepts learned on soil formation.
MA	Students carry out activity 6.6 using the given procedure on the student text and fig 6.12
CA	Students summarize their finding and discuss on their findings
Types of soil	
SA	Students brainstorm and classify the different types of soils based on the observation from their environment
MA	Students discuss on the three main types of soil: sandy, loam and clay, and their characteristics. They discuss on the advantages and disadvantages of each type. Students carry out Activity 6.7 to identify types of soil based on the procedures.
CA	Students perform exercise 6.3 to evaluate their understanding on the lesson.

Soil Composition (Activity 6.8)	
SA	Students arrange themselves in groups to carry out activity 6.8, soil composition.
MA	Students investigate different characteristics of soil: water content, Humus content, particle size distribution, water retention...
CA	Students draw and label the different composition of soil from what they observed in the experiment.
Soil Erosion	
SA	Students discuss how plants are important to prevent soil depletion/erosion.
MA	Students discuss factors contributing to soil erosion which are related to natural and manmade factors. Students carry out activity 6.9 to demonstrate on how soil erosion works.
CA	Students summarize how rain washes top soil away and how this can be avoided by contour ploughing and terracing.
Soil Conservation	
SA	Students brainstorm the importance of soil conservation
MA	Students discuss means of soil conservation and their methodologies. Students distinguish the different types of soil conservation methods.
CA	Students summarize the key points by analyzing the cases how our country is applying the methods to prevent soil and how to apply the concept in their local villages.
Importance of water	
SA	Students identify water as one of the abiotic factors of the ecosystem.
MA	Students discuss the importance of water in the light of our daily use and economic growing of a country.
CA	Students list down examples on the importance of water.
Water cycle (Activity 6.10)	
SA	Students brainstorm how water cycles in an ecosystem.
MA	Students carry out activity 6.10. How water cycles in an ecosystem by analyzing figure 2.21 on the water cycle.
CA	Summarize of key terms related to water cycle and its process will be given by the teacher

Water Cycle (Activity 6.11)	
SA	Students recap on the previous session; water cycle by asking questions
MA	Students carry out activity 6.11, factors affecting the water flow to analyze the global distribution of water flow. Students relate the activity in the context of our country water distribution and its impact on its ecology.
CA	Students summarize the major events of the water cycle.
Water conservation	
SA	Students discuss on how to conserve natural resources, particularly on water conservation based on their own experiences.
MA	Students carry out group discussion on the points given on the students' text. Students list out the different types of methods used in water conservation and relate the concept in the light of our country effort towards water conservation.
CA	Students summarize the lesson by reflecting their individual commitment to conserve water.
Unit summary (Project)	
SA	Students plan a visit to places where soil is eroded and water is wasted.
MA	Students organize groups and identify places to be visited.
CA	Students present their plan to the class.

Additional Notes

Other types of soil included for additional information

1. **Calcareous or Chalky soil**

   Lacks humus and as much organic matter as possible should be added every year. It is more of a limestone in nature and they are more useful in production of chalk and limestone than agriculture.

   Peat soil: is derived from marsh land where there has been continuous growth and decay over thousands of years. It is free of limestone and has good humus content.

C. Composition of Soil

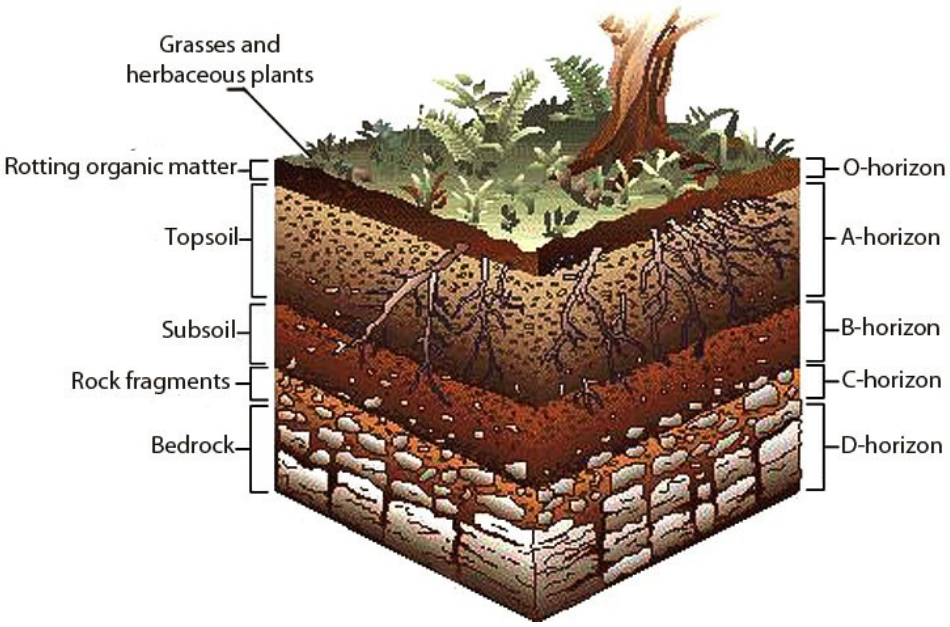
Facilitate activity 6.8: Soil composition

Learning Objectives: To identify soil composition.

Materials needed: Soil of different types, water, rocks, and water glass

Procedures: Follow the procedure 1 and 2 from the student text and help students do the experiment and see the results.

Have you noticed at construction sites that the ground excavated clearly demarks the different soil profiles as shown in Figure 6.13? Different people need the different layers of soil for different purposes. For example, agriculturalists are more interested on top soil, while engineers look for the parent material. Every type of soil has different profiles: a vertical section through the soil reveals layers known as horizons. Usually three main horizons, overlain by organic matter, can be seen.(See Figure 6.13).



The various parts of soil (soil profile)

Help them doing the experiment the following two questions

1. With reference to the figure 6.16 after 40 seconds measure the thickness of sediment. Call this A; after 30 minutes measure again and call this B; after 24 hours measure and call this C. Now, by subtraction, you can determine the thickness of the main layers: C-B = layer of clay, B-A = layer of silt, A = layer of gravel and sand. Using a sieve with 2 mm holes (less than 1/8 inches), you can separate the gravel from the sand and determine their ratio. On the basis of these data, calculate the content (%) of each component of the soil sample.
2. Investigate the different characteristics of soil

The amount of water content – by drying a known mass in an oven at 100 °C

- To calculate the percentage of water in a given soil sample, one has to get the following data:
- Weight of an evaporating dish
- Weight of dish + weight of soil before heating

- Weight of dish + weight of soil after heating

Percentage of water = Weight loss of water in soil x 100

Original weight of soil

The amount of humus content- by heating a known mass of dry soil on a tin lid with a Bunsen burner

- To calculate the amount of humus present in a given soil sample, we must get the above 3 data (a, b, and c). Thus,

Percentage of loss of humus in soil sample = Weight loss of humus in soil sample x 100

Original weight of soil sample

- Air content – by mixing 50 cm^3 of soil with 50 cm^3 of water and measuring the total volume.
- Particle size distribution –by passing a known volume of dry powdered soil through a series of sieves.
- Water retention –by timing how long it takes for water to pass down a column of soil.

