BIOLOGY

TEACHER'S GUIDE

GRADE 7

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TABLE OF CONTENTS

UNIT 4

UNIT 5

UNIT 6

Preface

This teacher's guide is designed to assist your efforts in organizing the units and topics more effectively for grade 7 biology and to achieve uniformity of instructions in all schools. At grade 7 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 textbook. 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 7 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 grade 7 consists of important units like biology and technology, cell biology, human biology and health, plants, animals and the environment. These units are the basis for understanding of biology as a subject. The lessons show the link between biology and 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 level, 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 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 is 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 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.

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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 7**
Date of lesson_____ **Unit of lesson** Unit 2: Cell Biology
Subunit lesson: 2.2 The cell **Topic of lesson:** Comparing plant and animal cells (Page 35)
Rationale of the topic:

Plants can produce their own food using a process called photosynthesis, while animals, which cannot carry out photosynthesis, need to obtain nutrients they need from the foods that they take. However, both plants and animals have same function such as breathing and leave offspring. In this lesson, they will understand the similarities and differences at cell level and understand the functions of each organelle.

Students will be motivated and will develop interest towards natural science (because they are going to use the microscope and it is also used in health centers and hospitals to diagnose disease) and they will be aware of the presence of difference and similarity between plant and animal cell.

Pre-requisite knowledge:

The students have studied cellular structures and their functions, microscope and how to manipulate it in the previous lessons of the unit, and they may have seen health professionals (lab technicians) working with the microscope.

Learning objectives:

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

- List the difference and similarities between plant and animal cell and;
- Differentiate animal cells from plant cells using a light microscope.

Stage	Time	Learning contents	Teacher's activities	Students activities	Assessment Activities
Starter Activities	5 min	Reviewing points from the previous class; Confirming the necessity of using the microscope to observe plant and animal cell;	By relating what students learnt and what they know, drawing interests of students toward today's topic as follows: ✓ Have you seen a cell before? ✓ What about the egg of birds (hen)? ✓ Is it possible to see all cells and living organisms with our naked eye? ✓ Why do you think that it is not possible to see all cells and living organisms with our naked eye? - Telling in short about the rationale of the topic; - Giving outline of the day's lesson;	- Listening attentively and answering questions; - taking short notes;	- Confirming the following points related to the topics by asking questions: ▪ The size of most cells range from 1∼100μm; ▪ The microscope to be used in the lesson has magnifying power of 40 and 100 times;

Main Activities	25 min	- Observing a plant(onion epidermal cell) and animal cell (cheek cell) under the microscopes and sketching what the students observe under the microscope; - Further discussion on the organelles of plant and animal cells to find out the common and uncommon ones.	**Activity 1: Observation under the microscope** - Giving a clear instruction on the objective of the activity, necessary materials, the procedure, and the task to draw what they observe; - Giving chance to all the students to observe them one by one. - Following and helping the students while they are observing the two cells under the microscopes. - Giving the instruction again that students to draw what they have observed under the microscope; - Asking four students to draw what they have observed on the chalkboard; (15 min) Activity 2 (Modified Activity 4.5): Discussing further the difference between plant and animal cells using a table(Charts) - Give 5 minutes to copy and fill the table in their own notebooks; - Confirming in entire class whether each organelle is to be found in plant cell or animal cell or both; - Giving brief explanations on why some organelles exist only in plants or animal cells; (10 min)	- Listening to the instruction attentively and taking notes; - Watching the teacher's demonstration with full attention; - Observing the prepared plant and animal cells under the two microscopes in front; - Drawing what they have seen under the microscope on their notebooks; - The four students come to front to draw on the chalkboard(two students for drawing the plant cell; two for animal cell); - Listening to and answering questions; - Taking notes; - Copying and filling in the table; - Confirming their own answers in entire class; - Asking questions on points that are not clear for them. - Taking notes;	- After the four students finish drawing, confirming in entire their observation by asking questions: ✓ How do the two cell look like? ✓ Do they have similar shape? ✓ What are the common parts for both cells? ✓ ... - Observing the progress of the individual work;

Concluding Activities	10 min	- Summary on the differences and similarities of plant and animal cells.	**Assessment Activity** - Giving a chance for 12 groups (3 – 4 students seat in one or two desks) to categorize the cell organelles using Venn diagram drawn on the board and the prepared flash cards; - Giving hints if necessary (e.g where can we put this card?) - Checking their answers with the help of students the table used previously if necessary. - Giving a short summary on the day's lesson by listing out the important points - Telling them to study for the next test - Giving chance to students to ask questions; - Giving homework (exercise 2.2 in page 36).	- In small group, identifying where the given flash card to be placed on the Venn diagram on the board; - A representative of each group come in front to attach the card where they think is appropriate. - Confirming all the answers in entire class; - Asking questions on points that are not clear for them (if any).	- Checking the students' performance on the activity.

Teaching and Learning Materials (Include the materials that you will use in your lesson):

- *Student's textbook, teacher's guide, syllabus;*
- *Two compound light microscopes, improvised charts of plant and animal cells, prepared glass slides (both plant and animal) with cover slips, onion, hen's egg, iodine solution(if available, if not water is possible), a dropper, methylene blue and tooth pick (tooth stick), magnifying glass (hand lens), flash cards (one name of organelle on one card).*

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: _____ P.1

The cell Comparison of plant and animal cells under a microscope

Activity 1

Observation of plant and animal cells under a microscope

Chart

Materials

- Onion->Plant cell
- Cheek cell-> Animal cell
- Microscope
- Glass slide
- Cover slide
- Toothpick
- Iodine and methylene blue

Materials

Draw what you have observed under the microscope.

*** Plant and animal cell Diagram**

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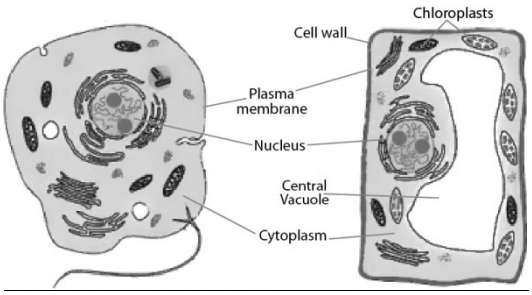
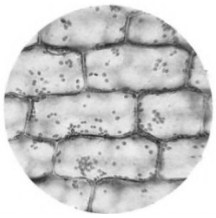


Animal Cell Plant Cell

P.2

Plant cell

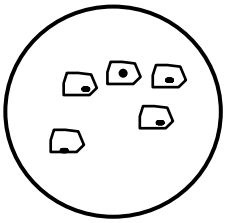


Drawing by students

- ✓ Nucleus
- ✓ Cell wall
- ✓ …

Plant cell Diagram

P.3



Drawing by students

- ✓ Nucleus
- ✓ Cell wall
- ✓ …

Animal cell Diagram

P.4

Activity 2

Compare plant and animal cells

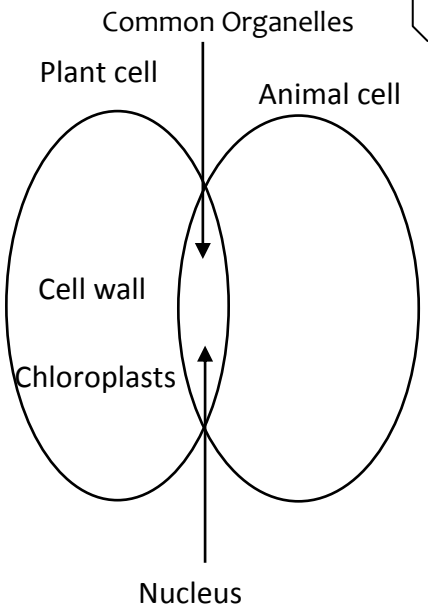
Table

Organelles	Plant cell	*Animal cell*
Nucleus	✔	✔
Cell wall	✔	×
Cell membrane	✔	✔
Cytoplasm		
Vacuoles		
Chloroplasts		

P.4

Assessment Activity

Flashcards



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: 10 Periods

Unit Overview

Grade 7 is the level where students encounter biology as a separate subject for the first time. You need to give special attention for introducing biology as a branch of science. As this is the first unit, it needs special attention.

The unit starts by exploring science and defining biology. This is followed by two sub-units which show the application of biological knowledge and competence in various human activity areas and its relevance to the society. The forth sub unit deals with how biological observations serve as a model for technological innovations. The final sub unit is about the values and attitudes gained from studying science in general and biology in particular.

The topics need discussions and observations of what is going on around the community and relating with biology. This unit is a prerequisite for the first unit in grade 8. Therefore, every effort should be made to make sure that students have the grasp of the contents. Skills such as discussion, communication, writing, observations, group work, etc will be developed in the course of the delivery of the various sub units.

In this guide, at the end of each unit, review questions are given based on competencies, in order to help you focus on their continuous assessments and make sure whether the ones set as standard competencies are achieved or not.

You should give special considerations for those who are working above and below the standard levels by encouraging the ones that work above the standard and by giving extra attention for those who work below the standard.

Unit outcomes

After completing this unit, students will be able to:

- *define biology as the study of life;*
- *list the branches of biology;*
- *state what each of these branches of biology studies about;*
- *indicate that all natural sciences are interrelated;*
- *describe how biological knowledge is utilized in the fields of agriculture, medicine and food;*
- *explain the relevance of biology to the society;*
- *give examples of technological innovations derived from biological knowledge;*
- *identify values developed in learning science.*

Main Contents

Planning for the Unit

As you are going to introduce to the students the strong relationship that exists between biology and technology, you are expected to carry out arrangements ahead of time. The most important activities which enable the students to examine the relationship of biology and technology are analyzing science, describing biology, characterizing technology, and outline the values of biology education. Please read the pieces of information indicated in this guide before you start covering the unit.

1.1 WHAT IS BIOLOGY?

Periods allotted: 2 periods

1. Competencies

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

- *define biology as the study of life;*
- *list the branches of biology;*
- *state what each of these branches of biology studies about;*
- *indicate that all natural sciences are interrelated.*

2. Sub-unit overview

This subunit familiarizes students with the definition of biology, describes the branches of biology, and illustrates the relationship of biology with other sciences. The students will start to define biology by analyzing what the characteristics of life and living things are. Then, the students will describe the branches of biology after examining the characteristics of life and the diversity among living organisms. Then after, the students will examine the need of borrowing knowledge and skills from different branches of science.

3. Forward planning

Long range lesson plan and arrangement for observation sites when applicable

4. SUGGESTED LEARNING-TEACHING APPROACHES

4.1 Suggested Teaching aids

Preparation of enlarged diagrams of Figure 1.1 and 1.2 from the student textbook.

4.2 Suggested Teaching methods

- Brainstorming on branches of biology and relationship of biology with other branches of science.
- Group discussion on relationship of biology with other branches of science.
- Reflection on relationship of biology with other branches of science.

4.3 Presentation of the lesson

Introduce to the students the main branches of natural sciences as Biology, Chemistry, Physics, Mathematics and Geology. Then, define biology and indicate to the students the diversity of living things around them. With that introduction, you can be now in a position to relate it to the branches in biology.

You can introduce the lesson by asking students what they studied in Grade 6 Science. Accept answers and write on the board. Then ask them which of the topics deal about living things.

Students should be asked what they think biology is. Write terms on the board like:

- Natural science
- Study of living things

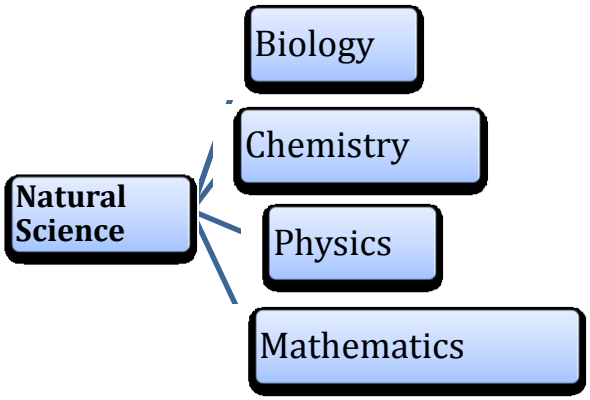
SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Branches of biology (Activity 1.1)	
SA	Students read the definition and branches of biology on page 3-4 in the student textbook.
MA	Students think of other branches of biology that are not included in Table 1.1.
CA	Students summarize their results in a table form to their class.
Relationship of biology with other sciences	
SA	Students reflect their understanding regarding the relationship of biology with the other science.
MA	Students discuss in groups the relationship of biology with other science by critically observing Figure 3.1.
CA	Students summarize their discussion and evaluation of Figure 3.1 to their class.

Students could be asked to write one sentence about each natural science indicating the areas or aspects of nature each is studying. After accepting all possible answers write the following on the board.

- Biology – study of living things
- Chemistry – study of the chemical properties of materials
- Mathematics– study of the numbers and quantity.
- Physics – study of the physical properties of materials

Students should appreciate that biology is one of a group of natural sciences and that this group also includes chemistry, geology and physics.

You can draw the following relation chart on the board for visualization.



Branches of Biology

You can initiate discussion to show the diversity of living organisms and how it will be difficult to study them in one's life time. Ask them to suggest a systematic way of studying living things. From here you can elaborate why there are different branches of biology each focusing on a particular aspect of living things.

Students should identify different branches of biology and have a brief understanding of what each is about. Our knowledge of living things comes from the different branches of biology. Write the study areas of some branches of biology given on the student text and ask them to name the branch involved.

This should include:

- ***Taxonomy*** – the classification of plants and animals into groups
- ***Botany*** – the study of plants
- ***Zoology*** – the study of animals
- ***Cytology*** – the structures and functions of cells
- ***Ecology*** – the study of the environment in which plants and animals live
- ***Physiology*** – the ways in which living things work

At this point remind them that biologists from different branches work together.

In Grade 7, in addition to biology, students are learning chemistry and physics. You can ask them, how these branches of science are related? What each science is studying?

Students should appreciate that there are regions of overlap between the disciplines, e.g. chemical reactions that take place in the cells of living things that combine biology and chemistry.

- Examination of fossils as evidence of evolution combines biology and geology.
- The action of muscles around joints, causing our limbs to act as levers combines biology and physics.

From the discussion summarize that there is a relationship between the different branches of sciences. This also shows why scientists should have to cooperate and work together.

Students could be asked to identify other topics where the different scientific areas overlap, and particularly those which overlap with biology.

Furthermore you can mention about the nervous system to show how biology, chemistry and physics are involved

- Nerve cells
- Chemical signal at the synapse
- Electrical impulse along the axon of nerve cells

Here the three branches of science overlap in their study area, Biology – studying cells, Chemistry – studying chemical reaction, Physics – studying the electrical impulse.

4.4 Assessment and follow up

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 satisfied and stop progress. Record of activities of each student.

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

1.2 INDUSTRIES UTILIZING BIOLOGICAL KNOWLEDGE

Periods allotted: 2 periods

1. Competencies

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

- *describe how biological knowledge is utilized in the fields of agriculture, medicine and food.*

2. Sub-unit overview

This sub-unit familiarizes students with the different industries that require and use biological knowledge and skills. These industries include agriculture, medicine and food. The students will begin treating the sub-unit by analysing the important agricultural factors related to plant growth. Next, they will examine the importance and abuse of drugs in medicine. Then, they will evaluate the composition of food, food groups, digestion and metabolism of foods, nutrients in a diet, balanced and deficiency diseases that resulted.

3. Forward Planning

Prepare diagrams of industries like agriculture, food, medicine that utilize knowledge from biology.

4. Suggested learning-teaching approach

4.1 Suggested teaching aids

The same diagrams as indicated above.

4.2 Suggested teaching method

- Brainstorming on industries that utilize knowledge from biology.
- Diagram explanation (analysis) on industries that utilize knowledge from biology.
- Discussion on industries that utilize knowledge from biology.