These experiments could be carried out on a single type of soil or on different soils and the results for each soil compared.

Check the results based on the pictorial description given in the students book and explain that to the students.

C. Erosion of the soil

Erosion and the causes of it. Wind and rain are the main causes for erosion. Sometimes erosion may be caused due to land sliding (gravitical erosion). Students should know the types of erosion; Splash, sheet, rill and gully rill erosion, tunnel and wind erosion.

a. During rainy season due to heavy rainfall, there is a tendency of creation of floods that can infiltrate and wash top soil away from the land.

b. Wind erosion: wind also has the power to wash the soil from its original part into another area.

c. Gravitical erosion: in mass movement of soil – slides, slips, slumps, flows and landslides – gravity is the principal force acting to move surface materials such as soil and rock. This occurs when the weight of the surface material on the slope exceeds the restraining ability of that material.

Manmade factors such as inappropriate land use deforestation, overgrazing, improper land use, faulty farming systems, high crop intensity, housing construction, mining are some of the major reason for soil erosion.

D. Soil conservation: Management of soil from water and wind erosion control is based on sensible soil conservation practices. The majority of these practices are recognized components of good soil, crop, and water management.

For effective erosion control:

a. Maintain good soil structure

b. Protect the soil surface by adequate crop and residue cover, and

c. Use special structural erosion control practices where necessary.

While protecting and improving land investment, controlling soil erosion will:

- ♦ sustain or improve crop yields
- ♦ reduce drainage costs
- ♦ retain nutrients and chemicals where applied
- ♦ reduce hazards when working on eroding soil, and
- ♦ help improve water quality.

E. Describe the different methods of protecting soil erosion using diagrams and pictures:

- Explain the different methods used in soil conservation,
  - Planting trees (reforestation) and Crop residue cover,
  - Terracing,
  - Contour Ploughing, and
  - Crop rotation

F. Conservation of Water

Facilitate group discussion based on the points given below.

- Water is important for drinking (potable water), to grow crops needed for food, to provide a variety of aquatic habitats for plants and animals.
- Draw and label the water cycle to identify the different processes and stages of recycling water.

Water Conservation: The amount of water within any environment varies from season to season. During rainy season there is enough or excess amount of water available and

provides moisture to the ground and also flows into streams or rivers and joins pools, lakes or seas.

It is so important in an area where rainfall is scarce to conserve water using various conservation methods.

Facilitate discussion based on the discussion questions and reflect based on their response.

These are some ideas to conserve water. Now, let's look at what solutions are available on the market that could help you use less water.

Water Conservation Solutions / Products Available that Help the Cause

- Use water efficient taps. These taps turn off automatically when not in use.
- Buy appliances that are marked with water efficiency labels. These energy efficient machines use about half the amount of the water as standard appliances.
- Use water efficient showerheads.
- Install a dual flush toilet. ....more detail on this below.
- Install aerators, flow regulators, flow restrictors, and pressure-limiting valves to your taps. These measures will minimize the flow of water considerably.
- Purchase washing machines with front-load washing. These machines use much smaller amounts of water compared to the other machines.
- Keep your appliances at the recommended level to ensure greater efficiency.
- Don't use water to wash your car. Yes, you read that correctly. Find out about this innovative new product at Freedom Waterless and see how it works.
- Consider each of these points as a thank you to the planet. When individuals begin to take part in creating a healthier environment, the law of cause and effect will start to spread in a life-enhancing way.

Answers to Review Questions on Unit 6

Part I: Multiple Choices

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

Part II: Matching

11.	C	12.	C	13.	B	14.	A	15.	D

Part III: Fill in the blank space

19. Abiotic factors

20. Symbiosis

21. Organic detritus, water, clay, silt, and gravel

Part IV: Give short answer

1. Ecosystem is all the living organisms and non – living part of a specific area and their interaction and Ecology is a branch of biology that studies all life forms and their interactions with their environment.
2. Biological relationships /associations
   - predation: eg lion and goat
   - parasitism: tape worm and human being
   - mutualism: lichens (association between algae and fungi on a bark of a tree)
3. The major physical factors in a given ecosystem includes features of soil and water.

Part V: Word Puzzle

Across

1. Conservation
2. Ecologist
4. Ecosystem
7. Commensalism
9. Decomposition

Downward

3. Biology
5. Symbiosis
6. Mutualism
8. Ecology

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en.wikipedia.org/wiki/conservation

Minimum Learning Competencies

Area of Competency	*Minimum Learning Competencies*
Biology and technology	• Explain the contribution of biology for development • Explain the role of technological products for the progress of biological knowledge and skills and list at least seven technological products used in biology
Cell biology	• Use hand lenses and microscopes to observe unicellular organisms • Name amoeba, euglena, paramecium, bacteria and yeast as unicellular organisms and explain their structure, habitat, locomotion, modes of nutrition, reproduction and importance • Describe the levels of organization of multi cellular organisms with examples for each level
Human biology and health	• State the primary and secondary sexual characteristics in males and females • Label the structures of male and female reproductive organs on a given diagram and describe their functions • Describe the menstrual cycle using a simplified diagram and explain the cares that girls should take before and during menstruation • Define and explain the process of fertilization • Mention birth control pills and condoms as birth control methods and explain how they are used • Discuss STIs, AIDS, early marriage, FGM, abortion and rape as harmful practices and how to prevent them • Explain the causes, symptoms, modes of transmission and • prevention of tapeworm, TB, malaria, diarrhea, gonorrhea, syphilis and AIDS • Show the local, national and global distribution of HIV and AIDS using graphs and maps • Explain the impacts of HIV and AIDS on the society and show willingness to care and support to PLWHA • Demonstrate assertiveness, decision making and problem solving skills as life skills that help to prevent HIV and AIDS • Define immunity and describe natural and acquired immunity with examples • Explain the proper handling of medicines and the risks of depending on self prescription

	• Use the information found on medicine packs and leaflets properly • Explain the role of traditional medicines in the treatment and cure of diseases
Plants	• Define the term photosynthesis, explain its light and dark phases and give a summary reaction of photosynthesis • Confirm that plants produce food by photosynthesis by conducting a starch test on leaves that are exposed to light and leaves that are not • Demonstrate the steps followed in growing trees and in caring for them • Show concern for environment protection through participation in tree growing project • Explain the advantage of indigenous trees over exotic trees
Animals	• Explain the reasons for caring for farm animals and list down their products • Compare the ruminant stomach with the human stomach and explain why some farm animals regurgitate • State the modern ways of preparing and storing foods of farm animals and sheltering them • List the pregnancy periods of cattle, sheep, goats, camels, horse and donkey and describe the cares that should be taken for pregnant farm animals • Describe the special care given to young farm animals. • State some of the symptoms seen on sick farm animals • Mention liver fluke (gubet til), anthrax (aba senga), and trypanosomiasis (gendi) as common diseases of farm animals and explain their causes, symptoms, modes of transmission and prevention
Environment	• Define ecosystem and distinguish between ecosystems such as forests, grasslands, desert and aquatic using the climate and adaptations of plants and animals to each ecosystem • List and explain the different kinds of biological associations and give examples for each • Describe soil as physical factor of the ecosystem and explain its types, formation, erosion and conservation • Describe water as physical factor of the ecosystem and explain its importance, cycle, and conservation

GRADE 8 BIOLOGY SYLLABUS

Biology Grade 8

General Objectives of Grade 8 Biology

1. To develop understanding and acquire knowledge of:

- The role of technology in biology, technological products used in biology, functions of these technological products and the contribution of biology for development
- The structure, habitat , locomotion, nutrition, reproduction and importance of some unicellular organisms
- Types and functions of cells, tissues, organs, and systems and organism as the highest level of organization
- The reproductive structures, the primary and secondary sexual characteristics of males and females, and the process of fertilization
- Birth control methods and the effects and prevention of some common reproductive health problems
- The local, national and global distribution of hiv and aids, and its impacts in the society and express
- Photosynthesis, its light and dark phases and its summary equation
- The steps followed in growing trees and the advantages of indigenous trees over exotic trees
- The importance of caring for farm animals, their products, the methods of preparing and storing food and sheltering for farm animals
- The ruminant stomach and why farm animals regurgitate
- The pregnancy periods of some farm animals and the special care given to their young
- The causes, symptoms, transmission and prevention of some common diseases of farm animals
- Ecosystems, the differences between them, and the adaptations of plants and animals to each ecosystem
- Some types of biological association, examples of organisms for each type
- Soil as a physical factor of the ecosystem, how it is formed, its different types, and the causes and methods of prevention of soil erosion
- Water as a physical factor of the ecosystem, the importance of water, the water cycle and the methods of conservation of water

2. To develop skills and abilities of:

- Using a hand lens and a microscope to observe unicellular organisms
- Assertiveness, decision making, and problem solving skills as life skills that help to prevent HIV
- Conducting a simple experiment to confirm that plants produce food by photosynthesis
- Investigate the water, humus and air contents of soil and particle size and water retention through simple experiment

- Demonstrating the steps followed in growing trees and in caring for them as they grow

3. To develop the habit and attitude of:

- Curiosity, love, freedom, honesty, respect, co-operation, tolerance, humility, reasoning, and openness as values of learning biology as a science
- Willingness to give care and support to PLWHA
- Assertiveness, decision making, and problem solving skills as life skills that help to prevent hiv
- Willingness to participate in tree growing projects

Unit 1: Biology and technology *(7 periods)*

***Unit Outcomes*:** Students will be able to:

- explain biology's contribution to development
- explain the role of technology in biology, list some technological products used in biology and tell the functions of these technological products.

Competencies	*Contents*	*Suggested activities*
Students will be able to: • explain how biology contributes to our country's development	***1. Biology and technology*** **1.1 Biology for development** *(3 periods)* • Role of biology in community health, agriculture, food production and other areas	Students should identify and discuss the ways in which biology and areas related to biology have important roles within their community. These should include: • Health care – clinics, doctors, hospitals • Agriculture – use of agro-chemicals, selective breeding • Food production – provision of nutrients • Improvement of the environment – tree planting, conservation of wildlife, reduction of disease • Natural products – remedies, cosmetics Let the students research on the roles of biology for development by interviewing different people and offoces from their locality and present their findings to the class.
• explain the role of technology for the progress of biology • list at least seven technological products used in biology • tell the functions of some technological products used in biology	**1.2 Technological products used in biology** *(4 periods)* • Microscope, thermometer, binoculars, stethoscope, sphygmomanometer, incubator, refrigerator	Students should discuss how studies in biology are helped by a variety of technological devices. Students should make a list of such devices and explain how each is used. These should include: • Microscope and hand lens – to see detail beyond what is possible with the unaided eye • Thermometer – to measure temperature • Binoculars – to observe animals in the field • Stethoscope – to listen to the heart beat

Competencies	*Contents*	*Suggested activities*
		• Sphygmomanometer – to measure blood pressure • Incubator and water bath – to keep things at a constant temperature • Refrigerator – to keep chemicals and samples cool so they do not go off • Freezer – to store specimens • Balance – to measure mass Students should demonstrate that they are able to use a range of technological products by carrying out simple procedures such as: • Measuring the temperature of a sample of water • Measuring the mass of an organism • Observing a specimen under a microscope • Observing birds or other animals in the field • Measuring a person's heart rate • Measuring a person's blood pressure

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: explain biology's contribution to development; explain the role of technology in biology, list some technological products used in biology and tell the functions of these technological products.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Unit 2: Cell biology *(23 periods)*

***Unit Outcomes*:** Students will be able to:

- Use hand lenses and microscopes to observe unicellular organisms and name some unicellular organisms
- Describe the structure, habitat , locomotion, nutrition, reproduction and importance of some unicellular organisms
- Name different types of cells, tissues, organs, and systems and state their functions
- Describe organism as the highest level of organization.

Competencies	***Contents***	***Suggested activities***
Students will be able to: • Use hand lenses and microscopes to observe unicellular organisms • Name amoeba, paramecium, euglena, bacteria and yeast as unicellular organisms	**2. *Cell biology*** **2.1 Looking at unicellular organisms** *(5 periods)* • Observing unicellular organisms using live or preserved specimens • yeast, euglena, paramecium, amoeba, bacteria	Students should be aware that there are many unicellular organisms. Many of these are too small to be seen with the unaided eye so they must be viewed using a hand lens or a microscope. Students should examine and draw a number of unicellular organisms including: • Amoeba, Paramecium, Euglena, Yeast, Bacteria Students should appreciate that at the unicellular level the traditional differences between plants and animals do not apply. For example, euglena is able to move – like and animal – but contains a chloroplast – like a plant. Students could discuss whether it is better classified as an animal of a plant. Students should understand that unicellular organisms like this are not classified as plants or animals but in different kingdoms. In the case of euglena, in the kingdom protoctista.