4.3 Presentation of the lesson

SA = Starter Activity MA = Main Activity CA = Concluding Activity	
The use of biological knowledge in agriculture and medicine.	
SA	Students tell their experience regarding the use of biological science to the society.
MA	Students discuss, in groups, the importance of biological knowledge to different activities in the society, emphasizing agriculture and medicine.
CA	Students summarize their discussion.
The use of biological knowledge in relation to food.	
SA	Students mention their own understanding regarding the use of biological knowledge to food production and processing.
MA	Students discuss, in groups, whether biological knowledge is utilized in food industries, to food production and processing industries, agro-chemical residues and selective breeding.
CA	Students summarize their results and present to their class.

You can start the topic by introducing major points to the lesson like:-

Industries are those areas of human activity involving the making, processing and production of things and commercial activities that provide services.

E.g.

- Agricultural industry
- Medicinal industry or pharmaceutical industry
- Food industry
- Transport industry
- Tourism industry

Knowledge derived from biology is applied in industries where living things (life) are involved in the process or services. Tell them these include agricultural, medical and food industries.

Students should appreciate that, although the different branches of science often overlap, there are certain areas or industries that are heavily orientated towards biological knowledge.

These include agriculture, medicine and food industries.

Students should discuss each of these areas in some detail and, identify biological aspects of each. The approach to be followed should be student centered, with more observation towards activities in your locality.

Biotechnology is the application of biological knowledge to the development of products that can improve various aspects of life such as health, food supply, environment and general well-being.

Examples of application of biotechnology in the field of medicine include diagnosis of genetic diseases, and production of medicinal pharmaceutical preparations such as vaccines.

Additionally, biotechnology can also be broadly applied in non-medical areas such as, production of transgenic crops in the agriculture sector, and DNA fingerprinting for criminal investigation.

4.4 Assessment and follow up

In the assessment, the statement “minimum requirement level” should not be misleading and should be understood as the “standard level”. Students working at the standard level are expected to achieve the competencies set for the grade level successfully.

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.

Additional Questions

1. What are agrochemicals and their use?
2. Name soil preservation methods?
3. What is the importance of crop-rotation?
4. Give examples of abused drugs in Ethiopia?
5. What is a balanced diet?

Answers to Additional Questions

1. Agrochemicals are chemical compounds made in laboratories to be used in agriculture. They are used to increase soil fertility, to kill crop pests and to destroy weeds.
2. Soil preservation methods include prevention of erosion, proper agricultural practices and using soil fertility improvement methods.
3. Crop-rotation is useful to prevent depletion of particular soil nutrients from the soil.
4. Abused drugs in Ethiopia include, Chat (Chat) and Hashish.
5. A balanced diet is a diet with all required nutrients in their proper amount.

Answers to Exercise 1.2

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

1.3 RELEVANCE OF BIOLOGY TO SOCIETY

Periods allotted: 2 periods

1. Competencies

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

- *explain the relevance of biology to the society.*

2. Sub unit overview

The sub-unit describes the relevance of biology to the society. The relevant areas in a society that require biological knowledge include health, nutrition, environment, and population. Hence the students begin discussing the sub-unit by being familiarized with the health aspect, then nutrition, natural resources and their conservation, and finally the importance of biology to population related issues.

3. Forward planning

Prepare table 1.3 in a larger form

4. Suggested learning-teaching approaches

4.1 Suggested teaching aids

Charts of Table 1.6, Figure 1.7, Figure 1.8 and Figure 1.9.

4.2 Suggested teaching method

- Brainstorming on the relevance of biology to the society, (health, nutrition, environment and population).
- Analysis of table 1.3
- Discussion on relevance of biology to the society.

4.3 Presentation of the lesson

Introduce the students to the relevance of biology in their daily life. You can show them by mentioning some health, nutrition, environment and population related issues.

The relevance of biology to nutrition and health (Activity 1.2).	
SA	Students read page 11-12 and Table 1.3; and carefully observe Figure 1.8.
MA	Students, discuss in groups, and classify the food items included in the figure into nutrient groups. Students list down, in groups, the food items they had for their breakfast and from the list they construct a table of balanced diet. Students discuss on using knowledge of biology to fight against diseases in the society.
CA	Students exchange their summary with other groups and discuss it further.
Application of biology in the environment and population (Activity 1.3).	
SA	Students read page 13-15 and list down activities that are harmful to the environment
MA	Students discuss the impact of the activities they listed down to the environment. Students compare the importance of tree planting to the effect of deforestation. They include the effect of population growth on the environment during their discussion.
CA	Students present their summary to the class.

Additional Notes

Students should appreciate that biology is not simply an academic subject with no relevance: biology is an essential part of the life of society as a whole, as well as each individual.

Students should discuss the relevance that biology has to different aspects of life.

Drug abuse is the bad use, or misuse of drugs outside their intended medical use. When a drug is not properly used, it is said to be abused (misused).

Abused drugs are mostly those which are dependence producing or addictive type.

Dependence producing drugs are those that can produce nervous system stimulation or depression or disturbance in perceptions, mood, thinking, or behavior.

Drug addiction is a state of behavior characterized by a compulsion to take a drug on continuous or periodic basis, resulting from the use of a drug. **Addicted persons** develop drug seeking behavior and they are unable to do their work without the drug.

Dependence producing drugs have restricted medical use for special conditions.

Illegal drugs are drugs which are cultivated, produced, distributed and used in illicit methods for non-medical use (practice).

Abused drugs can be grouped as:-

1. Those with medical use
2. Those with no medical use

Those with no medical use may be

a. Legal – such as alcohol, tobacco, Khat in Ethiopia
b. Illegal- such as cannabis (hashish) in Ethiopia.

Drug abuse is a serious worldwide problem

You can use the following tables to inform your students of sources of vitamins and minerals, when necessary.

Sources of vitamins

VITAMIN	SOURCES
A	Green vegetables, milk products, liver
B_1 (Thiamine)	Organ meat, pork, grains, legumes
B_2 (Riboflavin)	Milk products, liver, eggs, grains, legumes
B_3 (Niacin or Nicotinic Acid)	Liver, lean meat, grains, legumes
B_5 (Pantothenic Acid)	Milk products, liver, eggs, grains, legumes
B_6 (Pyridoxine)	Whole-grain cereals, vegetables, meats
B7(Biotin)	Meats, vegetables, legumes
B_9 (Folic Acid)	Whole-wheat foods, green vegetables, legumes
B_{12} (Cobalamin)	Red meats, eggs, dairy products
C (Ascorbic Acid)	Citrus fruits, green leafy vegetables, tomatoes
D	Dairy products, eggs, cod liver oil; ultraviolet light
E	Margarine, seeds, green leafy vegetables
K	Green leafy vegetables

Sources of minerals

MINERAL	SOURCES
Calcium	Milk, cheese, dried legumes, vegetables
Chlorine	Foods containing salt; some vegetables and fruits
Magnesium	Whole grains; green, leafy vegetables
Phosphorus	Milk, cheese, yoghurt, fish, poultry, meats, grains
Potassium	Bananas, leafy vegetables, potatoes, cantaloupe, milk, meat
Sulphur	Fish, poultry, meats
Sodium	Table salt
Chromium	Legumes, cereals, organ meats, fats, vegetable oils, whole grains
Copper	Meat, drinking water
Fluorine	Drinking water, tea, seafood
Iodine	Salt-water fish, shellfish, dairy products, vegetables, iodized salt
Iron	Lean meat, eggs, whole grains, green leafy vegetables, legumes
Selenium	Seafood, meat, grains
Zinc	Lean meat, whole-grain breads and cereals, dried beans, seafood

Human Nutrition

Human Nutrition is the study of how food affects the health and survival of the human body. Human beings require food to grow, reproduce, and maintain good health. Without food, our bodies could not stay warm, build or repair tissue, or maintain a heartbeat.

Eating the right foods can help us avoid certain diseases or recover faster when illness occurs. These and other important functions are fueled by chemical substances in our food called nutrients.

Nutrients are classified as carbohydrates, proteins, fats, vitamins, minerals, and water.

When we eat a meal, nutrients are released from food through digestion. **Digestion** begins in the mouth by the action of chewing and the chemical activity of saliva, a watery fluid that contains enzymes, certain proteins that help break down food. Further digestion occurs as food travels through the stomach and the small intestine, where digestive enzymes and acids liquefy food and muscle contractions push it along the digestive tract.

Nutrients are **absorbed** from the inside of the small intestine into the bloodstream and carried to the sites in the body where they are needed. At these sites, several chemical reactions occur that ensure the growth and function of body tissues. The parts of foods that are not absorbed continue to move down the intestinal tract and are eliminated from the body as feces.

Once digested, carbohydrates, proteins, and fats provide the body with the energy it needs to maintain its many functions.

Scientists measure this energy in kilocalories, the amount of energy needed to raise 1 kilogram of water to 1 degree Celsius. In nutrition discussions, scientists use the term calorie instead of kilocalorie as the standard unit of measure in nutrition.

Population

Population – all members of the same kind of organisms

Growth of population is an increase in the number of individuals. **Population increase is due to:**

- *Medical care*
- *Food availability*
- *Better living conditions*
- *Peace*

Problems due to population growth

- **Increased resource consumption**
  - *Soil depletion*
  - *Soil erosion*
  - *Deforestation*
  - *Loss of species*
- **Overcrowding**
  - *Urbanization*
  - *Industrialization*
  - *Transport*
  - *Mechanized agriculture*
  - *Medical care problem*
  - *Education problem*
  - *Food shortage problem*
  - *Habitat fragmentation and destruction*
- **Environmental change**
  - *Pollution –air, water, soil*
  - *Global warming, Greenhouse effect, (CFC)*
  - *Ozone depletion*
  - *Acid rain*
  - *Desertification*
  - *Loss of biodiversity*

You can summarize the lesson by stating that biological knowledge and skills are very important to our day-to-day life. The areas to which biology is relevant in a society include health, agriculture, nutrition, environment and population. You can also mention to the students the relationship among the areas.

4.4 Assessment and follow up

In the assessment, the statement "minimum requirement level" should not be misleading and should be understood as the "standard level". Students working at the standard level are expected to achieve the competencies set for the grade level successfully.

You should assess 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.

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.

Additional Questions

1. What are natural resources?
2. What is deforestation?
3. What is conservation of natural resources?
4. What causes air pollution?
5. What are the problems of population growth?

Answers to Additional Questions

1. Natural resources are resources such as air, water, soil, minerals, etc, found naturally in an area.
2. Deforestation is a human activity that leads to removing plants from a given area.
3. Conservation of natural resources is the proper management of natural resources to prevent destruction or degradation.
4. Air pollution is caused by various chemicals released into the air due to human activity such as burning, or from cars and industries.
5. Population growth causes problems of land degradation, habitat destruction, resources depletion, etc.

Answers to Exercise 1.3

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

1.4 BIOLOGY AND TECHNOLOGICAL INNOVATIONS

Periods allotted: 2 periods

1. Competencies

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

- *give examples of technological innovations derived from biological knowledge.*

2. Subunit overview

This subunit familiarizes the students with the importance of understanding biological knowledge, systems and principles in the technological innovations. The biological principles copied in technological innovations by humans include a camera (from eye), an airplane (from bird's flight) and submarines (from fish's swimming).

3. Forward planning

Arrange to get a camera, prepare or collect pictures

4. Suggested learning-teaching approaches

4.1 Suggested teaching aids

Pictures of airplane, submarine, real camera

4.2 Suggested teaching method

- Asking students about relationships between airplane and birds, fish and submarine and eye and camera.
- Library researching on legend of Icarus.
- Discussion on the relationships that exist between the eye and a camera; an airplane and birds, and fish and submarine.

4.3 Presentation of lesson

Content outline to be followed

- Human eye versus camera
- Birds versus airplanes
- Fish versus submarines

Ask students how they think about the flight of birds, airplanes, tell them to observe and discuss. Students should appreciate how some technologies mimic aspects of biology in what they seek to achieve. Students should discuss:

- The similarities between the human eye and the camera in detecting light and recording pictures.
- How aircraft are able to move in air like birds.
- How submarines are able to move in water like fish.

SA = starter Activity MA = Main Activity CA = Concluding activity	
Human eye and camera (Activity 1.4)	
SA	Students carefully examine Figure 1.13.
MA	Students list down the common features of camera and human eye. In groups, they list down the features that differentiate the human eye from a camera.
CA	Students organize their discussion in a form of a table.
Researching the legend of Icarus and fish versus submarine (Activity 1.5)	
SA	Students read on page 19 and learn the human desire to fly like birds was started long back in human history.
MA	Students in groups search for the legend of Icarus of the Greek and other people who tried to construct under water containers for transportation.
CA	Students present their summary to the class.

You can summarize to the students that some of technological innovation were and still are copies of observations from biological processes.

ADDITIONAL NOTES: Human eyes vs. a camera

Human eyes have often been compared to cameras. They are alike in terms of structure, but they have one fundamental difference in functioning mechanism.

Summary of lesson (i)

Table: Similarities and the difference between a camera and the human eye

Similarities		
	Camera	**Human eyes**
opening for light	aperture	pupil
control the amount of light entering camera/eye	diaphragm control size of aperture	Iris muscles control size of pupil
refract light	glass biconvex lens	mainly cornea; lens, aqueous and vitreous humor
object of light action to form image	photosensitive chemicals on film	photoreceptors (rods and cones) in retina
absorb excessive light to prevent multiple images formation	Dark internal surface	pigmented, dark choroid
Difference		
focusing mechanism	change distance between lens and film	change focal length of lens using ciliary muscles

ADDITIONAL NOTES: BIRDS VS AIRPLANE

For many centuries, humans have tried to fly just like birds and have studied the flight of birds. Wings made of feathers or light weight wood have been attached to arms to test their ability to fly. The results were often disastrous as the muscles of the human arms are not like that of birds and cannot be compared with the strength of a bird.

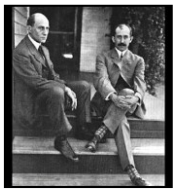
In 1899, after Wilbur Wright had written a letter of request to the Smithsonian institution for information about flight experiments, the Wright brothers designed their first aircraft; a small, biplane glider flown as a kite to test their solution for controlling the craft by wing warping. Wing warping is a method of arching the wingtips slightly to control the aircraft's rolling motion and balance.

The wrights spent a great deal of time observing bird in flight. They noticed that birds soared into the wind and that the air flowing over the curved surface of their wings created lift. Birds change the shape of their wings to turn and maneuver. They believed that they could use this technique to obtain roll control by warping, or changing the shape, of a portion of the wing.

Wright Airplane in Flight

The Wright *Flyer* was built in 1903 by Wilbur and Orville Wright. It made its first successful flight the same year. This photo shows Orville Wright piloting the *Flyer* in 1908.

Wilbur and Orville Wright
American brothers, Wilbur, left, and Orville Wright, invented the first practical airplane. They achieved the first powered flight in 1903.



Daedalus

Daedalus, in Greek mythology, is Athenian architect and inventor who designed the labyrinth for King Minos of Crete. It was built as a prison for the Minotaur, a man-eating monster that was half man and half bull. The labyrinth was so skillfully designed that no one who entered it could escape from the Minotaur. Daedalus revealed the secret of the labyrinth only to Ariadne, daughter of Minos, and she aided her lover, the Athenian hero Theseus, to slay the Minotaur and escape. In anger at the escape, Minos imprisoned Daedalus and his son Icarus in the labyrinth.

Although the prisoners could not find the exit, Daedalus made wax wings so that they could both fly out. Icarus, however, flew too near the sun; his wings melted, and he fell into the sea. Daedalus flew to Sicily, where he was welcomed by King Cocalus. Minos later pursued Daedalus but was killed by the daughters of Cocalus.

Fall of Icarus

In Greek mythology Daedalus and Icarus escaped on wax-coated wings from the labyrinth on Crete where they were imprisoned by King Minos. Ignoring Daedalus's warning, Icarus flew too close to the sun.

His wings melted and he plunged into the sea. Fall of Icarus was painted in the 17th century by Jacob Peter Gowi. It is in the Prado Museum in Madrid, Spain.

Assessment and follow up

In the assessment, the statement "minimum requirement level" should not be misleading and should be understood as the "standard level". Students working at the standard level are expected to achieve the competencies set for the grade level successfully.