Competencies	*Contents*	*Suggested activities*
• describe the structure, habitat , locomotion, nutrition, reproduction and importance of amoeba, paramecium, euglena, bacteria and yeast	**2.2 Single celled organisms** *(12 periods)* • Amoeba (structure, habitat, nutrition, reproduction, locomotion, importance)	Students should know that amoeba is a single celled organism found in mud at the bottom of ditches and ponds. Students should be able to draw and label the parts of amoeba including: • Nucleus, Cytoplasm, Contractile vacuoles, Food granules Students should know that amoeba is able to move by forming pseudopodia as a result of the flow of cytoplasm. It feeds on bacteria and microscopic algae which are engulfed by pseudopodia and form a vacuole in the cytoplasm. Enzymes are released into the vacuole and the food is digested. Students should appreciate that amoeba reproduces asexually and there are two mechanisms for this. Binary fission: • Occurs every few days when conditions are favourable • Amoeba stops moving and becomes rounded • The nucleus divides in two and each part takes some cytoplasm with it forming two daughter cells Sporulation: • Occurs when conditions are unfavourable e.g. drought • A thick covering or cyst surrounds the amoeba • Whilst in the cyst it may divide many times • When conditions become
	• Paramecium (structure, habitat, nutrition, reproduction, locomotion, importance)	

Competencies	*Contents*	*Suggested activities*
	Euglena (structure, habitat, nutrition, reproduction, locomotion, importance) • Bacteria (structure, habitat, nutrition, reproduction, locomotion, importance)	favourable the cyst ruptures and the amoeba are released Students should be able to draw the sequence of events that occurs in each mechanism. Students could observe the movement of amoeba with the aid of a microscope. Students should know that paramecium is a single celled organism, shaped rather like a shoe print, which is found in fresh water ditches and ponds. Students should be able to draw and label the parts of paramecium including: • Nucleus, Cytoplasm, Contractile vacuoles, Oral groove Students should know that paramecium is able to move by spinning around its long axis due to the rhythmic movement of cilia. It feeds on bacteria which are drawn into the oral groove and carried to the cytosome by the action of cilia. The food is digested by enzymes as it passes around the cytoplasm. Students should appreciate that paramecium reproduces both asexually and sexually. Asexual reproduction – binary fission • This mode of reproduction is more common • The nucleus of the paramecium divides in two and each part takes some cytoplasm with it forming two new individuals Sexual reproduction –

Competencies	*Contents*	*Suggested activities*
	• Yeast (structure, habitat, nutrition, reproduction, locomotion, importance)	conjugation • Two paramecium come together and are joined at the oral surfaces by cytoplasm • The meganuclei break up and disappear • The micronucleus in each organism divides into four. Three of these disappear and the remaining one divides into two • One micronucleus from each organism migrates into the other organism and unites with the remaining micronucleus forming a zygotic nucleus in each organism • The organisms separate and the nucleus in each divides into eight • Each organism undergoes binary fission twice to form four new individuals Students should be able to draw the sequence of events that occurs in both asexual and sexual reproduction. Students could observe the movement of cilia surrounding paramecium with the aid of a microscope. Students should know that euglena is a single celled organism which is oval shaped and has a single flagellum. It is in fresh water ditches and ponds, particularly those contaminated by urine and faeces. Students should be able to draw and label the parts of euglena including:

Competencies	*Contents*	*Suggested activities*
		• Nucleus, Cytoplasm, Contractile vacuoles, Chloroplast, Flagellum Students should know that euglena is able to move in a wave-like motion as it spins around its long axis due to the lashing of the flagellum against the water. Euglena has a chloroplast and produces its own food by photosynthesis. Students should appreciate that euglena reproduces asexually only. Asexual reproduction – binary fission • The euglena stops moving • The nucleus divides into two and a second flagellum forms • The cytoplasm divides along the length of the organism, with a nucleus and flagellum on each side • Two new organisms are formed Students could observe the movement of euglena by the whipping of the flagellum with the aid of a microscope. Students should know that there are many different kinds of bacteria but they have certain generalised features. Some bacteria exist as individuals while others group together. Bacteria are found in a variety of habitats both outside and inside other organisms. Students should be able to draw and label the parts of a bacterium including: • Nuclear material, Cell

Competencies	*Contents*	*Suggested activities*
		wall, Cytoplasm, Slime envelope, Flagellum Students should appreciate that bacteria have no nucleus but a knot of nuclear material. Bacteria are able to move due to the motion of flagella. Bacteria reproduce asexually by binary fission: • The bacterium stops moving • The nuclear material divides into two • The cytoplasm divides along the length of the organism, with nuclear material on each side. • Two new bacteria are formed Students could research the different bacterial forms: • Cocci, Bacilli, Vibrios, Spirilla Students shoud appreciate that some bacteria can cause diseases in people. They could find out more about such diseases including: • Cholera, Pneumonia, Typhoid, Syphilis Students should know that yeast is a single-celled fungus. It is found naturally on the skins of fruit such as grapes and is also found in fermented dough. Students should be able to draw and label a yeast cell, showing the nucleus. Students should appreciate that since yeast is a fungus, it has no chlorophyll and therefore cannot obtain its

Competencies	*Contents*	*Suggested activities*
		own food by photosynthesis. Nutrition in yeast involves the breakdown of glucose in the absence of air. This is sometime called alcoholic fermentation since alcohol (ethanol) is one of the products: glucose → ethanol + carbon dioxide + energy Students should appreciate the commercial importance of this process including: • The formation of alcoholic drinks like beers and wines • The use of ethanol as a biofuel • The role of yeast in baking by providing carbon dioxide to make bread rise Yeast reproduces asexually by budding: • The yeast cell grows in size • The nucleus divides • A new yeast cell (bud) grows on the side of the parent cell Students could review the four unicellular organisms described in this section and comment on any similarities and differences that are apparent.

Competencies	*Contents*	*Suggested activities*
• name different types of cells • state the functions of different types of cells • name some plant and animal tissues • state the functions of some plant and animal tissues • name some plant and • animal organs • state the functions of some plant and animal organs • name some plant and animal systems • state the functions of some plant and animal systems • describe organism as the highest level of organization in multi-cellular organisms	**2.3 levels of organization in multi-cellular organisms** *(6 periods)* • Cell (type, function) • Tissue - Plant (meristematic, conductive) - Animal (epithelial, blood, nerve) • Organ -Plant (leaf, stem flower root) -Animal (heart, lung, liver, stomach) • System • Plant (root system, shoot system) • Animal (digestive system, circulatory	Students should already be familiar with the cell as the basic building block from which organisms are formed. Students should appreciate that in a living organism, there are different types of cells, each having a particular function. Students should name some of the different types of cells found in plants and explain their function including: • Leaf epidermal cells; Leaf palisade cells; Root tip cells Students should also name some of the different types of cells found in the human body and explain their function including: • Skin cells, Blood cells, Muscle cells, Nerve cells, Sperm and ova Students should view prepared specimens of different types of cells using a microscope. They should note the similarities and the differences. Students should appreciate that cells are a particular type are usually grouped together to form a tissue. Tissue consists of cells of the same shape and size which carry out the same function. Students should identify some of the tissues present in plants and explain their function including: • Photosynthetic tissue, Epidermal tissue, Conducting tissue,

Competencies	*Contents*	*Suggested activities*
	system) • Organism - Plants - Animals	Strengthening tissue Students should identify some of the tissues present in animals and explain their function including: • Epithelial tissue, Blood tissue, Nerve tissue, Muscle tissue, Skeletal tissue Students should appreciate that tissue may be grouped together to form a functional unit called an organ. An organ consists of a number of different tissues which combine to enable the organ to perform specific functions. Students should identify some organs present in plants and explain their functions including: • Leaf, Stem, Root, Flower Students could examine some plants and identify these organs. Students should identify some organs in animals and explain their functions including: • Heart, Lungs, Liver, Stomach Students should appreciate that organs may be grouped together to form a system. A system consists of several organs whose functions are coordinated. Students should identify some systems present in plants and explain their function including: • Root system; Shoot system Students should identify some systems present in animals

Competencies	*Contents*	*Suggested activities*
		and their functions including: • Digestive system; Circulatory system; Reproductive system Students should appreciate that systems combine together in an organism. Students should review the five levels of organisation in a multicellular organism: cells → tissues → organs → systems → organism Students could compare this organisation with that of a single-celled organism such as amoeba.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: use hand lenses and microscopes to observe unicellular organisms and name some unicellular organisms; describe the structure, habitat, locomotion, nutrition, reproduction and importance of some unicellular organisms; name different types of cells, tissues, organs, and systems and state their functions; describe organism as the highest level of organization.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Unit 3

Human biology and health *(24 periods)*

***Unit Outcomes*:** Students will be able to:

- state the primary and secondary sexual characteristics of males and females, label the reproductive structures and give their functions
- explain the menstrual cycle and the cares that girls should take before and during menstruation
- define fertilization and explain its process
- mention pills and condoms as birth control methods and explain how they are used
- trace some common reproductive health problems, describe how they affect humans and how they could be prevented
- show the local, national and global distribution of HIV and AIDS, explain its impacts in the society and express willingness to give care and support to PLWHA
- demonstrate assertiveness, decision making, and problem solving skills as life skills that help to prevent HIV.

Competencies	*Contents*	*Suggested activities*
Students will be able to: • state the primary and secondary sexual characteristics of males and females • label the reproductive structures of males and females on a diagram • describe the functions of the reproductive structures of males and females	***3. Human biology and health*** **3.1 The reproductive system** *(14 periods)* • Primary and secondary sexual Characteristics • The male and female reproductive organs • structure and function	Students should identify the reproductive system as one of the systems found in a animals. Students should discuss the primary and secondary sexual characteristics including: Male: • Male reproductive organ; Growth of facial hair; Deepening of the voice; Body becomes more muscular; Chest and shoulders broaden; Production of sperm begins Female • Female reproductive organ; Development and enlargement of breasts; Hips widen as the pelvic girdle enlarges; Body contours become more rounded; Ovulation accompanied by menstruation begins Students should appreciate that the secondary sexual characteristics only develop in the early teens during a period called

Competencies	*Contents*	*Suggested activities*
		puberty. Students should be able to name the parts of the male reproductive system and label a diagram showing them. These should include: • Penis, Testes, Scrotum, Sperm tube (vas deferens), Urethra, Prostate gland, Cowper's gland Students should be able to explain the function of the various parts of the male reproductive system including: • Production of sperm in the testes • Passage of sperm along the sperm tube • Secretion of fluid by the prostate and Cowper's glands • Passage of semen along the penis through the urethra Students should be able to name the parts of the female reproductive system and label a diagram showing them. These should include: • Ovaries, Oviducts (Fallopian tubes), Uterus, Cervix, Vagina, Vulva, Clitoris Students should be able to explain the function of the various parts of the female reproductive system including: • Production of ova in the ovaries • Passage of an ovum along the oviduct • Development of a fertilised ovum in the uterus • Location of the male penis in the vagina during intercourse • Opening of the cervix during childbirth
• explain the menstrual cycle using a simplified diagram • explain the cares that girls should take before and during menstruation	• The menstrual cycle	
• define fertilization as the union of sperm and egg • explain the process of fertilization	• Fertilization	
	• Birth control methods (pills and	Students should appreciate that

Competencies	*Contents*	*Suggested activities*
• mention pills and condoms as birth control methods • explain how pills and condoms are used for birth control • describe how FGM, early marriage, STIs, rape and illegal abortion affect reproductive health • explain how FGM, early marriage, STIs, rape and illegal abortion could be prevented	condoms) • Reproductive health (Female genital mutilation, early marriage, STIs, rape, illegal abortion)	one a female has reached puberty she is able to reproduce. They should be aware of the following sequence of events which take place on a monthly basis in the female reproduction system: • The wall of the uterus begins to thicken. • An ovum is released from one of the ovaries. • The ovum passes down the oviduct. At this time it may be fertilised as a result of intercourse. • If the ovum has been fertilised it becomes embedded in the thickened uterus wall and develops into an embryo. • If the ovum has not been fertilised the thickened uterus wall breaks down with the loss of a small amount of blood, and passes out of the body through the vagina. • The loss of blood from the vagina over a few days is commonly called a period. Students should understand that this sequence of events is called the menstrual cycle. It occurs over a period of 28 – 35 days on a regular basis. Ovulation, the release of an ovum, occurs in the middle of the cycle. Students should be able to use a simple diagram to explain what is happening during this cycle. Students should appreciate that menstruation is a natural process that should be acknowledged and discussed freely. They should appreciate the need for additional personal hygiene during the period a woman passes blood and discuss the use of sanitary towels and other products.

Competencies	*Contents*	*Suggested activities*
		Students should understand that a woman is most fertile during the few days after the ovum is released and if intercourse takes during this time, there is a significant chance that fertilisation will occur. Students should know that: • Fertilisation is the union of a male sex cell or sperm, and a female sex cell or ovum. • Fertilisation normally takes place in the oviduct • A single sperm penetrates the wall of the ovum and the nucleus of the sperm combines with the nucleus of the ovum • The fertilised ovum is called a zygote Students should understand that any method of birth control involves preventing fertilisation which, in turn, involves preventing the sperm and ovum from coming together. Students should discuss how this might be achieved. The most effective method would be to avoid sexual intercourse but, assuming this does take place, pose the question of how can the sperm be prevented from reaching the ovum? Students should know how each of the following is used and why it is effective: • Contraceptive pills – prevent ovulation so no ovum released • Condoms – a thin rubber barrier that prevents sperm entering the vagina Students should discuss these birth control methods, considering such factors as: • Cost

Competencies	*Contents*	*Suggested activities*
		• Availability • Effectiveness • Side effects of the contraceptive pill Students could research other methods of birth control including: • Coitus interruptus • Rhythm method • Spermicidal creams and foaming tablets • Intra-uterine device (IUD) • Diaphragm • Sterilisation Students should appreciate that birth control is the responsibility of both the man and the woman. Students could discuss the need for birth control and its role in family planning. Students could identify and discuss the problems arising from over-population both for the individual, the country and the world as a whole. Students should discuss the effects of factors on the reproductive health of a woman including: • Female genital mutilation • Early marriage • Sexually transmitted infections • Rape • Illegal abortion Students should appreciate that none of these practices is acceptable and they should discuss how to educate people against them.
• show the local, national and global distribution of HIV and AIDS using	**3.2 HIV and AIDS** *(10 periods)* • HIV and AIDS - Distribution of	Students should already be familiar with the causes of HIV and AIDS. They should be provided with current data on the