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.

Answers to Exercise 1.4

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

1.5 VALUES IN BIOLOGY EDUCATION

Periods allotted: 2 periods

1. Competencies

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

- *identify values developed in learning science*

2. Subunit overview

This sub-unit introduces the students with the values that they develop while learning biology. Since biology involves practical activities; the values that they develop during learning other sciences will be consolidated as well.

3. Forward planning

Prepare larger size of table 1.4

4. Suggested learning-teaching approaches

4.1 Suggested teaching aids

Charts of table 1.4 and Figure 1.15

4.2 Suggested teaching method

- Brainstorming on values that students develop after learning biology at school.
- Group discussion on values that students develop after learning biology.

4.3. Presentation of the Lesson

Content outline to be followed

- Curiosity, love, freedom, honesty, respect, cooperation, tolerance, humility, reasoning, openness. Students should discuss the different values that can be developed within the context of learning about biology. These should include:
- A curiosity about the living world around them.
- Love of nature and a desire to know more about it.
- Respect for all living things and a desire to live in harmony with them.

SA = starter Activity MA = Main Activity CA = Concluding activity	
Values in biology education	
SA	Students give their responses on the possibilities values they develop after learning biology and read the text.
MA	Students discuss, in groups, the values they develop after learning biology and critically evaluate Figure 1.15.
CA	Students summarize their discussion.
Discussing Table 1.4	
SA	Students refreshed with previous lesson on values that they develop after learning biology, they evaluate Table 1.4.
MA	Students critically examine the values they develop after learning biology and their definitions in Table 1.4.
CA	Students summarize their discussion and present it to their class.

ADDITIONAL NOTES: SOME DEFINITIONS

Curiosity: - a strong desire to learn or to know.

- Inquisitiveness about things around us.

Perseverance –to keep going until getting a solution or an answer.

Respect – feeling of admiration or appreciation for people or things.

Accommodation - inclusiveness of other ideas.

Critical thinking - checking and rechecking information collected.

Open mindedness – understanding and considerate of other's ideas.

***Freedom of ability to act freely*:** a state in which somebody is able to act and live as he or she chooses, without being subject to any undue restraints or restrictions.

Honesty- genuine in all activities.

Cooperation –working with others.

- accepting other ideas to learn and teach.

Tolerance- accepting differences.

Humility– A modest or low opinion of one's own importance.

Humble– not proud, having or showing a low or modest opinion on one's own importance.

Reasoning– logical thinking based on objective conditions.

Time and resource consciousness – wise use of time and resources.

Love – affection for nature, humans, plants and animals (life).

Commitment – devotion for duty and to accomplish tasks.

Conformity – behavior that conforms to established rules, regulations and standards.

Inferring – to reach an opinion based on available information or evidence to arrive at a conclusion.

Industrious- working diligently, hard-working, conscientious, and energetic.

Summarize the values that students are expected develop after learning biology using Figure 1 in the student's textbook.

6. Assessment and follow up

In the assessment, the statement "minimum requirement level" should not be misleading and should be understood as the "standard level". Students working at the standard level are expected to achieve the competencies set for the grade level successfully.

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

- What is curiosity?
- What is the importance of critical thinking in daily life?
- Is reasoning important in scientific investigation?

Answers to Exercise 1.5

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

Answers to Review Questions

Part I: Multiple Choices

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

Part II: Matching

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

Part III: Fill in the blank

14. Airplane 15. Camera 16. Balanced diet
17. Submarine

Part IV: Give short answers to the following questions

18. Biology is a branch of science that studies about living things and their interaction with the environment.
19. Bad practices that lead to deterioration of land and reduce agricultural productivities of an area in the long run include:
    - Cutting trees to get space for farming
    - Plowing horizontally steep lands
    - Burning vegetation cover
    - Allowing overgrazing
    - Avoiding crop rotation practices

20. The idea of flying like birds is not a bad idea, but practicing the activity by its own is disastrous. This is because our body is not designed at all for flying like birds. The birds' forelimbs are adapted for flying, their muscles are attached to the strong chest bone; they have hollow bones that reduced their body weights. Because of these and other anatomical features birds are able to fly and we cannot at all.

Part V: Word Search

BOTANY

DRUG

HONESTY

NUTRITION

TECHNOLOGY

C	B	G	Z	D	S	T	A	E	T
T	P	I	U	R	X	C	W	N	E
X	D	O	M	U	E	J	U	P	C
D	U	M	I	G	W	T	K	Q	H
V	U	M	L	Q	R	E	M	R	N
S	H	U	W	I	L	X	T	Y	O
V	B	O	T	A	N	Y	S	X	L
A	S	I	Y	L	P	N	T	M	O
H	O	N	E	S	T	Y	Z	I	G
N	T	E	X	V	O	L	D	N	Y

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UNIT 2 CELL BIOLOGY

Total Periods Allotted: 13 Periods

Unit overview

The students are by now well familiar with cells as the smallest unit of life. This unit will introduce the students to cell biology in detail. Since almost all cells are microscopic in size, the discovery of cells was closely associated with the invention of microscope. The basic concept of this unit is examining cells and their parts under compound light microscope. To examine cells under compound microscope, they need to identify first the major parts of microscope.

Unit outcomes

After completing this unit, students will be able to:

- *define microscopes,*
- *classify them into simple and compound,*
- identify their parts and tell the functions of each part;
- *define cell, list parts of plant and animal cells seen under a compound microscope,*
- *tell the functions of each part and compare a plant cell with an animal cell;*
- *examine plant and animal cells under a microscope; draw and label the structures seen under a microscope;*
- *show types, shapes, and sizes of cells using diagrams.*

Main Contents

2.1 MICROSCOPE AND ITS USES

2.2 THE CELL

2.3 OBSERVATION OF CELLS

2.4 CELL TYPE, SHAPE AND SIZE

Planning for the unit

Since in this unit you are going to introduce the students to the importance of technology in science, and to how technological development aid in finding new discoveries you need to make prior arrangements ahead of time. Getting familiar and using of microscope are the two most important activities which enable the students to investigate the cellular world. Therefore, you need to carry out the following activities before you start dealing with the unit.

- ❖ Go to the school laboratory and do the following activities:
- ♦ make sure if any type of microscope (simple [hand lens] or/and compound) is/are available or not. If it is not available think of what you need to do next and how you are going to show a microscope, to your students consider visiting nearby clinic or health center. To make a visit to any health center (private or government) requires permission and prior arrangement; hence do the arrangement at least before a week.
- ♦ If there is no microscope in your school laboratory; and moreover, if there is no a nearby health center, you may draw a picture or make a model of microscope to treat some of the sub-units included in this unit, if not all.
- ♦ make sure if posters or/and models for typical plant and animal cells is/are available in your school laboratory, pedagogical resource center or not; if it/they is/are not available prepare your own diagram before time and post it/them in the class so that the students get familiarized to plant and animal cells and their parts before you begin the unit.
- ❖ If microscope is available in your school laboratory, since students are going to observe onion epidermal cells and check cells with the microscope,
- ♦ arrange to bring into the laboratory onion and stains like iodine,
- ♦ arrange to get tooth picks and methylene blue (another stain),
- ♦ make sure, if slides and cover slips are available or not,
- ♦ make sure, if prepared slides of typical plant and animals cells are available or not; if it/they is/are not available please borrow from another nearby school (if possible).

2.1 MICROSCOPE AND ITS USES

Periods allotted: 5 Periods

1. Competencies

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

- ♦ *define microscope;*
- ♦ *classify microscope into simple and compound;*
- ♦ *identify parts of a microscope;*
- ♦ *tell the functions of parts of microscope.*

2. Sub-unit overview

This sub-unit introduces students to the definition and, classification of microscope, identification and functions of its parts. The students will begin the discussion of the sub-unit by investigating the history of discovery of cells. After treating the history of detection of cells, the students will identify the strong link between the invention of microscope and the discovery of cells. Then after, the students will develop interest to learn more about types of microscope and the functions of its parts. Keep in mind that this sub-unit which introduces the students to microscope and its significance in biology will be given within 5 periods (200 minutes).

3. Forward planning

Since this is the sub-unit during which you are going to deal with microscope (definition, its type, its parts and the function of its parts) planning ahead of time is necessary 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.

- Check the availability of a microscope (simple [hand lens] and/or compound) in your school laboratory or not; if it is not available, organize a visit to nearby health center (if there is one around). If there is no any type of microscope at your school laboratory or at the nearby health center you may have still an alternative to achieve the objective of the sub-unit by drawing a microscope (compound).
- If you have hand lenses and compound light microscope at your school you are expected to carry out Experiment 2.1 and 2.2, which are indicated in the student's text. For Experiment 2.1 you have to collect flowers (rose and chrysanthemum) and leaves of different plants, and different insects (housefly, ants and grasshopper) at least two days before conducting the experiments.
- For Experiment 2.2 you need to collect and arrange the following items for the experiment
  - Compound light microscope, glass slides, cover slips, droppers with teat, forceps, beakers with water, and pieces of paper with dots typed on them.

4. Suggested teaching-Learning approaches

4.1 Teaching aids (Resources)

As teaching resources use the real microscopes or you can make drawings or prepare a model of microscopes to cover this sub-unit. Use the textbook as well.

4.2 Suggested teaching methods

- Brainstorming on what a microscope is.

- Reflections on the key parts of a compound microscope and the calculation of total magnification.
- Discussions on the function of key parts of a compound microscope.
- Demonstration on types of microscopes and key parts of a compound microscope.
- Practical activities on mounting and focusing.

4.3 Presentation of the lesson

As teaching resources use the real microscopes or you can make drawings or prepare your own model of microscopes to cover this sub-unit. Use the textbook as well.

You can introduce the lesson by bringing into the class a picture or drawing of a compound microscope (without any labeling of its parts) and ask them what it is. You can still ask them whether they have had the chance to see or use a microscope (hand lens and/or compound) before or not. Then after, you can brainstorm the students what is the use of a microscope.

SA = Starter Activity, MA = Main Activity , CA = Concluding Activity	
What is a microscope?	
SA	Question and answer session on the history of discovery.
MA	Students explain the lens system and magnification power of a microscope to enlarge image of objects under it.
CA	Students appreciate the discovery of cell was made possible after the invention of a microscope.
Types of microscopes and hand lens	
SA	Students observe simple and compound microscopes.
MA	Students compare simple and compound microscopes and also carry out activity 2.1 to practice how to use a lens, examine specimens of flowers and insects.
CA	Students classify microscope into simple and compound microscope.
Parts of a compound microscope	
SA	Teachers prepare a compound microscope and take notes.
MA	Students identify parts of a microscope and carry out Activity 2.2 to discuss on the total magnification of a compound microscope and calculate by taking examples.
CA	Students review parts of a compound microscope and take notes.

Practicing mounting (part I)	
SA	Teacher prepares a compound microscope.
MA	Students perform acivity2.3 to practice mounting.
CA	Students describe how mounting is done.
Practicing focusing (part II)	
SA	Teacher prepares a compound microscope.
MA	Students perform activity 2.3 to practice focusing
CA	Students describe how focusing is done.

After discussing the parts of the microscope and their functions you can proceed to Experiment 2.2 (if there microscope at your school or if you borrow one). Refer again the planning part what materials you need to arrange before conducting the experiment.

At the end of Experiment 2.2 discuss with your students on the practice of mounting and focusing. Ask them what is the need of caring for a microscope is, why they place water on a glass slide before they put the sample, why they incline the cover slip before covering, and why they need to start focusing with low power objective and its magnification.

4.3 Assessment and follow up

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

- When was cell discovered?
- What are the names of the major scientists who took the credit in the discovery of cells?
- Explain the relationship between the discovery of cells and the invention of microscope.
- What is the purpose of hand lens?
- Give them a picture or drawing of a microscope indicating its main parts and ask them to label the parts of a compound light microscope (you can give them in groups or individually). You can correct labeling of parts of the microscope out of ten points.
- Give them matching questions on the parts of microscope and their functions so that they can relate parts of the microscope with their functions.

Answers to Exercise 2.1

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

2.2 THE CELL

Periods allotted: 3 Periods

1. Competencies

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

- *define cell as the smallest unit of life;*
- *list parts of plant and animal cells seen under a compound microscope;*
- *tell the functions of parts of plant and animal cells seen under a compound microscope;*
- *compare a plant cell with an animal cell.*

2. Sub-unit overview

This sub-unit familiarizes the students with definition of cells, parts of cells, the structure of animal and plant cells, and comparison of animal and plant cells. The students will begin the discussion of the sub-unit by defining cells as the smallest structural and functional units of life. After defining cells, the students will identify the differences between unicellular and multicellular organisms on the basis of the number of cells they have. The students will also discuss parts of cells and will identify common parts of all cells. Then after, they will start examining structural parts of animal and plant cells. Finally, students will compare animal and plant cells. Keep in mind that this sub-unit which introduces the students to a cell will be given within 3 periods (120 minutes). To actively engage your students, plan every lesson using 5E-learning model, which includes five phases: engage, explore, explain, elaborate and evaluate.

3. Forward planning

During treatment of this sub-unit you are going to discuss the introductory part; but it is fundamental concept in cell biology. Thus, planning ahead of time is necessary 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.

- Check the availability of posters showing simplified typical cell, animal and plant cells in your laboratory or school resource center. If the posters are not available prepare your own drawings.

4. Suggested teaching method

4.1 Teaching aids (Resources)

As teaching resources, use the posters or drawings of plant and animal cell to cover this sub-unit. Use the textbook as well.

4.2 Suggested teaching methods

- Brainstorming on what a cell is and comparison of plant and animal cell.
- Reflections on the structure of plant and animal cells observed through a compound microscope.
- Discussions on the effect of plant and animal cells different on their mode of life.

4.3 Presentation of the lesson

You can introduce the lesson by asking students from what microscopic possible units their bodies are made from? This question may lead to atom level composition; you can exploit the situation by informing them that atoms do not carry out biological functions unless they are organized to a higher level, cell level organization. Indeed, cells are complete units that are capable of interacting with the surroundings, and carry out biological activities by their own.

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
What is a cell?	
SA	Students are asked to define a cell and to give examples such as eggs.
MA	Students discuss cells as the smallest units of living things. Tell about their sizes and the need for a microscope.
CA	Students appreciate that cells are too small to be seen with naked eyes.
Structures of plant and animal cells	
SA	Class discussion to review the student's understanding of cells from the earlier sub topic.
MA	Students list parts of plant and animal cells and also tell the function of the parts seen under a compound microscope. In addition students observe plant and animal cells under a microscope and draw what they see. - cell wall - nucleus - cell membrane - vacuole - cytoplasm - chloroplast
CA	Students identify similarities of both plant and animal cells.
Comparing plant and animal cells	
SA	Students revise the structures and parts of both plant and animal cells.
MA	Students list the differences between plant and animal cells and discuss the effects of these differences on the mode of life of these cells. Plant cells photosynthesize but not animal cells.
CA	Students copy table 2.2 their notebooks.

After students discussed parts of the cells and compared animal and plant cells; summarize the lesson indicating that the microscopic cells have in turn compartments that are specialized to carry out specific functions in cells. Plants that manufacture their own foods and strong covering have additional parts to that of animal cells.

4.4 Assessment and follow up

You can assess your students by asking them the following questions

- What are cells?
- What are the parts of cells?
- What are the common features of animal and plant cells?
- What are the unique structural parts of plant cells? etc.

then by evaluate the group report after discussion.

Answers to Exercise 2.2

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

Assessment

As possible alternative, you can give them a quiz on definition of cells, parts of cells and comparing animal and plant cells. Also you can evaluate your students by giving exercise 2.2 as a home work or class work.

2.3 LOOKING AT CELLS

Periods allotted: 4 Periods

1. Competencies

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

- *examine plant and animal cells under a microscope*
- *draw and label the structures of plant and animal cells seen under a microscope*

2. Sub-unit overview

During the treatment of this sub-unit you will give the opportunity to your students practice further on how to use a microscope on different types of cellular samples. The samples to be observed under the microscope include pollen grains, epidermal cells of plant leaves (onion bulb and *Elodea*) and their own cheek cells. Keep in mind that this sub-unit that requires a lot of practical activities using a microscope will be done within 4 periods (160 minutes). Involve your students actively.

3. Forward planning

This sub-unit deals with observation of different samples under microscope. The followings are activities you are expected to carry out before starting to deal with the sub-unit.

- Check the availability of microscope (simple [hand lens] and/or compound) in your school laboratory or not; if it is not available use web-service or internet service to show them microscopic images of the samples. If these sources are not available, prepare drawings to show them the images.
- Check the availability of pond weed around or not. If it is not available replace it with other alternatives.
- Check for stains that are going to be used during the practical activities.

4. Suggested teaching-learning approaches

4.1 Teaching aids (Resources)

As teaching resources use microscopes or you can make drawings of onion and Elodea plant epidermal cells and cheek cells.

Prepare onion, Elodea plant, Iodine solution and methylene blue.

4.2 Suggested teaching methods

- Practical activities on observing pollen grains through a compound microscope.
- Observing onion epidermal cells, Elodea plant epidermal cells and cheek cells under a compound microscope using a stain.
- Discovery of the difference in structures onion and epidermal cells and the difference in appearances or without staining.

4.3 Presentation of the lesson

This sub-unit is nearly a laboratory practical activity during which you will give chances to your students to practice on how to use microscope and let them observe different types of cells under the microscope. Here, you have a chance to support and further stabilize the previous sub-unit in which you discussed about the cell and comparison between plants and animal cells.

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Observing pollen grains	
SA	Students prepare a pollen grain for observation. Teacher gives general instructions how to handed a microscope.
MA	Students perform Activities 2.6 and 2.7. Teacher helps students how to mount the specimen for observation. Students draw what they observe through a microscope.
CA	Students draw what they observe though a microscope.

Staining onion epidermal cells for observation	
SA	Students prepare onion cells for observation.
MA	Students perform Activities 2.8and 2.9. teacher helps students in removing epidermal (skin) cells from onion; and how to stain the specimen using iodine solution for observation.
CA	Students draw and label what they observe through a microscope.
Staining Elodea plant epidermal cells for observation	
SA	Students prepare Elodea or any other water plant epidermal cells for observation.
MA	Students perform Activities 2.8 and 2.9. Teacher helps students in removing epidermal (skin) cells from *Elodea* plant, and how to stain the specimen using iodine solution for observation.
CA	Students draw and label what they observe through a microscope. Then, notice the difference in chloroplasts of an onion epidermal cell and Elodea plant.
Observing cheek cells	
SA	Students prepare the sample of cheek cells.
MA	Students perform Activity 2.10. Help students in scrapping cheek cells; and how to stain the specimen using methylene blue solution for observation.
CA	Students draw and label what they observe through a microscope. Then, notice the difference without staining.

Summarize the lesson, by emphasizing that cells have common parts like the cell membrane, cytoplasm and nucleus. But, plant cells have additional structures like cell wall, large vacuole and chloroplasts. Due to the presence of cell wall, plant cells have regular shapes. On the other hand, animal cells that lack cell wall have irregular shape when observed under microscope.

4.4 Assessment and follow up

You can assess your students by asking them the following questions

- What is the shape of plant cells?
- What is the shape of animal cells?
- What is the reason that animal cells look irregular in their shapes under the microscope?

then by evaluate their drawings and labeling of parts.

Answers to Exercise 2.3

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

2.4 CELL TYPE, SHAPE AND SIZE

Periods allotted: 1 Period

1. Competencies

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

- *show types, shapes, and sizes of cells using diagrams.*

2. Sub-unit overview

This sub-unit introduces students to the diversity of cells. Cells, despite being microscopic in their dimensions, they still show differences in shape, size and type. The students will begin examining the sub-unit by investigating the diversity of shapes that exist among unicellular organisms and the types of cells that present among cells of multicellular organisms. Keep in mind that this sub-unit which familiarizes the students to diversity of cells will be given within 1 period (40 minutes). Actively involve your students.

3. Forward planning

Since this is the sub-unit during which you are going to deal with diversity of cells planning ahead of time is necessary 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.

- Check the availability of posters and drawings at your resource center. If there is no resource at the center, collect or do copies from books in advance to the lesson.

4. Suggested teaching-learning approaches

4.1 Teaching aids (Resources)

As teaching resources, you can use drawings or posters or preserved specimen of different types of cells.

4.2 Suggested teaching methods

- Demonstration on cell type, shape and size
- Discussions on the relationship between the structures and functions of cells.
- Using flash cards
- Explanations

4.3 Presentation of the lesson

You can introduce the lesson by asking students to observe Fig 2.4, 2.6 2.8 and 2.10

(from the student's textbook) whether they are all similar in their shapes or not. You can additionally ask the students to carefully observe Fig 2.1 and Table 2.2 (from the student's textbook).

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Cell type, shape and, size	
SA	Students recall and explain the differences among cells while observed under a microscope.
MA	Students do Activity 2.11. Help students to prepare drawings or models to be used for this lesson. If possible make use of preserved or fresh specimen for observation through a microscope.
CA	Students associate cell type, size, and shape with their functions and take notes.

Summarize your lesson by indicating the variation within cells to the students. Specially, variations in type, shape and size among cells of multicellular organisms is commonly associated with the function of cells.

4.4 Assessment and follow up

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

- Are cells of plants varying in shape?
- Are cells in our body varying?
- Why do cells vary in function?

Then evaluate the students' groups report after discussion.

Answers to Exercise 2.4

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

Evaluation alternatives

As a possible alternative, you can give them a quiz on diversity of cells.

Answers to Unit Review Question Unit 2

Part I. Multiple choices

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

Part II: Matching items

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

16. C

Part III: Fill in the blanks

17. Magnification power
18. Low, medium, high and oil immersion objectives
19. in, out

Part IV: Short Answer questions

20. We use Stains to color contrast cellular structures for identification.
21. Cell wall, Chloroplast, Large vacuole make plant cells different from animal cells.
22. In the cytoplasm
23. Coarse and fine adjustments
24. Unicellular organisms are different from multicellular organisms by the number of their cells.

Part V: Puzzle

Across

2. Nucleus
4. Vacuole
6. Chloroplast
7. Microscope
9. Stain
10. Cell membrane

Downward

1. Cytoplasm
3. Mounting
5. Cell wall
8. Magnification

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www.en.wikipedia.org/wiki/cell_(biology)

UNIT 3 HUMAN BIOLOGY AND HEALTH

Total Periods Allotted: 15 Periods

Unit overview

This unit has two sub-units. It begins with the sub unit, muscular and skeletal system. It deals first with the parts, structures and functions of the skeletal system. Following this, it describes the types of bones and joints. Then, it explains the types of joints and muscles. In addition, it describes how muscles function.

The second sub-unit deals with the human dentition that includes the types of teeth, the functions of each type of teeth, and dental formula.

Both sub-units in this unit are accompanied by a number of activities carried out by students that include discussions, making charts and models and presentations. Thus, you are required to make close and regular follow up of students' involvement every time in the classroom.

In this unit, like the previous two units review questions are given based on competencies in order to help you focus on their continuous assessments and make sure whether the ones set as standard competencies are achieved or not.

As usual, you should give special considerations for those who are working above and below the standard levels by encouraging the ones that work above the standard and by giving extra attention for those who work below the standard.

Unit outcomes

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

- *describe the structure and functions of human skeleton and divide it into axial and appendicular skeleton;*
- *list types of bones and joints, state their functions, give examples of each and demonstrate by using models;*
- *list types of muscles, explain their structures and functions and demonstrate how they work using models;*
- *describe how muscles and skeleton work together;*
- *describe the importance of physical exercise and proper diet for health of bones, muscles and joints;*
- *name the different types of human teeth, relate them with their functions;*
- *define dental formula;*
- *show the dental formula of humans and compare it with that of some other mammals.*

Main Contents

Planning for the Unit

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, make presentations, harmonize concepts, stabilizing and evaluation.

3.1 THE MUSCULAR AND SKELETAL SYSTEMS

Periods allotted: 10 periods

1. Competencies

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

- *divide human skeleton into axial and appendicular skeleton;*
- *describe the structure and functions of human skeleton;*
- *list the types of bones;*
- *give examples for each types of bones;*
- *list the types of joints;*
- *tell the functions of each types of joints;*
- *classify joints into movable and immovable;*
- *demonstrate movable joints using models;*
- *list the types of muscles;*
- *explain the structure and functions of muscles;*
- *demonstrate how muscles work using models;*
- *describe how muscles and the skeleton work together;*
- *describe the importance of physical exercise and proper diet for the health of bones; muscles and joints.*

2. Sub-unit overview

This sub-unit introduces students to the parts of the human skeleton, describes the structures and functions of the skeletal system, explains the types of bones, joints and structures and functions of muscles, types of muscles, and how muscles work, and discusses the importance of physical exercise and diet for skeleton and muscle health.

3. Forward planning

Prepare a long range of lesson plan to make arrangements for group activities and library readings. Ahead of time, check whether the relevant charts/models are available or not in your school. If there are no charts or models try to prepare them by using local materials.

4. Suggested Learning - teaching approaches

4.1 Suggested Teaching aids

- Use charts, diagrams, and models of the human skeleton, bones and antagonistic functioning of muscles that will be made available by your school or students.

4.2 Suggested Teaching methods

- Brainstorming on the structures and functions of skeleton and the importance of regular physical exercise and proper diet on skeletal and muscle health.
- Discussions on structures and functions of muscles.
- Reflections on axial and appendical parts of a human skeleton of bones and joints.
- Demonstration on types of joints and their functions and how muscles work.
- Library readings

4.3 Presentation of the lesson

Start the lesson by asking students to define skeleton. Then outline the contents:

- Axial and appendicular skeleton
- Structures and functions of the skeleton
- Types of bones
- Types of joints
- Structures and functions of muscles
- Types of muscles
- How do muscles work?
- Muscles and skeletal health

You are requested to give emphasis to these important points outlined here below.

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
Axial and Appendicular Skeleton (Part I)	
SA	Students observe a drawing or model of human skeleton
MA	Students carryout activity 3.1 and describe the division of human skeleton into axial and appendicular skeleton.
CA	Students review the axial and appendicular skeleton of human.

Axial and Appendicular Skeleton (Part II)	
SA	Students bring simple model or drawing of human skeleton with a cardboard.
MA	Students do activity 3.2 and activity 3.3. On the cardboard they trace bones of the axial and appendicular skeleton from the drawing to be connected on the appropriate position system. **Axial** — **Appendicular** Skull — Collar And Shoulder Bones And Fore Limb Ribs — Hip Bones And Hind Limb Vertebral Column
CA	Students make notes on the bones of the axial and appendicular skeleton.
Structures and Functions of The Skeleton	
SA	Students describe the divisions of the human skeleton into axial and appendicular.
MA	Students describe the structures and functions of the human skeleton.
CA	Students review the functions of the human skeleton.
Types of Bones	
SA	Students come up with bones of cattle.
MA	Students perform activity 3.4 and give examples of each type of bones. **Long Bones**: humerus, radius ulna, femur ,tibia and fibula **Short Bones**: carpals, metacarpals, tarsals , metatarsals and phalanges **Flat Bones**: ribs
CA	Students summarize the types of bones
Types of Joints (Part I)	
SA	Students brainstorm on the functions of joints.
MA	Students carryout activity 3.5 and give examples of each type of joints and their functions **Immovable Joints:** skull **Movable Joints** : hinge joints to bend and stretch arm and knee ball and socket joints to rotate fore and hind limbs gliding joints to move fingers, toes and vertebrae pivot to twist head, wrist, and ankle
CA	Students review the types of joints and their functions.

Types of Joints (Part II)	
SA	Students bring the necessary materials to construct models of joints.
MA	Students do activity 3.6 to demonstrate the types and functions of joints.
CA	Students review the types and functions of joints.
Structures and Functions of Muscles	
SA	Students describe that our body moves when muscles act on bones.
MA	Students discuss with the teacher on the structures, functions and types of muscles using a chart. Muscles are tissues that aid movement of the body. The types of muscle are **Skeletal Muscles**:-Voluntary muscles attached to skeleton. **Smooth Muscles**: - Involuntary muscles attached to internal organs. **Cardiac Muscles**: - Involuntary muscles attached to heart.
CA	Students Make Notes On The Types And Functions Of Muscles.
How Do Muscles Work?	
SA	Students come up with model of bones and coiled wire.
MA	Students do activity 3.7 to demonstrate the interaction of muscles and bones
CA	Students revise how muscles and skeleton work together.
Muscle and Skeletal Health (Part I)	
SA	Students summarize how muscles and skeleton interact.
MA	Students discuss with the teacher on the importance of regular physical exercise and proper diet in keeping skeleton and muscle healthy.
CA	Students review the importance of physical exercise and proper diet on the health of skeleton and muscles.
Muscle and Skeletal Health (Part II)	
SA	Students recap the importance of physical exercise and proper diet for healthy skeleton, muscles and body.
MA	Students perform activity 3.8 to suggest &forward physical exercise and diets recommended for healthy bones, joints, muscles and body parts of different age group.
CA	Students make notes on the physical exercise and proper diets recommended for healthy skeleton, muscles and body parts.

- The human skeleton consists of the axial and appendicular parts.
- The skeletal system of humans is structurally composed of bones, cartilage, joints, tendons, and ligaments.
- There are three types of bones in humans based on the shape. They are long, short and flat bones.
- Joints are junctions of two or more bones to assist movement of bones. They can be of fixed or movable. The immovable ones include the bones of skull and ear while the movable bones include the bones of neck, shoulders, waist, elbows, wrist, fingers, hip, knees, ankles and toes.
- These movable joints can be classified as hinge, pivot, ball and socket, and gliding.
- Muscles are tissues for movement. They can be of three types. Smooth muscles to move internal organs, skeletal muscles to move skeleton and cardiac muscles to contract heart.
- Muscles exist in pairs and work antagonistically for their contraction and relaxation.

4.4 Assessment and follow up

Prepare a list of all students in each section you are going to teach. The list serves as students' performance checklist where you can make a record how every student is involved in activities, discussions and in the learning-teaching process.

You can use your own questions and Exercise 3.1 for assessment. Check their exercise books and make a record. Make sure that students working at the minimum requirements have fulfilled the competencies suggested in the section. Give additional lesson time for students performing below the level of minimum requirements. Appreciate the students working above the level of minimum requirements.

Additional Questions

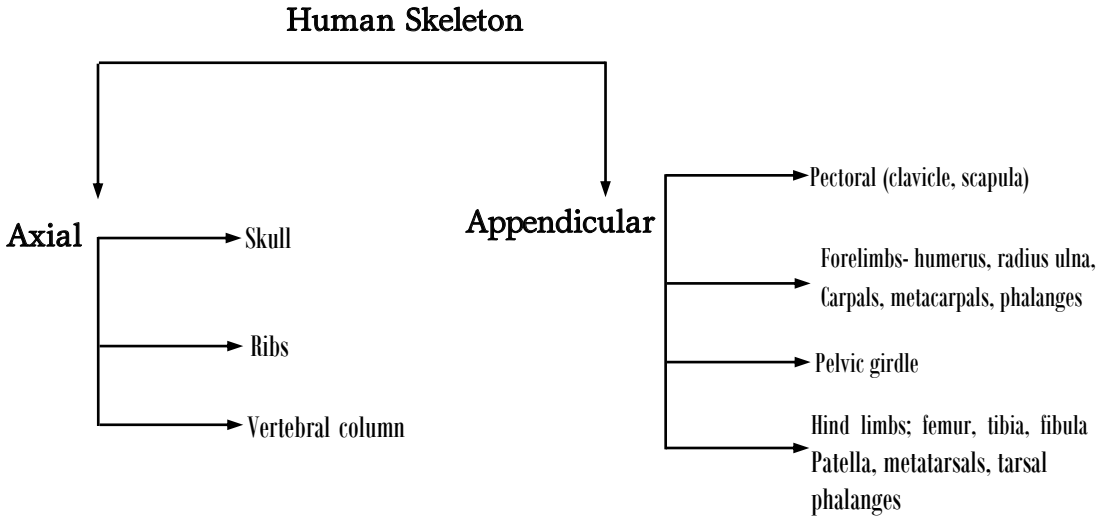
1. Write down the name of the bones of the skull?
2. Write down all the bones of the fore and hind limbs?
3. What are the functions of the bones of ribs?
4. Which type of joints work like a door?
5. How does a pair of muscles work?