Competencies	*Contents*	*Suggested activities*
graphs and maps • explain the impacts of	HIV and AIDS (local, national and global)	prevalence of HIV and AIDS in their locality, in Ethiopia and in the world. Students should be posed questions on the data which will require them to interpret maps, graphs and data tables.
• HIV and AIDS in the society	- Impacts of HIV and AIDS on society	Students should discuss the impact on HIV and AIDS on: • A person • A person's family and friends • The country as a whole
• express willingness to give care and support to PLWHA	- Care and support to PLWHA	Let the students find out if there are governmental or non-governmental institutions in their locality that work on giving care and support to PLWHA. A visit could be arranged to such an institution. A guest speaker from the institutions could also be invited to the class to discuss with students. Students should be trained in safer ways of giving care and support to PLWHA.
• demonstrate assertiveness, decision making, and problem solving skills as life skills that help to prevent HIV	- Life skills	Students should discuss how each individual can keep him or herself safe from HIV. This should include the development of life skills, a willingness to be assertive and not give in to peer pressure and an assessment of the risks involved in any situation. Let them practice these skills through role plays.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: state the primary and secondary sexual characteristics of males and females, label the reproductive structures and give their functions; explain the menstrual cycle and the cares that girls should take before and during menstruation; define fertilization and explain its process; mention pills and condoms as birth control methods and explain how they are used;

trace some common reproductive health problems, describe how they affect humans and how they could be prevented; show the local, national and global distribution of HIV and AIDS, explain its impacts in the society and express willingness to give care and support to PLWHA; demonstrate assertiveness, decision making, and problem solving skills as life skills that help to prevent HIV.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Unit 4

Plants *(17 periods)*

***Unit Outcomes*:** Students will be able to:

- define photosynthesis, explain its light and dark phases and give a summary equation of photosynthesis
- conduct a simple experiment to confirm that plants produce food by photosynthesis
- demonstrate the steps followed in growing trees and in caring for them as they grow
- explain the advantages of indigenous trees over exotic trees and show willingness to participate in tree growing projects.

Competencies	*Contents*	*Suggested activities*
Students will be able to: • define photosynthesis as the production of food by leaves using sunlight, water and chlorophyll • give a summary equation of photosynthesis • explain the major events in the process of photosynthesis • confirm that plants produce food by photosynthesis by conducting a simple	***4. Plants*** **4.1 Food manufacture in green plants** *(7 periods)* • What is photosynthesis? • Summary equation • Utilization of sunlight and production of glucose • Confirming occurrence of photosynthesis	Students should already know that green plants make their own food by the process of photosynthesis. In this process light energy is trapped by the green pigment, chlorophyll, in the leaves and used to combine carbon dioxide and water to form glucose. Students should be familiar with the equation: $6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$ Water carbon dioxide

Competencies	*Contents*	*Suggested activities*
experiment		Students should understand that the following occur during and after food manufacture in plants • Sunlight is absorbed • Carbon dioxide and water combine to form glucose • Glucose is converted to starch in the leaves • Starch in the leaves is converted to glucose • Glucose is transported to different part of the plant • Glucose is converted back to starch and stored in different parts of the plant Starch is an example of a stored carbohydrate. Students could find out why: • glucose in plants is stored as starch and doesn't just remain as glucose • in which form is glucose stored in the human body Students should appreciate that the temporary storage of starch in leaves provides a convenient way of demonstrating that photosynthesis is taking place. Students should carry out a starch test on a green leaf by: 1. Placing the leaf in

Competencies	*Contents*	*Suggested activities*
		boiling water for a few minutes 2. Transferring the leaf into ethanol and heating it on a water bath for a few minutes 3. Washing the leaf in cold water 4. Adding a few drops of iodine solution to the leaf 5. A blue-black colour indicates the presence of starch Students could carried out the starch test on the leaves of a plant which has been kept in the dark for several days to demonstrate that light is needed for photosynthesis. Students could carry out the starch test on the leaves of a plant which has variegated leaves to demonstrate that starch is only present in the green parts of the leaf therefore chlorophyll is necessary for photosynthesis. Students could carry out an experiment on the pond weed *elodea* by placing a large piece in water under an inverted funnel and an inverted test tube filled with water. The apparatus is left in the light for several days and the gas collected is tested with a glowing

Competencies	*Contents*	*Suggested activities*
		wooden spill. Oxygen will cause the wooden spill to relight. Students could be given data showing how the rate of photosynthesis changes with light intensity and asked to display the data in some way and explain the pattern seen.
• demonstrate the steps followed in growing trees	**4.2 Growing trees** *(10 periods)* • Steps in growing trees	Students should be familiar with the stages of growing trees to eventually be planted on the land. They should be able to discuss different aspects of the different stages. Planting seeds : • Prepare seed bed or pot of soil
• demonstrate the steps followed in caring for trees as they grow	• Caring for trees as they grow	• Provide conditions suitable for growth • Protect against pests such as caterpillars who will target the young soft growth • Provide water and nutrients Transplanting seedlings in final position: • Dig a hole big enough for the root ball • Transplant and firm into the ground • Tie the seedling to a stake until is well established to support itself • Protect the seedlings from grazing animals

Competencies	*Contents*	*Suggested activities*
• show willingness to participate in tree growing projects	• A tree growing project	• Continue to water the seedling in dry spells until its root system is sufficiently well established. Students could research those areas of Ethiopia that were forested in 1900 and those which are forested now. Students could find out the names of indigenous trees and what is being done across the country to re-establish forests of them. Students should, as a group, organise a tree-growing project in their area. This could involve such things as: • Raising funds to buy seedlings or acquiring them from suitable organisations • Caring for the seedlings until they can be planted in their final positions • Planning where the trees are to be planted • Planting the trees and providing immediate care such as sticks for support and protection from animals • Providing long-term support such as providing water in dry conditions until the tree roots are sufficiently developed to obtain all the water needed from the ground

Competencies	*Contents*	*Suggested activities*
• explain the advantages of indigenous trees over exotic trees	• Advantages of growing indigenous trees	• Educating local people of the need to support their work by not allowing animals to damage the trees of chopping the trees for firewood Students should research which trees in their locality are indigenous and which have been imported from other regions or countries Students should discuss the advantages of growing indigenous trees. This could include: • Maintaining the characteristic look of the area • Providing flowers that can be pollinated by indigenous insects • Providing food for indigenous animals such as birds • Providing products such as herbal medicines which are obtained from indigenous trees Protecting existing trees from excess competition which may result from planting imported trees which are faster-growing

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the Competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: give examples of flowering plants, state their general characteristics and explain the structures and functions of the root, stem and leaves; identify stomata using a microscope; classify flowering plants into monocotyledons and dicotyledons, distinguish between the two, and give examples for each; explain vegetative reproduction and give examples of flowering plants that reproduce by vegetative reproduction; draw and label the structures of a flower, state their functions and examine pollen grains and ovaries using a hand lens; tell the importance of pollination and the process of fertilization, state how fruits and seeds develop, state the functions of the structures of a seed and draw and label these structures; define photosynthesis, explain its light and dark phases and give a summary equation of photosynthesis; conduct a simple experiment to confirm that plants produce food by photosynthesis; demonstrate the steps followed in growing trees and in caring for them as they grow; explain the advantages of indigenous trees over exotic trees and show willingness to participate in tree growing projects.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Unit 5

Animals *(13 periods)*

***Unit Outcomes*:** Students will be able to:

- explain the importance of caring for farm animals, list down their products, and state the methods of preparing and storing food and sheltering for farm animals
- compare the ruminant stomach with the human stomach and explain why farm animals regurgitate
- list the pregnancy periods of some farm animals and describe the special care given to their young
- explain the causes, symptoms, transmission and prevention of some common diseases of farm animals.

Competencies	*Contents*	*Suggested activities*
Students will be able to: • explain the reasons for caring for farm animals • list down the products of farm animals • compare the ruminant stomach with the human stomach • explain why farm animals regurgitate • state the methods of	***5. Animals*** **5.1 Keeping farm animals** *(13 periods)* • Why we care for farm animals • Products of farm animals • Feeding and sheltering them (the ruminant stomach and regurgitation) • Preparing and storing food (silage hay, fodder)	Students should give examples of farm animals including poultry, cattle, sheep, goats, camels, horses and donkeys Students should discuss the reasons why farm animals are kept. This could include: • To provide food; To provide skins; To be sold for profit; To do work; To breed Students should describe the provided for different farm animals and how they are sheltered. For example, for free-range poultry: • Food - grain, green foliage, insects, poultry pellets • Shelter – coop Students should be aware that cattle are herbivores and therefore their diet is very different to the average person. Students should also recall from their knowledge of human digestion, that mammals cannot digest cellulose. From this they

Competencies	*Contents*	*Suggested activities*
preparing and storing food for farm animals		should deduce that a ruminant's stomach must be significantly different to a human stomach. Students should know that: • The stomach of a ruminant like a cow has four chambers • The first chamber is called the rumen • Food enters the first chamber when it is swallowed and is fermented by anaerobic bacteria which break down the cellulose • The food then passes to the second chamber of the stomach, the reticulum were it becomes known as cud • The cud is regurgitated into the mouth where it is chewed again • The chewed cud passes to the third chamber of the stomach, the omasum where much of the water it contains is reabsorbed • The food then passes to the last chamber of the stomach, the abmasum, where normal gastric secretions digest the protein in the food
• state the methods of sheltering farm animals • list the pregnancy periods of some farm animals • describe the special care given to young farm animals • state some of the symptoms seen on sick farm animals	• Pregnancy periods (cattle, sheep, goats, camels, horse, donkey) • Care for pregnant farm animals • Care for young farm animals	Students should understand that forage crops are grown to feed livestock and that it is necessary to harvest and store the crop to feed animals when natural food is in short supply.
• name some common diseases of farm animals • explain the causes, symptoms,	• Common diseases of farm animals (liver fluke, anthrax, trypanosomiasis)	Students should appreciate

Competencies	*Contents*	*Suggested activities*
transmission and prevention of some common diseases of farm animals	- causes, symptoms, transmission and prevention	that hay is composed mainly of legumes and grasses, including cereal crops. Hay is best made in the dry season when there is sufficient sun to dry the cut material. Students should discuss the properties of well-prepared hay including: • Slight green colour • High leaf to stem ratio • Low fibre so easily digestible • Low moisture content (15-25%) • No mould or dust • Free from weeds and stones • Able to be stored for long periods without deteriorating Students should appreciate that making silage involves the preservation of forage crop by acids produced by the fermentation of sugars present in the fodder. Students should understand the steps in the formation of silage including: • Chopping and compacting the crop within a few days of cutting to exclude air • Sealing the compacted material with soil and covering with a tarpaulin to exclude air and protect it from the sun and rain • Leaving the silage to ferment Students should discuss the properties of a well-prepared silage including: • Green colour • Free from moulds and

Competencies	*Contents*	*Suggested activities*
		unpleasant odours Students should research the gestation periods of farm animals including cattle, sheep, goats, camels, horses and donkeys. Students should discuss different aspects of caring for pregnant farm animals and caring for the young after they are born Students should discuss how they might become aware that an animal is unwell. This could include: • Loss of appetite • Unusual behaviour • Lack of strength or energy Students should appreciate that, just as with people, farm animals are susceptible to disease. Students should be aware of the causes, symptoms, transmission and prevention of the following diseases or conditions. Arrange a field visit to a nearby animal farm of individual farmers or modern private or governmental husbandries. Let them observe how farm animals feed are prepared and stored and how the young and the pregnant are taken care of. Liver fluke:

Competencies	*Contents*	*Suggested activities*
		• Caused by a parasitic fluke Fasciola hepatica and affects cattle, but more serious in sheep • General weakness and debilitation • Transmitted by animals eating spores attached to grass. The parasite lodges in the body and eggs pass out in the animal dung. The eggs infect a snail, the secondary host, and more spores are laid • Remove infected animals and prevent animal dung coming into contact with water sources to break the cycle of re-infection. Anthrax: • Caused by a bacterium and affects all livestock • Symptoms include a high fever, swollen neck, lower abdomen and genitals, and in the latter stages, staggers • Transmitted through contaminated water but may also be licked up from the soil, particularly where the skin is broken due to injury • Isolating infected animals and vaccinating them. Burning the carcasses of dead animals and disinfecting all equipment and the area where the animal has been Trypanosomiasis: • Caused by a parasite

Competencies	*Contents*	*Suggested activities*
		called trypanosome which is carried by the tsetse fly • Symptoms fever followed by a coma which is often fatal • Transmitted by tsetse fly when the victim is bitten by a fly carrying the parasite Removing bushes and undergrowth along streams where the tsetse fly is found; spraying infected areas with insecticides; spraying with animas with insect repellents.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: explain the importance of caring for farm animals, list down their products, and state the methods of preparing and storing food and sheltering for farm animals; compare the ruminant stomach with the human stomach and explain why farm animals regurgitate; list the pregnancy periods of some farm animals and describe the special care given to their young; explain the causes, symptoms, transmission and prevention of some common diseases of farm animals.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Unit 6

Environment *(18 periods)*

***Unit Outcomes*:** Students will be able to:

- Define ecosystem, give examples of ecosystems, distinguish between them, and explain the adaptations of plants and animals to each ecosystem
- List some types of biological association, explain them and give examples of organisms for each type
- Describe soil as a physical factor of the ecosystem, explain how it is formed, and explain its different types,
- Describe the causes and methods of prevention of soil erosion
- Investigate the water humus and air contents of soil and particle size and water retention through simple experiments
- Describe water as a physical factor of the ecosystem
- State the importance of water, explain the water cycle and describe the methods of conservation of water.