Answers to additional questions

1. Cranium and facial bones.
2. Bones of the forelimbs are: humerus, radius, ulna, carpals, metacarpals and phalanges; the hind: femur, tibia, fibula, tarsals, metatarsals and phalanges.

3. To protect internal organs like lungs and heart.
4. The elbows, knees and knuckles are the best examples.
5. A pair of muscles work antagonistically when one contracts the other relaxes.

Concept Map



Answers to Exercise 3.1

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

3.2 HUMAN DENTITION

Periods allotted: 5 Periods

1. Competencies

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

- *mention the different types of human teeth;*
- *relate types of human teeth with their functions;*
- *define dental formula as a short way of indicating the numbers, types and arrangement of teeth;*
- *show the dental formula of humans;*
- *compare human dental formula with that of some other mammals.*

2. Sub-unit over view

This sub-unit introduces students with the different types of human teeth and their functions. The students will be familiarized with the term dental formula. Then, they will calculate the dental formula of humans and other mammals for comparison.

3. Forward planning

Read the contents of this subtopic exhaustively. Prepare a plan related to the contents and activities ahead of time. You should plan during each period so that the whole content in the section can be covered within five periods.

In this section, three activities, in making a model and group discussions are suggested in the student's text. You should allocate time for constructing models, to discuss activities, make demonstration, harmonizing concepts, stabilization and evaluation during each period. Arrange time for library reading, practicing and comparing dental formula of animals.

4. Suggested Learning -teaching approach

4.1 Suggested teaching aids

Make use of charts and models parts of a tooth and types of teeth to facilitate the learning teaching process.

4.2 Suggested teaching methods

- Brainstorming on the functions of human teeth.
- Discussions on the functions of teeth.
- Discovery on the cause of variations in dental formula of mammals.
- Library reading on dental formula of some mammals.
- Reflections on labeling parts of teeth, writing dental formula of humans.
- Demonstration on parts of a tooth.

4.3 Presentation of the lesson

To start with this section, introduce students to structures in a tooth and their functions, and the sets of teeth in humans (milk and permanent). Then, tell students the definition of dentition as the development of teeth and their arrangement in the mouth. Allow students to carry out Activity 3.11 to reinforce the lesson.

SA = Starter Activity, MA = Main Activity, CA = Concluding Activity	
What are teeth?	
SA	Students bring models or drawings of a tooth.
MA	Students carry out Activity 3.9 to identify parts of a tooth and present their finding to the class.
CA	Students make notes on the definition of dentition and parts of a tooth.

Types of human teeth	
SA	Students come up with models or drawings of teeth.
MA	Students carry out Activity 3.10 to identify the four types of human teeth and present their findings to the class. Incisors Premolars Canines Molars
CA	Students recap the four types of teeth and take notes.
Functions of human teeth	
SA	Students summarize the four types of teeth
MA	Students discuss the structure of each type of teeth and its function and present their report to the class. .
CA	Students correlate the structure of each type of teeth with its function.
Dental formula (Part I)	
SA	Students brainstorm on number of teeth of different animals.
MA	Students practice writing the human dental formula and each student will be asked to write his/her formula on the chalk board.
CA	Students make notes on the dental formula.
Dental formula (Part II)	
SA	Students write down dental formula of some mammals.
MA	Students compare dental formula of other mammals with that of humans and discuss on why such difference among mammals.
CA	Students summarize the dental formula of mammals vary in accordance with their feeding habit.

You are required to focus on the following points.

Dentition refers to the development and arrangement of teeth in a mouth.

There are four types of dentition in humans and other mammals.

These are:

- Incisors, scissors-like for cutting.
- Canines, pincers-like for piercing.
- Premolars and molars, grinder-like for grinding and crushing.

Dental formula refers to the number, type and arrangement of teeth in one-half of the upper and lower jaws especially in mammals.

4.4 Assessment and follow up

You can use your own questions and Exercise 3.1 for assessment. Check their exercise books and make corrections of their work whenever necessary. Prepare a list of all students in each section you are going to teach. The list serves as students' performance checklist where you can make a record of how each student is doing in activities, discussions and in the teaching-learning process.

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to keep on working hard and not to be exhausted.

Students working below the minimum requirement level will require back up in order to catch-up with the rest of the class. They should be given extra attention in class and additional lessons during breaks or at the end of the day.

Additional questions

1. Which type of teeth is useful for gnawing?
2. Which type of teeth serves as a grinder?
3. Write the dental formula of yourself? How many are they?

Answers to the additional questions

1. The incisors
2. Premolars and molars
3. The answers may vary depending on the number of teeth they have.

Answers to exercise 3.2

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

Answers to Review Questions

Part I: Multiple choices

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

Part II: Matching

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

Part III: Fill in the blanks

19. Axial, Appendicular
20. Incisors
21. Contracts, relaxes
22. Dentition
23. Feeding

Part IV: Fill in the blanks

24. The central or the main axis of the skeleton.
25. Pectoral girdle is found at the shoulder.
26. Hinge joints allow movement in single direction, while pivot joint allows sideway movements.
27. When you die.
28. Because of their wider edge and depression

Part V: Word Search

P	E	L	V	I	C	G	I	R	D	L	E	Q	H
E	B	E	E	T	W	E	N	A	E	U	C	U	E
O	G	F	R	T	T	N	Q	D	T	C	B	E	L
P	K	P	T	I	B	I	A	I	H	Y	D	E	L
L	D	Z	E	U	K	D	H	U	M	E	R	U	S
E	V	W	B	P	L	S	M	S	O	T	I	L	K
M	N	J	R	E	A	T	S	O	V	H	B	N	U
A	M	O	A	R	F	H	Q	T	E	I	S	A	L
N	S	F	I	B	U	L	A	H	R	O	J	T	L
A	X	I	A	L	S	K	E	L	E	T	O	N	R

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Encarta premium 2009 DVD

En.wikipedia.org/wiki/Human_skeleton

En.wikipedia.org/wiki/Muscular_system

UNIT 4 PLANTS

Total periods allotted: 25 periods

Unit Overview

Students are by now well familiar with plants as multicellular, self-feeding and, photosynthetic organisms. This unit will introduce students to plants, especially to flowering plants (*Angiosperms*). Flowering plants are advanced plants that dominate all the rest of plants both in number and types. This is due to the fact that these plants are vascular, seed bearing and those that use flowers as their sexual reproductive organs. In fact, the dominance of flowering plants is principally related to having flowers. Flowers allowed the flowering plants to use different pollinating agents, unlike the cone bearing plants. The double fertilization in flowering plants enables the plants to have reserve food in the form of cotyledon for the emerging embryo and the formation of fruits. Fruits formed by flowering plants are not only used for protection of the seed, but they are also important in dispersal of seeds.

Unit outcomes

After completing this unit, student will be able to:

- *tell that plants are diverse in size, type and distribution and demonstrate love and respect to plants;*
- *classify plants into flowering and non-flowering and mention mosses, ferns and gymnosperms as non-flowering plants;*
- *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.*

Main contents

Planning for the unit

As you are going to introduce the students to the diversity of plants, and especially of the flowering plants you need to organize materials, collect plant samples and their flowers ahead of time. Identifying flower parts, differentiating flowering plants as monocots and dicots, vegetative means of reproduction in flowering plants and pollination and fertilization in flowering plants are the most important components of the unit. Please read pieces of information given in this guide before starting covering the sub-unit.

4.1 DIVERSITY OF PLANTS

Periods allotted: 3 periods

1. Competencies

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

- *tell that plants are diverse in size, type and distribution;*
- *demonstrate love and respect to plants;*
- *classify plants into flowering and non-flowering;*
- *mention mosses, ferns and gymnosperms as non-flowering plants.*

2. Sub-unit overview

This sub-unit introduces students to the unifying characteristics of all organisms grouped under plants, which is self-feeding and their diversity as well. Students will begin to study the diversity of plants by letting them to tell if plants that they can see through the window and those they have been looking at while coming to school are similar in size, shape and type. This will give students the opportunity to visualize that there are differences among plants. Then they will be allowed to discuss the differences that exist among plants, like forming seeds or not, having flower or not and forming fruits or not. They will also categorize plants as flowering and non-flowering plants. Thus, the students will develop the interest to learn more about the similarity, types and differences among plants. Keep in mind that this sub-unit which introduces students to diversity of plants will be given within 3 periods (120 minutes). Actively involve your students.

3. Forward planning

Since this is the sub-unit in which you are going to treat the diversity of plants as broad category of flowering and non-flowering plants, you need to plan ahead of time so that you can cover the sub-unit and achieve its objectives. The following are activities you are expected to carry out before starting to deal with the sub-unit.

- Check for moss plant around shady area growing on the surface of rocks or on the barks of trees in your school compound.
- Check for the presence of a fern plant, usually found in shady area under trees or if there is any grown in a pot.
- Check for presence of any gymnosperms and flowering plants in your school compound.
- Check the availability of microscope (simple [hand lens] and/or compound) in your school laboratory; if it is not available draw a moss plant and allow the students to examine its structures.
    - If you have hand lenses and compound light microscope observe a moss plant.
- Take your students out of the class and give them the opportunity to observe the differences that exist among plants (mosses, ferns, gymnosperms and angiosperms) to carry out Activity 4.2.
- For Activity 4.3 you need to collect and arrange the following items for the experiment
    - Cones and flowers.

4. Suggested Teaching-Learning Approaches

4.1 Suggested Teaching aids

As teaching resources, use the real plants and their parts or you can make drawings or prepare model of flowers to cover this sub-unit. Use the textbook as well.

4.2 Suggested Teaching-Learning approaches

- Brainstorming on diversity of plants.
- Reflections on the tables that they form on diversity of plants.
- Discussions on diversity of plants.
- Group activities on identifying the main parts of samples of plants.

4.3 Presentation of the lesson

The moment you start the lesson, ask your students what different types of plants they can remember from their surroundings. Then, ask them whether they have ever seen a moss, a fern, a gymnosperm and a flowering plant. Then after, you can inspire them by

asking: Which of these plants are common or the dominant type in their surroundings? What do they think of the reason for the commonness or dominance of the group? What specific feature(s) is/are displayed by the group? You can also assess the students if it is possible to roughly dividing these plants into flowering and non-flowering plants.

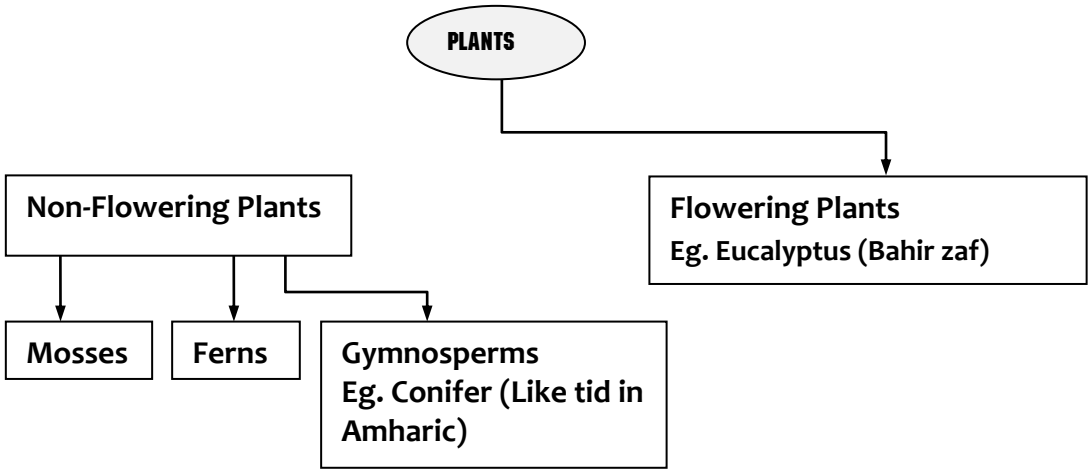
You can trigger your students to discuss if the non-flowering plants possess sexual reproductive structures or not. Then, you can forward to the students what is/are the unique features of flowers, the sexual reproductive structures of flowering plants.

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Diversity of plants (Activity 4.1).	
SA	Students read the text of activity 4.1 in order to carry out the activity from their textbook.
MA	Students discuss the general features of plants given in the student text).
CA	Students summarize their discussion in a table form about the general features of plants.
Diversity of plants (Activity 4.2).	
SA	Students read activity 4.2 in order to carry out the activity.
MA	Students consider characteristics like size of plants, presence or absence of flowers, presence or absence of cones and color and types of flowers. Students discuss with their teacher the classification shown in Figure 4.3.
CA	Students give answers to the questions with in the activity 4.2.
Diversity of plants (Activity 4.3).	
SA	Students read the text of activity 4.3 in order to carry out the activity.
MA	Students identify the reproductive structures in plants (like flowers and cones) and check if there are some more.
CA	Students give answer to the question in the Activity 4.3.

You can allow the students to discuss in groups the information they have on:

- Algae
- Mosses
- Ferns (vascular (have phloem and xylem) non-seed bearing plants)
- Gymnosperms (cone bearing plants)
- Angiosperms (flowering plants)

You can give them a short note on how the above mentioned plants are differentiated from each other.



You can use real samples to show the students the diversity among plants. You can either bring some of the samples into the classroom or/and by letting the students go around the school compound to observe the existing diversity among plants.

After going around the school compound and discussing on the diversity of plants you can proceed to Activity 4.2 and 4.3 to finalize the discussion on diversity among plants. At the end of Activity 4.2 and 4.3 ask the students if there is diversity among plants? Can plants be categorized grossly as flowering and non-flowering plants?

4.4 Assessment and follow up

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

- What are plants?
- What is the unifying feature of all plants?
- What are flowers?
- Explain the relationship of flowers and to the dominance of flowering plants.

Then evaluate the group reports after discussion and making study tour through the school compound.

Answers to Exercise 4.1

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

4.2 FLOWERING PLANTS

Periods allotted: 22 periods

1. Competencies

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

- *state the general characteristics of flowering plants;*
- *give examples of flowering plants;*
- *explain the structures and functions of the root;*
- *explain the structures and functions of the stem;*
- *explain the structures and functions of the leaf;*
- *identify stomata using a microscope;*
- *classify flowering plants into monocotyledons and dicotyledons;*
- *distinguish between monocotyledons and dicotyledons;*
- *give examples of monocotyledons and dicotyledons;*
- *explain vegetative reproduction in flowering plants;*
- *give examples of flowering plants that reproduce by vegetative reproduction;*
- *draw and label the structures of a flower;*
- *state the functions of the structures of a flower;*
- *examine pollen grains and ovaries using a hand lens;*
- *tell the importance of pollination;*
- *explain the process of fertilization;*
- *state that ovaries develop into fruits and ovules develop into seeds;*
- *draw and label the structures of a seed;*
- *state the functions of the structures of a seed.*

2. Sub-unit overview

This sub-unit familiarizes students to flowering plants, which are the most common plants on Earth. The students will start studying the features of the flowering plants by investigating the uniqueness of flowers, the sexual reproductive structures of this group of organisms. This will give them the chance to inspect the significance of flowers to the dominance of flowering plants; they can compare the flowers and the cones to visualize if this is actually true or not. Then, students will be allowed to discuss the different parts of a flower and its uniqueness; containing sexual parts (pistil [female] and stamen [male]) and non-sexual parts (sepals and petals). Then after, the students

will begin to organize concepts that each part of a flower has its own function to facilitate the pollination and fertilization processes that happen in this group of plants. Students should be given the chance to inspect pollination in flowering plants, unlike that of *Gymnosperms* (cone-bearing plants like *tid*) is not a chance matter. In flowering plants the colored petals and nectars play significant roles in attracting different pollinating agents, which also contribute to the success of the group. The Angiosperms not only reproduce sexually but also reproduce with non-sexual means of reproduction using vegetative structures like parts of stem, roots and leaves. Keep in mind that this sub-unit that introduces the students to different features of flowering plants will be treated within 22 periods (880 minutes). 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

Because this is the sub-unit within which you are going to introduce the features of flowering plants giving more emphasis on flowers and their characteristics, planning ahead of time is necessary to cover the sub-unit and to achieve its objectives. The following are activities you are expected to carry out before starting working on the sub-unit.

- Look for a plant that you can easily uproot and bring it to the class and with which you can demonstrate parts of a plant (stem, leaf, roots and flower as well) or a model plant with all the parts of a plant. If you couldn't find an easily up-root able plant or a model, you can make your own drawings to show them the parts.
- Look for models in your school resource center to treat the function, internal and external parts of the stem, the leaf and the root of flowering plants.
- Look for representative plants to demonstrate ***the tap root*** and ***fibrous root systems*** from your school compound or get from somewhere else; you can use a carrot plant and a grass for demonstration of the ***tap*** and ***fibrous root systems*** respectively.
- Plant beans in pots to carry out ***Activity 4.6***, which is about the examination of transporting water and minerals up through the stem.
- Look for leaves in your school compound for better observation of ***stomata***, you can use ***Cana indica*** leaf for this purpose.
- Make sure to collect representative seeds of different monocot and dicot plants.
- Make sure the availability of flowers at your school compound to examine parts of flowers and their functions.

- Check the availability of vegetative reproductive parts of flowering plants like ***bulbs*** (onion), ***rhizome*** (ginger), ***tuber*** (potato), ***runner*** (*serdo*) and ***crom*** (crocus).
- Look a rose plant to carry out ***Activity 4.13*** *(stem cutting)*, which is an artificial vegetative propagation of flowering plants.
- Check the availability of any type of plant hormones.
- Check the availability of microscope (simple [hand lens] and/or compound) in your school laboratory. If it is not available draw and allow the students to examine pollen grains and the pistil.
    - If you have hand lenses and compound light microscope observe pollen grains and the pistil.
- Make sure to soak seeds of monocot and dicot plants ahead of time to carry out ***Activity 4.16***.

4. Suggested Teaching-Learning Approach

4.1 Suggested Teaching aids

As teaching resources, use the real plants and their parts or you can make drawings or prepare models of flowers to cover this sub-unit. Use the ***textbook*** as well.

4.2 Suggested teaching-Learning approaches

- Brainstorming on the structure of flowering plants and giving emphasis to the flower.
- Reflections on function of roots, difference of monocots and dicots, underground stems for natural vegetative propagation and fertilization in flowering plants.
- Discussions on general characteristics of flowering plants, functions of roots, internal features of root, the stems, leaves, monocots and dicots, reproduction in flowering plants, pollination, fertilization and the seed.
- School compound visits
- Group activities on plant samples (been, carrot and maize, leaves (Cana), classify monocots and dicots, vegetative propagation in flowering plants, identifying parts of flowers, classify wind and animal pollinated flowers.
- Laboratory activities on transport of materials up through the stem, parts of seed and plant hormone.

4.3 Presentation of the lesson

You can introduce the lesson by asking students what is the unique characteristic of flowering plants? What makes the flowering plants different from the rest of the plants? The success of the group in terms of number and variety is associated with having flowers as sexual reproductive structures. You can ask them to closely examine a

flower, its parts, the color of the petal, the smell and the nectar. You can provide them a hint, by asking them what they think as to why the flowers of different plants need to have different colors, smell and shapes.

General characteristics of flowering plants (Activity 4.4)	
SA	Students discuss main features of flowering plants. They emphasize the issue of flowers and dominance of the group on Earth.
MA	Students discuss that flowering plants only have flowers, flowers are reproductive structures of these plants, and they are plants that produce seeds and fruits (unlike the cone forming plants that only produce seeds).
CA	Students summarize the main features of flowering plants and give some examples of flowering plants that are grown in their localities.
The main parts of flowering plants (Activity 4.5)	
SA	Students bring plant samples (bean plant, maize or grass plant) by carefully uprooting them.
MA	Students in groups observe and identify the main parts of the sample plants with hand lens. They discuss the main parts of these plants.
CA	Students draw and label the main parts of these plants.
The functions of roots of plants?	
SA	Students brainstorm the possible functions of roots to plants.
MA	Students discuss in pairs the function of plants by observing Figure 4.8 in their text.
CA	Students summarize the main functions of roots and present it to the class.
The root (Activity 4.6).	
SA	Students bring plant samples (bean, carrot, and maize or grass plants) by carefully uprooting them. They brush away the soil from the plants and wash them clean.
MA	Students, in groups, observe the roots of the plants and compare them with Figure 4.9 in their text. Students identify the roots of these plants as tap root system or fibrous root system.
CA	Students draw and label the main parts of the root systems.
What are the main internal features of the root?	
SA	Students read about the main internal features of the root.
MA	Students emphasize during their discussion *epidermis*, *pith*, *cortex* and *vascular bundles*. Students refer to Figure 4.10 in their text.
CA	Students summarize the main features in drawing as indicated in Figure 4.10.

The stem (Activity 4.7)	
SA	Students, in groups, bring plant samples (bean, carrot, and maize or grass plants) by carefully uprooting them. They brush away the soil from the plants and wash them clean. Students recollect what they read about the main features and functions of the stem.
MA	Students, in groups, carry out the experiment by dipping the plant into the beaker that contains a dye and after an hour observing the presence of the dye by cutting the stem with a blade/scalpel.
CA	Students from this experiment conclude that water moves upward by being absorbed from the soil by roots of plants and ascend through the stem then to all parts of the plant.
The leaves	
SA	Students brainstorm what they think are the main functions of leaves..
MA	Students discuss main function of leaves and allowed to closely observe during their discussion Figure 4.13 and Figure 4.14 in their text.
CA	Students summarize their discussion by drawing a leaf and by labeling its main external and internal parts..
The leaf (Activity 4.8)	
SA	Students in groups bring plant samples (leaves of Cana [*Key abeba'*] or from any other plants). They make sure that all the necessary apparatus and chemicals are there or not.
MA	Students cut a very small section from the leaf they brought and mount and observe it using medium power objective. Students after painting with nail varnish the underside of the leaf, drying and peeling it they observe the stomata with a hand lens.
CA	Students compare what they observe under the compound microscope and hand lens with Figure 4.14.
Monocotyledons and dycotyledons	
SA	Students differentiate the leaves and seeds of very common plants like bean and any grass.
MA	Students discuss the difference between monocots and dicots and to examine Table 4.1.
CA	Students summarize their discussion by presenting Table 4.1 to the class.
Monocotyledonous and dicotyledonous plants (Activity 4.9)	
SA	Before the class, students in groups collect specimen of plants (at least each for the group) from the school compound. Teacher's guidance is necessary to easily locate where these plants are there in the school compound. They organize their specimens for this lesson.

MA	Students tape (stick) the samples of plants on the piece of paper and examine them carefully. They classify the sample plants as monocots or dicots based on the criteria given on **page 80-81**
CA	Students label the samples as monocots or dicots.
Monocotyledonous and dicotyledonous plants (Activity 4.10)	
SA	Students in groups they soak seeds of corn and bean plants one day ahead of this activity.
MA	Students tape the samples of plants on a piece of paper and examine them carefully. They classify the sample plants as monocots or dicots based on the criteria given on **page 80-81.**
CA	Students label the samples as monocots or dicots.
Reproduction in flowering plants	
SA	Students brainstorm what they think how flowering plants reproduce.
MA	Students discuss the possible methods of reproduction available in flowering plants. During their discussion they consider asexual methods of reproduction and read the text at **page 85 - 85.**
CA	Students summarize their discussion by explaining the sexual and asexual methods of reproduction in flowering plants.
Underground stems for natural vegetative propagations	
SA	Students brainstorm about Figure 4.15 in their text and the importance of underground stems of flowering plants.
MA	Students identify the underground stems flowering plants that are commonly used for vegetative propagation.
CA	Students present their summary to the class.
Vegetative propagation (asexual reproduction in flowering plants) (Activity 4.11)	
SA	Students in groups examine samples of plants they are provided with carefully.
MA	Students identify and classify the samples they are provided with to specific group of means of asexual propagation as indicated in Figure 4.15, 4.16 and 4.17.
CA	Students brainstorm on different types of vegetative means of propagation.
Vegetative propagation (asexual reproduction in flowering plants) (Activity 4.12)	
SA	Students prepare portions (11 – 20 cm long stem cut with leaves attached to) from plants in order to grow and propagate plants from stem cuttings and dig a hole not less than 20 cm deep.
MA	Students remove leaves from the lower portion 4 – 5 cm of the stem cut and plant the stem in moisten hole dug for the purpose.
CA	They follow the development and growth of the stem cut.

Examine the effect of plant hormones on stem cuttings (Activity 4.13)	
SA	Students read the procedures of activity 4.13.
MA	Students prepare rose stem cuttings, prepare auxin solution, dip half of the stem cuttings into auxin solution and dip the other half stem cuttings in water. They plant them in two rows.
CA	Students prepare a plan to follow rooting of the stem cuttings.
Parts of a flower (Activity 4.14).	
SA	Students dissect the flower they are provided with scalpel.
MA	Students identify parts of the flower and compare the parts of the flowers they identified with the Figure 4. 18 and Table 4.2.
CA	Students draw a flower and label its parts according to their observation.
Pollination	
SA	Students read the process of pollination.
MA	Students discuss those pollen grains from the stamen transferred by different agents to the pistil of the flower.
CA	Students summarize the main discussion points and to the class.
Pollination (Activity 4.15).	
SA	Students evoke the features of wind and animal pollinated flowers..
MA	Students identify the main features of wind and animal pollinated flowers based on the characters given for the activity. .
CA	Students summarize their discussion in the form of a table and analyze it.
Unique feature of the fertilization in flowering plants	
SA	Students give response how fertilization in flowering plants could possibly happen given that pollen landing first on the stigma.
MA	Students discuss in group fertilization in flowering plants by closely observing Figure 4.20.
CA	Students summarize their discussion and share with other groups.
Pollination (Activity 4.16).	
SA	Students collect flowers from plants available in the school compound.
MA	Students classify the flowers as wind or animal pollinated types based on the criteria they identified and set in Activity 4.15.
CA	Students reason out as to why they classify the flower from a given plant as wind or animal pollinated type.

The seed (Activity 4.17)	
SA	Students soak seeds of bean and corn one or two days before.
MA	Students, in groups, carefully examine the parts of the seeds by removing the external covers. They compare the parts of the flowers they identified with the Figure 4.
CA	Students draw and label its parts of the seeds.

When you start the lesson, ask your students what features make the flowering plants different from the rest of plants. Then, ask them whether they have ever noticed flowers from different types of plants as different or the same. If they say different, what do they think is/are possible reason(s) for different flowering plants to produce different types of flowers? You can ask the students, if it is possible, to roughly divide these plants into flowering and non-flowering plants, and thereby make a generalization about the dominance of flowering plants in relation to the possession of flowers.

You can motivate your students to discuss whether a flower is associated with the formation of seeds and fruits in flowering plants or not. Then, you can what the unique features of flowers is/are?

You can allow students to discuss the information they have in groups on:

- Sexual reproduction in Gymnosperms and its difference with the sexual mode of reproduction in flowering plants.
- Pollination and pollination agents.
- Fertilization, and especially double fertilization of flowering plants.
- The formation of seeds and fruits.
- The association between pollination agents and seed formation.
- Means of vegetative propagation in flowering plants.

You can give them a short note on the parts of a flower and its significance.

You are advised to stabilize lesson by underlining the following major points. Flowers are specialized sexual reproductive structures of flowering plants. The pistil contains the female sex cell; the anther contains pollen grains, each containing a male sex cell. Pollination transfers pollen to the stigma of a carpel. As the pollen lands on stigma it germinates and develops pollen tube that grows down through the style to the ovule and carries with it the male sex nucleus to the female sex nucleus. Fertilization occurs when the nuclei fuse.

The seed is a fertilized ovule. Following fertilization, the ovary and its wall develop into fruits and enclose the seed(s). Dispersal of seeds and fruits guarantees the distribution of plants on a wider area than being congested together.

4.4 Assessment and follow up

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

- What features distinguish the flowering plants from the rest of the plants?
- What are parts of a flower?
- What is/are the major factor(s) that contribute to the dominance of flowering plants?
- How are monocots and dicots differentiated?.

Then evaluate the group reports after discussion and making study expedition in the school compound.

Answers to Exercise 4.2

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

Answers to Review Questions on Unit 4

Part I: Multiple choices

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

Part II: Matching

6.	E	7.	D	8.	A	9.	B	10.	C

Part III: Fill in the blanks

11. Photosynthesis
12. Stem, leaf and root
13. Stamen and pistil
14. Self and cross-pollinations
15. Sperm and polar nuclei

Part IV: Short answers

16. The major groups of plants that don't possess flowers are the mosses, fern and gymnosperms.
17. The major parts of flowering plants include the stem, leaf and roots and flower as well

- ***Stem:*** is part of the aboveground part of plats and which give support to leaves, branches, flowers, fruits and that keeps the plant stand erected above the soil.
- ***Leaf***: is broad and flat part of the above the soil part of a plant and which is the major site of photosynthesis.
- ***Root:*** is the underground part of the plant, which fixes the plant to the ground and that involves in absorbing water and minerals from the soil.
- ***Flower:*** is part of above ground part of plants and which is specialized for sexual reproduction of flowering plants.

Part V: Word puzzle

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A			A		L
L					E
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	6S	T	Y	L	E

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UNIT 5 ANIMALS

Total Periods allotted: 23 Periods

Unit Overview

The unit starts by exploring the diversity of animals and discusses insects as the most diverse group of animals. This is followed by sub-units which focus on the life cycle of insects, the economic importance of some common insects and social insects as beneficial insects.

The topics need discussions and observation by students in the context of their locality. Therefore, every effort should be made to make sure that students grasp of the required competencies in dealing with the contents. Skills such as discussion, communication, writing, observations, group work, etc. will be developed in the course of the various sub units.

At the end of each sub-unit are given review questions based on competencies, in order to help you focus their continuous assessments around them and make sure whether the ones set as standard competencies are achieved or not. Furthermore, additional notes and questions are included.

You should give special considerations for those who are working above and below the standard levels by encouraging the ones that work above the standard and by giving extra attention for those who work below the standard.

Unit outcomes

After completing this unit, students will be able to:

- *tell that animals are diverse in size, type and distribution, demonstrate love and respect to them and explain why insects are the most diverse group of animals,*
- *define metamorphosis, explain complete and incomplete metamorphosis and give examples of insects that reproduce by complete and incomplete metamorphosis,*
- *describe how tsetse flies, army worm and maize borer affect humans and explain the methods of controlling them,*
- *explain the characteristics specific to social insects and give examples of social insects,*
- *explain the roles of queen, drones and workers in bees, explain methods of bee keeping and management of beehive, demonstrate the techniques of harvesting honey and compare a modern beehive with a traditional one,*
- *construct a model of modern beehive, appreciate the behaviour of social insects and express an interest to investigate more about social insects.*

Planning for the Unit

Long term lesson plan, arrangement for observation sites when applicable, insect collection apparatus, charts and drawings should be prepared.

Main Contents

5.1 DIVERSITY OF ANIMALS

Periods allotted: 2 Periods

1. Competencies

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

- *tell that animals are diverse in size, type and distribution;*
- *demonstrate love and respect to animals;*
- *explain why insects are the most diverse group of animals.*

2. Sub-unit overview

The sub unit deals with the following contents:

- Diversity of animals in size, type and distribution;
- The most diverse and successful animals – insects;
- Reasons for the success of insects.

The topic explains that animals are diverse in size, type, distribution and why insects are the most diverse group of animals including:

- the different habitats which they inhabit, and physical conditions in which they are found,
- their ability to adapt to changing conditions and to reproduce rapidly.