Competencies	***Contents***	***Suggested activities***
Students will be able to: • Define ecosystem as • Distinguish between forest, grassland, desert, and aquatic ecosystems • Explain the adaptations of plants and animals to each ecosystem	***6. Environment*** **6.1 Ecosystem** *(3 periods)* • What is ecosystem • Examples of ecosystems and their climate, animals, plants, and their adaptations (forest, grassland, desert, aquatic)	Students should be aware that an ecosystem is composed of all of the living and the non-living things in a habitat. There are two main types of ecosystem; the aquatic (water) ecosystem and the terrestrial (land) ecosystem. Students should discuss the characteristics of some different ecosystems including: • Forest; Grassland; Desert; Freshwater aquatic For each ecosystem students should consider such factors as: • The overall climate • The availability of food and water • The type of animals and plants that live in them Students should take examples of animals and plants from each ecosystem and discuss how each animal and each plant is adapted to survive within the habitat. For example in a desert ecosystem students may discuss the adaptation of the camel and of the cactus. Students could research the conditions in other ecosystems. Students could be given

Competencies	*Contents*	*Suggested activities*
		information on unknown animals and plants and asked to suggest what conditions the animal or plant is adapted to.
• List some types of biological association • Explain the types of biological association listed • Give examples of organisms for each type of biological association	**6.2 Biological associations** *(3 periods)* • Parasitism, predation, mutualism, commensalisms	Students should appreciate that some organisms form close relationships with other organisms. In some relationships one organism provides food and/or a habitat for another. This type of relationship is called symbiosis. Students should discuss some symbiotic relationships including: Mutualism: A symbiotic relationship between organisms of different species in which both organisms benefit. Examples include: • Micro-organisms which live in the alimentary canal of herbivorous mammals and break down cellulose. • Nitrogen-fixing bacteria which live in roots nodules of leguminous plants • Lichens which are an association between an alga and a fungus Commensalism: A symbiotic relationship between organisms of different species in which one organism benefits but the other neither benefits nor is harmed. Examples include: • The remora fish which attaches itself to the underside of a shark and travels with it Parasitism: A symbiotic relationship between organisms of different species in which one organism benefits while the other is harmed. Examples include: • Ticks that attach themselves to animals and feed on their blood • Parasitic worms like tapeworm which live inside animals

Competencies	*Contents*	*Suggested activities*
		Students should discuss each of the examples, determining which organisms benefit from the relationship and which organs suffer as a result of it. As a result of their discussions, students should appreciate the differences between these forms of symbiosis. Students should appreciate that predation is the process by which one animal, the predator, kills and feeds on another animal, the prey. Students should name examples of animals in a predator-prey relationship. Students could discuss aspects of this relationship. These could include: • The predator relies on the prey for food • The predator tends to kill and eat the weakest animals so the population of prey is kept strong • A decrease in the size of the prey population will result in a decrease in the predator population • A decrease in the size of the predator population will result in an increase in the prey population
• Describe soil as a physical factor of the ecosystem • Explain how soil is formed • Explain the different types of soil • Describe the causes of soil erosion • Describe the methods of prevention of soil	**6.3 physical factors of the ecosystem** *(12 periods)* • Soil (formation, types, erosion, conservation)	Students should appreciate that soil is a growing medium in which plants grow. The soil provides a plant with stability as well as water and minerals essential for growth. Students should understand that soil consists of a matrix of tiny particles of rock which result from the erosion and weathering or rocks. Within this matrix there is air and water, and over time organic materials and mineral salts accumulate. These together provide a

Competencies	*Contents*	*Suggested activities*
erosion • Investigate different characteristics of soil using simple experiments • Describe water as a physical factor of the ecosystem • State the importance of water • Explain the water cycle with the help of a diagram	• Water (importance, water cycle, conservation)	habitat for plants and small animals. Students should be aware of the three main types of soil: sandy, loam and clay, and their characteristics. They should discuss the advantages and disadvantages of each type. Students could investigate the components of soil by placing soil in a jar with water, shaking the mixture and leaving it to settle. They will see a gradation of particles starting with the largest at the bottom the finest at the top. Humus will float on the water. Students can investigate different characteristics of soil: • Water content – by drying a known mass in an oven at 100 °C • Humus content – by heating a known mass of dry soil on a tin lid with a Bunsen burner • Air content – by mixing 50 cm3 of soil with 50 cm3 of water and measuring the total volume • Particle size distribution – by passing a known volume of dry powdered soil through a series of sieves • Water retention – by timing how long it takes water to pass down a column of soil These experiments could be carried out on a single type of soil or on different soils and the results for each soil compared. The work on soil depletion can be linked into previous work on water retention and the importance of plants. Students should be able to explain how rain washes top soil away and how this can be avoided by contour ploughing and terracing. Students should also be able to describe how plant roots bind soil together and how the loss of ground

Competencies	*Contents*	*Suggested activities*
		cover, due to overgrazing, can result in soil erosion. Extend this work by discussing the problems of erosion by wind. Soil depletion can be linked into human activity. For example, the removal of trees for timber exposes plants that normally flourish in the shade, to the full strength of the sun. These plants eventually die and the soil is then exposed to erosion. Students could carry out research to find the extent of this problem in Ethiopia and in other countries. Students should appreciate from work earlier in this unit that water is an important abiotic (physical) factor in any ecosystem. Students should discuss why water is so important. This could include: • For drinking • To grow crops needed for food • To provide a variety of aquatic habitats for plants and animals Students could be able to draw and label the water cycle to identify the different processes and stages of recycling water. Students should be aware that: • In warm climates water evaporates from the surface of the oceans • The Sun provides the energy needed to convert liquid water to water vapour • Water vapour forms clouds • Clouds pass to colder parts of the world • At some point water vapour condenses and falls to the ground as rain, or sometimes as hail or snow • Water that lands on high ground

Competencies	*Contents*	*Suggested activities*
• Describe the methods of conservation of water		has potential energy • This potential energy can be converted into electrical energy by a hydroelectric power plant Students should be aware that in some parts of the world it rains a lot and may result in flooding while in other parts of the world it rains very little and water is a scarce commodity. Students could identify parts of the world which frequently experience drought. Students could obtain data on the average rainfall in different parts of Ethiopia and review the data. They could use the data to draw contour maps showing the rainfall in different areas. Students could build a rain gauge from an empty 2 litre water bottle and use it to measure the rainfall in their locality over a period of time. Students should appreciate how important it is, in areas where rainfall is scarce, to conserve water and not waste it unnecessarily. Students could discuss different methods of water conservation. These could include: • During the rainy season collecting as much of the rain as possible in reservoirs and store ponds. • Eliminating leakage from the pipes used to transport water from storage to the user. • As individual, reducing ways in which water is wasted in the home such as leaking taps due to damaged washers, washing under running water rather than in a bowl of water, leaving taps on unnecessarily. • In times of shortage eliminating unnecessary uses such as car

Competencies	*Contents*	*Suggested activities*
		washing and garden watering Students could draw up a plan of how they could reduce the use of water in their own homes should there suddenly be a period of drought.

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

A student working at the minimum requirement level will be able to: define ecosystem, give examples of ecosystems, distinguish between them, and explain the adaptations of plants and animals to each ecosystem; list some types of biological association, explain them and give examples of organisms for each type; describe soil as a physical factor of the ecosystem, explain how it is formed, and explain its different types; describe the causes and methods of prevention of soil erosion; describe water as a physical factor of the ecosystem; state the importance of water, explain the water cycle and describe the methods of conservation of water.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.