3. Forward planning

Prepare plan for the lesson.

Prepare pictures of various animals for different classes of animals.

4. Suggested Learning-Teaching Approach

4.1 Teaching Aids

Pictures of various animals; film (if available) showing the life of animals.

4.2 Suggested teaching Methods

- Brainstorming on the difference in size, type and distribution of animals.
- Discussion on the diversity of habitat, adaptability and reproducibility in animals.
- Discovery on the reasons why to show love and respect to animals.

4.3 Suggested presentation

Introduce the lesson by asking what students know about animals, such as naming, describing them in size, habitat, feeding, etc. Accept answers and write on the board. Then ask them which animals are found everywhere and in large numbers. Let students list down all animals they see in their locality and describe their relative size, distribution and types.

Suggested Active Learning-teaching Guide

The diversity of insects should be discussed so that students give the reasons for the success of insects. This discussion should be made so as to link with the next section.

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Diversity of animals (Activity 5.1); (1)	
SA	Students brainstorm, define the word animal and list some animals found in Ethiopia.
MA	Students discuss and describe the various ways by which animals differ. Students group animals and explain their features. Students do activity 5.1 and discuss in class.
CA	Students summarize and write the highlights of their discussion and activity.
Why insects are the most diverse group of animals?(Activity 5.2) (1)	
SA	Students brainstorm their knowledge about insect type and number.
MA	Students give free response and discuss which animal groups are the most diverse. Students conclude that insects are the most diverse group of animals and describe the reason for their diversity. Students discuss and reason out why they have to respect and love animals. Students work on activity 5.2 and stabilize their understanding of the need for love and respect to animals.
CA	Students recap the main points of the lesson and write notes.

Answers to Exercise 5.1

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

5.2 LIFE HISTORIES OF SOME INSECTS

Periods allotted: 4 Periods

1. Competencies

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

- *define metamorphosis as a change of form of an animal involving several distinct stages;*
- *explain complete and incomplete metamorphosis;*
- *give examples of insects that reproduce by complete and incomplete metamorphosis.*

2. Sub-unit overview

The section deals with insects, how they transform during the process of growth by metamorphosis and the two types of metamorphosis in the Life histories of some insects. This is discussed starting with the physical characteristics of insects.

3. Forward planning

Prepare lesson plans, prepare diagrams showing insect body parts, lifecycles of different insects and preserved specimens of various insects.

4. Suggested learning teaching approach

4.1 Teaching aids

Diagrams of insects, insect lifecycles, preserved insect specimens, hand lens and insect collection apparatus

4.2 Suggested Teaching Methods

Discussion and brainstorming with questions and answers are suggested learning methods. Activities (group and individual) should be used as indicated in the student textbook.

Discussion on the process of types of metamorphosis, and demonstration on the structures of insects.

Charts on the life cycle of butterfly and grasshopper.

4.3 Suggested presentation

Suggested Active Learning-teaching Guide

Insects are among the most common animals around us. It is necessary for the students

to study the biology of insects before their importance is understood.

Start the topic by asking the following questions and share ideas:

1. What is an insect?
2. What are the physical characteristics of insects?

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
What are Insects	
SA	Students recap previous lessons on insect diversity.
MA	Students discuss and describe the main body structures of insects using pictures and real insects.
CA	Students summarize the main structures of insect bodies and take notes.
What is Metamorphosis	
SA	Students recall and revise adult insect body structures.
MA	Students explain metamorphosis in insects and identify two types of metamorphosis in insects. They discuss complete metamorphosis.
CA	Students summarize the main points and take notes.
Incomplete Metamorphosis	
SA	Students recall stages of complete metamorphosis.
MA	Students discuss incomplete metamorphosis with examples and identify the different stage in each life cycle examined.
CA	Students summarize the main points and take notes.
Examining life cycle of insects (Activity 5.3).	
SA	Students revise complete and incomplete metamorphosis
MA	Students conduct identification of life cycles of different insects found in their community as complete or incomplete metamorphosis using specimens collected or preserved beforehand.
CA	Students stabilize their understanding and take notes.

The following notes can be useful for arranging further insect collection activities.

Based on the locality and facilities students perform insect collection, observation, identification of body parts, life cycles, and related aspects. Students at this level are motivated in understanding insects and making fun.

Insects can be collected using one of the following methods:

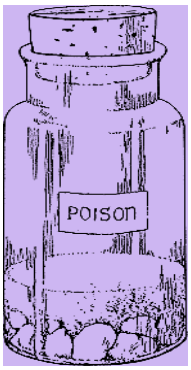
- **Sweep nets** - to collect insects from long vegetation.
- **Butterfly nets** - to collect insects in the air
- **Pond nets** - to collect visible pond animals
- **Plankton nets** - to collect small, drifting pond life, such as larva.
- **Small-fish trap** - to collect small-fish sized organisms
- **Pootors or Aspirators** - to collect insects from short vegetation and litter
- **Tree beating** - to collect soil organisms
- **Tullgren funnels** - to collect soil organisms
- **Pitfall traps** - to collect ground level organisms

How to Kill Insects:

A wide mouthed Jar with chemicals is used for killing insects. The Jar is called **Killing Jar.**

The chemicals used in the killing Jar could be one of the following: **Chloroform; Benzene; Ether; Ethyl acetate, or Insecticides**. Insecticides are insect killing preparations, which are available commercially.

A convenient killing bottle can be made by a few drops of chloroform or ether on a wad of cotton in the bottom of wide-mouthed bottle.



A jar for killing insects

Preservation:

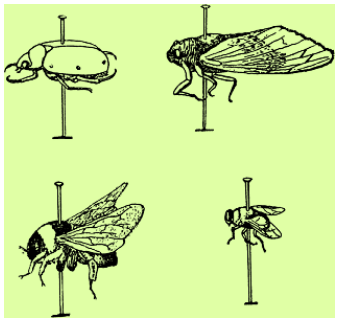
Insects and small animals can be preserved in one of the following after they are killed.

1. Using 70% Ethanol (Ethyl alcohol), mainly used for permanent or long time storage.
2. Using 4% Formalin (Formaldehyde) - mainly used for soft-bodied animals.

Mounting

After the insects, have been caught and killed, they should then be prepared for the permanent collection.

Most insects such as wasps, beetles, flies and grasshoppers should simply have a pin thrust through their bodies until they are two-thirds the way up on the pin and then put them away in a box. Such forms as butterflies and moths make a much better collection if the wings are spread so as to bring out their gaudy markings.

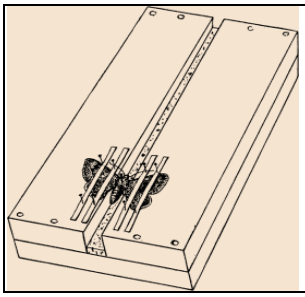


In order to spread butterflies' wings, one needs a spreading board, which can be made by taking a pine board two feet long, and six inches wide and on these nail two strips an inch thick, so that there is a crack between them.

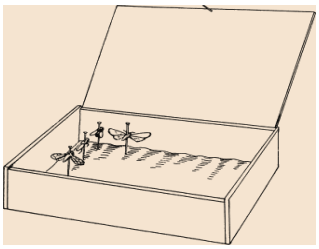
The crack should be half an inch wide at one end and a quarter of an inch wide at the other end, and in the bottom of it press strips of cornstalk pith so as to have something soft in which to stick the pins.

Method of pinning different kinds of insects

After a pin has been stuck through the body of a dead butterfly between the wings, it is then pinned in the crack so that the back of the butterfly is on a level with the strips.



spreading board for spreading butterflies and moths



box with strip of corrugated paper in bottom used for keeping pinned insects

Then the wings are drawn forward until they stand straight out from the body when they are pinned down by means of strips of paper and left to dry until they become perfectly rigid. Where time and materials are not available, simply pin them up like other insects, leaving the wings to hang as they will. After the specimens are pinned they should be put away in boxes.

Answers to Exercise 5.2

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

5.3 SOME ECONOMICALLY IMPORTANT INSECTS

Periods allotted: 6 Periods

1. Competencies

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

- *describe how tsetse flies affect humans and animals.*
- *explain the methods of control of tsetse flies.*
- *describe how armyworm damages crops.*
- *explain the methods of control of armyworm.*
- *describe how maize borer damages maize.*
- *explain the methods of control of maize borer.*

2. Sub-unit overview

The sub-unit deals with some insects that are harmful to humans including tsetse fly, dark moth-armyworm, and maize borer moth.

Students will describe how tsetse flies affect humans and animals and explain the methods of controlling them; explain the damages caused by army worm and maize borer, and the methods of controlling them.

3. Forward planning

Identify reference materials on the topic for guided reading assignments, if possible arrange for a guest speaker on crop pests from the agriculture office in your area.

4. Suggested Learning-Teaching methods

4.1 Teaching aids

Pictures showing damaged crops or plants, tsetse fly, army worm and maize borer moth.

4.2 Suggested teaching approach

Discussion on the economic importance of some insects and how to control these insects. Brainstorm on the damage caused by army worm on crops.

4.3 Suggested Presentation

Suggested Active Learning-teaching Guide

SA: Starter Activity, MA: Main Activity, CA: Concluding Activity	
Some economically important insects	
SA	Students recap previous lesson on insect life cycles
MA	Students discuss economic importance of insects, both useful and harmful aspects. Students identify some insects which are economically important due to their harmful function.
CA	Students summarize the economic importance of insects and take notes.
Tsetse flies -1	
SA	Students describe the body parts of tsetse fly using a diagram.
MA	Students discuss the economic importance of tsetse fly. Students explain the term vector and understand the role of tsetse flies as vectors of disease in humans and cattle. Students describe trypanosomiasis in humans and cattle.
CA	Students recap and write summarized notes

Tsetse flies -2 (Activity 5.4)	
SA	Students recap main points of the previous lesson
MA	Students discuss methods to control tsetse flies and do activity 5.4 and discuss in class
CA	Students summarize main points of the lesson and take notes
The Dark moth (Army worm)	
SA	Students recap economic importance of insects
MA	Students discuss the life cycle of dark moth and describe how the larval stages, called caterpillars, form the armyworm. Students explain the damage caused by army worm on crops and list the various methods for controlling armyworm.
CA	Students summarize main points of the lesson and take notes.
Maize stock borer moth	
SA	Students recap main points of previous lesson
MA	Students discuss how the maize stalk borer attack crops and cause damage. Students describe how the larval stage called caterpillar damage crops.
CA	Students summarize main points of the lesson and take notes.
Investigate Economically important insects in their locality (Activity 5.5)	
SA	Students recap previous lesson
MA	Students discuss the control methods for harmful insects in their community. Students conduct the group work and discussion in activity 5.5.
CA	Students recap their lesson on economically important insects and summarize the main control methods.

The following additional notes on Trypanosomiasis are included for elaboration purpose, if needed.

ADDITIONAL NOTES: Trypanosomiasis

Trypanosomiasis or Tryps (Sleeping sickness in humans) is a group of diseases **caused by** the widely distributed and highly variable members of the *Trypanosome* species.

- Transmission occurs by species of the biting Tsetse fly (*Glossina*).
- The tsetse fly inhabits highland forest areas where cattle are moved during the dry season. This includes the forested areas of western and southwestern Ethiopia, where expansion of agricultural production could be possible.
- The disease is constantly present depending upon the fly population.
- With all Trypanosome parasites, common symptoms of hosts include intermittent fever, progressive anaemia and loss of weight.
- The nutritional status of the animal and the stress/activity required can accelerate the progress of the disease.
- Dehydration may occur when infected animals are too weak to trek for water.
- Nutritional intervention and a non-stress environment can allow gradual recovery.
- Treatment with a number of drugs is complex, unavailable in Ethiopia and relatively expensive.
- 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.

Additional exercises to be considered

1. List harmful insects and what they cause in the community.
2. List useful insects and what their use is.
3. Describe how can harmful insects affect an economy.
4. How can useful insects contribute in an economy?

Answers to Questions 5.3

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

5.4 SOCIAL INSECTS

Periods allotted: 11 Periods

1. Competencies

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

- *explain the characteristics specific to social insects;*
- *give examples of social insects;*
- *explain the roles of queen, drones and workers in bees;*
- *explain methods of bee keeping and management of beehive;*
- *demonstrate the techniques of harvesting honey;*
- *compare a modern beehive with a traditional one;*
- *construct a model of modern beehive;*
- *appreciate the behaviour of social insects;*
- *express an interest to investigate more about social insects.*

2. Sub-unit overview

The section deals with social insects, the characteristics that are specific to social insects with examples, the behavior of social insects including ants, termites, and honeybees as the main social insects

The discussion deals with honeybee and beekeeping, the roles of the queen, drones and workers in bee colony. The methods of beekeeping, management of beehive and techniques of harvesting honey and benefits of beekeeping and its products are elaborated.

Discussions on modern beehive and traditional beehive, the advantages and disadvantages of each, characteristics of good beehive, management of beehive, and techniques of harvesting honey are included.

3. Forward planning

Prepare charts and enlarged diagrams from the student text.

Identify reference materials on the topic for guided reading assignments.

Arrange a visit to a nearby area of beekeeping or identify and arrange for a guest speaker about honeybee.

Prepare large diagrams, models and preserved specimen of social insects (if posssible) some social insects.

4. Suggested Learning-Teaching Approach

4.1 Teaching aids

Social insects preserved specimen, drawings, live specimen and a hive model

4.2 Suggested teaching methods

Reflection on examples of social insects.

Field visit on the traditional and modern beehives.

Discussion on the management of beehive, the economic importance of beekeeping and how the products of honeybees are used.

Demonstration on a model beehive and harvesting honeybee, researching on other social insects.

In this subunit, different combinations of methods are suggested including guided reading, guest speakers, and actual observations, models with discussion and brainstorming as the main methods.

4.3 Suggested Presentation

SA: Starter Activity , MA : Main Activity; CA : Concluding Activity	
Social Insects	
SA	Students list from their previous study of insects the economic importance of insects, which could be a harmful or useful aspect.
MA	Students discuss and describe insects living together in colonies. Students analyze the life of common social insects and explain their common characteristics.
CA	Students take activity 5.6 as an assignment.
The honeybee: what are the casts of honeybee? What is queen bee?	
SA	Students report their works on activity 5.6.
MA	Students describe the three casts of honeybee colony and identify them using figure 5.10. Students discuss the role of the queen bee and explain the process of its reproductive function.
CA	Students list the three casts of honeybee and the function of the queen bee.
The Honeybee: what is a worker bee? What is a drone bee?	
SA	Students identify the three types of honey bee from a chart.
MA	Students discuss the function of the worker bee and the different types of tasks performed based on their age. Students appreciate that the worker bee is a female which cannot reproduce unlike the queen bee. Students describe the drone bee and its role in the colony
CA	Students summarize the main points of the lesson and write notes.

Bee keeping (Activity 5.7)	
SA	Students brainstorm what they know about bee keeping.
MA	Students discuss the method of bee keeping using traditional and modern beehives. Students do activity 5.7 and discuss in class.
CA	Students compare modern and traditional beehives.
Beehive management	
SA	Students tell what they would do if they are to manage a beehive.
MA	Students discuss the modern ways of beehive management and explain the importance of proper management.
CA	Students summarize the responsibilities of a beekeeper.
Techniques of harvesting honey	
SA	Students recap the previous lesson
MA	Students discuss the techniques used in harvesting honey and explain the dangers of sting of no proper techniques are used.
CA	Students take activity 5.8 as an assignment.
Importance of Beekeeping	
SA	Students report their works on activity 5.8.
MA	Students tell the importance of beekeeping and explain the products obtained from honeybee including the importance of honeybee in pollinating crops.
CA	Students summarize main points of the lesson and take notes.
Importance of modern beehives and communication in bees (Activity 5.9)	
SA	Students tell their own understanding about communication in bees.
MA	Students brainstorm and discuss the advantage of using modern beehive. They compare and contrast with traditional beehive. Students do activity 5.9 and present their group report.
CA	Students summarize communication in bees.
Constructing a model of modern beehive (Activity 5.10)(1)	
SA	Students prepare materials for activity 5.10.

MA	Students identify main parts of modern hive and explain the purpose of each part. Students construct a modern beehive, working on Activity 5.10.
CA	Students demonstrate their model beehives (if they finish).
Constructing a model beehive(2)	
SA	Students prepare materials for model construction.
MA	Students continue activity 5.10.
CA	Students demonstrate their models.
Termites – Social insects	
SA	Students tell their own experiences about termites.
MA	Students discuss and recognize termites as social insects. They describe the casts of termites and their life activities. Students conduct activity 5.11.
CA	Students identify casts of termites from a chart.

Students could research into how the life of solitary wood bees differ to that of the honeybee, and another social insect such as the termite and make comparisons with the honeybee.

Additional exercises to be considered

Let students work in small groups.

Procedure:

1. Collect honeybee, ants, and termites.
2. Study their body parts and draw their pictures.
3. What are their similarities and differences?

Additional notes are given to assist planning the lesson. You can refer further to be ready for possible questions and explanations required by students and in assisting them to construct a model modern hive.

Colony reproduction, swarming and supersedure

All colonies are totally dependent on their queen, who is the only egg-layer. However, even the best queens live only a few years and one or two years longevity is the norm. She can choose whether or not to fertilize an egg as she lays it; if she does so, it develops into a female worker bee; if she lays an unfertilized egg it becomes a male drone.

She decides which type of egg to lay depending on the size of the open brood cell which she encounters on the comb; in a small worker cell she lays a fertilized egg; if she finds a much larger drone cell she lays an unfertilized drone egg.

All the time that the queen is fertile and laying eggs she produces a variety of pheromones which control the behavior of the bees in the hive; these are commonly called 'queen substance' but in reality there are various different pheromones with different functions.

As the queen ages she begins to run out of stored sperm and her pheromones begin to fail. At some point, inevitably, the queen begins to falter and the bees will decide to replace her by creating a new queen from one of her worker eggs.

At this point the bees will produce one or more queen cells by modifying existing worker cells which contain a normal female egg. However, there are two distinct behaviors which the bees pursue:

1. Supersedure: queen replacement within one hive without swarming.
2. Swarm cell production: the division of the hive into two colonies by swarming.

Supersedure is highly valued as a behavioral trait by beekeepers because a hive that supersedes its old queen does not swarm and so no stock is lost; it merely creates a new queen and allows the old one to fade away, or alternatively she is killed when the new queen emerges. When superseding a queen the bees will produce just one or two queen cells, characteristically in the center of the face of a brood comb.

In swarming, by contrast, a great many queen cells are created-typically a dozen or more — and these are located around the edges of a brood comb, most often at the sides and the bottom.

Once either process has begun, the old queen will normally leave the hive with the hatching of the first queen cells. When she leaves the hive the old queen is accompanied by a large number of bees, predominantly young bees (wax-secreters), who will form the basis of the new hive.

Scouts are sent out from the swarm to find suitable hollow trees or rock crevices and as soon as one is found the entire swarm moves in, building new wax brood combs within a matter of hours using the honey stores which the young bees have filled themselves with before leaving the old hive.

Only young bees can secrete wax from special abdominal segments and this is why there tend to be more young bees than old in swarms. Often a number of virgin queens accompany the first swarm (the 'prime swarm'), and the old queen is replaced as soon as a daughter queen is mated and laying. Otherwise, she will be quickly superseded in their new home.

Factors that trigger swarming

It is generally accepted that a colony of bees will not swarm until they have completed all of their brood combs, i.e. filled all available space with eggs, larvae and brood. This generally occurs in late spring at a time when the other areas of the hive are rapidly filling with honey stores.

So one key trigger of the swarming instinct is when the queen has no more room to lay eggs and the hive population is becoming very congested. Under these conditions a prime swarm may issue with the queen, resulting in a halving of the population within the hive and leaving the old colony with a large amount of hatching bees.

The queen who leaves finds herself in a new hive with no eggs, no larvae but lots of energetic young bees who create a new set of brood combs from scratch in a very short time. Another important factor in swarming is the age of the queen. Those under a year in age are unlikely to swarm unless they are extremely crowded, while older queens have swarming predisposition.

Beekeepers monitor their colonies carefully in spring and watch for the appearance of queen cells, which are a dramatic signal that the colony is determined to swarm. When a colony has decided to swarm, queen cells are produced in numbers varying to a dozen or more. When the first of these queen cells is sealed, after 8 days of larval feeding, a virgin queen will pupate and be due to emerge seven days after sealing.

Before leaving, the worker bees fill their stomachs with honey in preparation for the creation of new honeycombs in a new home. This cargo of honey also makes swarming bees less inclined to sting and a newly issued swarm is noticeably gentle for up to 24 hours-often capable of being handled without gloves or veil by a beekeeper.

This swarm is looking for shelter. A beekeeper may capture it and introduce it into a new hive, helping to meet this need. Otherwise, it will return to a feral state, in which case it will find shelter in a hollow tree, an excavation, an abandoned chimney, or even behind shutters.

Back at the original hive, the first virgin queen to emerge from her cell will immediately seek to kill all her rival queens who are still waiting to emerge from their cells. However, usually the bees deliberately prevent her from doing this, in which case, she too will lead a second swarm from the hive. Successive swarms are called 'after-swarms' or 'casts' and can be very small, often with just a thousand or so bees, as opposed to a prime swarm which may contain as many as ten to twenty thousand bees.

Small after-swarms have less chance of survival and, depleting the original hive, may threaten its survival as well. When a hive has swarmed despite the beekeeper's preventative efforts, a good management practice is to give the depleted hive a couple frames of open brood with eggs. This helps replenish the hive more quickly, and gives a second opportunity to raise a queen, if there is a mating failure. The following descriptions may help for construction of model modern beehive.

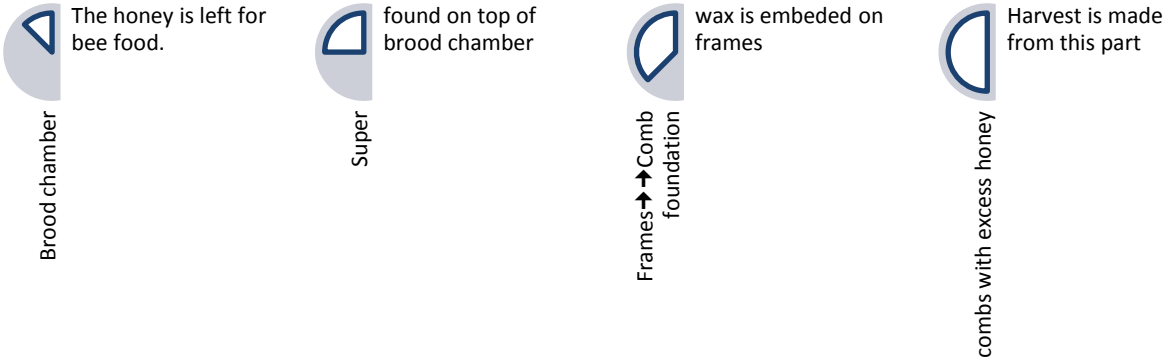
Anatomy of a Beehive

A good base: A base sits on the ground. The point is to keep the bottom board off the ground. The bottom board is what it stays. The rest of the hive stacks on top of it and it has one open side that lets the bees go in and out of the hive.

Frames and Foundations

The frame is where the action is. On the wooden frame bees build their comb in the frames using the foundation as a template. Wax foundation with embedded plastic foundation wires can be used.

Wedge or grooved wire is used with wax foundation with sides matching the depth of the box.



Traditional artificial hives

Traditional beehives simply provided an enclosure for the bee colony. Because no internal structures were provided for the bees, the bees create their own honeycomb within the hives. The comb is often cross-attached and cannot be moved without destroying it. This is sometimes called a "fixed-frame" hive to differentiate it from the modern "movable-frame" hives.

Harvest generally destroyed the hives, though there were some adaptations using extra top baskets which could be removed when the bees filled them with honey. These were gradually supplanted with box hives of varying dimensions, with or without frames, and finally replaced by newer modern equipment.

Honey from traditional hives was typically extracted by pressing-crushing the wax honeycomb to squeeze out the honey. Due to this harvesting, traditional beehives typically provided more beeswax, but far less honey, than a modern hive.

There are three basic styles of traditional beehives; mud hives, clay/tile hives, skeps which are baskets placed open-end-down, and bee gums.

Modern artificial hives

There are two basic types of modern or movable hive in common use, the "Langstroth hive" (including all the size variants) which has enclosed frames to hold the comb and the "top-bar hive", as the name implies, has only a top-bar to support the comb.

These hives are typified by removable frames which allow the apiarist to inspect for diseases and parasites. Movable frames also allow a beekeeper to more easily split the hive to make new colonies.

Bees only occupy the new hive "correctly" if it already contains frames with some honeycomb or wax plates. If only empty frames are present, bees often build honeycomb that does not follow them and cannot be later removed with the frame.

Langstroth frames are often reinforced with wire, making it possible to extract honey in centrifuges to spin the honey out of the comb. As a result, the empty frames and comb can be returned to the beehive for use in the next season.

Creating honeycomb involves a significant energy investment, conservatively estimated at 6.25 kilograms of honey needed to create 1 kilogram of comb in temperate climates. Re-using comb can thus increase the productivity of a beekeeping enterprise.

Top-bar hives

The top-bar were developed as a lower-cost alternative to the standard Langstroth hives and equipment. Top-bar hives also have movable frames and make use of the concept of bee space. The top-bar hive is so named because the frames of the hive have only a top bar, not sides or a bottom bar. The beekeeper does not provide a foundation (or provides only a fractional foundation) for the bees to build from. The bees build the comb so it hangs down from the top bar. The hive body is often shaped as an inverted trapezoid in order to reduce the tendency of bees to attach the comb to the hive-body walls. Unlike the Langstroth design, a top-bar hive is generally expanded horizontally, not vertically. The top-bar design is a single, much longer box, with all the frames hanging in parallel.

Unlike the Langstroth hive, the honey cannot be extracted by centrifuging because a top-bar frame does not have reinforced foundation or a full frame. Because the bees have to rebuild the comb after each harvest, a top-bar hive yields more beeswax but less honey.

However, like the Langstroth hive, the bees can be induced to store the honey separately from the areas where they are raising the brood. Therefore, bees are less likely to be killed when harvesting from a top-bar hive than when harvesting from a skep or other traditional hive design.

Answers to Exercise 5.4

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

Additional questions to be considered

Give short answers

1. Explain the characteristics specific to social insects.
2. Explain the roles of queen, drones and workers in bees.
3. Compare traditional and modern beehive.
4. What are the defence methods of honeybee sting?

Answers to additional questions

1. ♦ Large populations (colonies),
   - ♦ Elaborate nests,
   - ♦ Parental care,
   - ♦ Protective devices,
   - ♦ Swarming and
   - ♦ Communication.

2. **Queen:** A completely developed female bee (with functioning ovaries) that lays eggs and serves as the central focus of the colony. There is only one queen in a colony of bees. A queen's productive life span is 2-3 years.

   Drone: A male bee, whose main function in the colony is to fertilize the queen. Drones make up a very small percentage of the total colony. In the Autumn drones are expelled from the hive by the female worker bees.

   Workers: Completely developed female bees that do have developed ovaries and do not normally lay eggs. They gather pollen and nectar and convert the nectar to honey. A worker's life expectancy is only several weeks during the active summer months. However, they can live for many months during the relatively inactive winter period.

3.

Traditional hive	Modern hive
Frames not removable and difficult to inspect Not easy to form new colony No re-using of comb thus decrease the productivity Bee are damaged during honey harvest Yields more beeswax but less honey	Removable frames which allow the apiarist to inspect for diseases and parasites. Movable frames also allow a beekeeper to more easily split the hive to make new colonies. Re-using comb can thus increase the productivity of a beekeeping enterprise. Safe to bees during harvest only extra honey is harvested. Yields more honey but less beeswax

4. Knowledge of the bees is the first line of defense. Wearing protective clothing is the second line of defense. Smoke is the beekeeper's third line of defense.

Assessment

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.

Answer to Review Questions on Unit 5

Part I: Multiple Choices

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

Part II: Matching

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

Part III: Fill in the blank

21.	Insects	22.	Four stages	23.	Caterpillar
24.	Colony	25.	Waggle and round dancing		

Part IV: Short answers

26. Social insects are insects living together in a large numbers. They have a division of labor and organized society.

27. The role of the queen is to lay eggs or reproduction.

28. Modern hive is advantageous

- Easy to harvest honey
- Do not harm bee during harvest
- Can be moved easily
- Frames can be reused
- Safe for the honey bee.

29. Wearing protective clothing and using smoke are protective majors.

Part V: Word Search

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

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UNIT 6 ENVIRONMENT

Total Period Allotted: 16 periods

Unit overview

This unit is designed to help students to explore and know about environment and its characteristics. The unit helps to describe how living organisms interact with their environment. The unit has three sub-units; habitat, studying a habitat and food relationships.

The first sub-unit entitled as habitat, which defines what it is and its attributes. Habitat is classified as aquatic and terrestrial. Organisms of the same species live together are considered as a population and the interaction among different living organisms as a community.

The second sub-unit explains how to study a habitat using scientific techniques. The unit helps students in how to identify smaller habitats in their surrounding using a sampling technique. Furthermore, students know what quadrat means and how to use quadrats to estimate distribution of organisms in a given habitat. Lastly, the sub-unit contains topics, such as how to collect plant and animal specimens and how preservation techniques of plants and animals takes place.

The third sub-unit deals on food relationship within a habitat. Students are expected to know what food relationship means within an environment, difference between food chain and food web using a simple diagram of food chain and food web. Students are also expected to know and differentiate the different types of models in food relationships such as pyramid of numbers, pyramid of energy and the different trophic levels of the pyramid of numbers.

At the end of the unit students will be assessed based on the minimum competencies given on each sub-unit.

Unit outcomes

After completing this unit, students will be able to:

- *define habitat, classify habitats into terrestrial and aquatic and give examples for each;*
- *define population and community and give examples for each;*

- *identify smaller habitats in their surroundings, examine organisms that dwell in them and write a report on their findings;*
- *use quadrats to estimate distribution of organisms in a given habitat, demonstrate methods of collecting and preserving plant and animal specimens and collect and preserve plant and animal specimens;*
- *describe food chain and food web with practical examples and construct a simple food chain by observing food relationship of organisms in their surrounding;*
- *Explain the different trophic levels of a food chain, describe the pyramid of numbers using a diagram and indicate the trophic levels on the diagram of the pyramid of numbers.*

Main Contents of the chapter

Planning for the Unit

The unit requires the teacher to assess the environment for appropriate group work and field work around the school and/or village in relation to lesson before the session starts depending on the specific need of the sessions. The teacher should design the overall picture of the unit using a model or a diagram to illustrate what the environment looks like and what it contains.

6.1 HABITATS

Period allotted: 3 Periods

1. Competencies

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

- *define habitat as a place where living things live;*
- *classify habitats into terrestrial and aquatic;*
- *give examples of terrestrial and aquatic habitats;*
- *define population as a group of organisms of same species;*
- *give examples of populations;*
- *define community as a group of populations of different species;*
- *give examples of communities;*
- *demonstrate methods of collecting and preserving plant and animal specimens;*
- *collect plant and animal specimens;*
- *preserve plant and animal specimens.*

2. Sub-unit overview

This sub-unit familiarizes students with the definition of habitat, its characteristics and scope. In the sub-unit students know new terms like habitat, population and community with the necessary examples and demonstrations. Furthermore, students will differentiate the types of habitats and the various types of population and community within a habitat.

3. Forward Planning

In this sub-unit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitated teaching learning approach.

4. Suggested Learning-Teaching Approaches

4.1 Suggested Teaching Aids

Site seeing for activity 6.1 and diagrams of different types of habitat.

4.2 Suggested teaching methods

- Brainstorming for all starting activities
- Group activity and discussion based on activity 6.1
- Field work to examine a habitat
- Summary lesson on key points.

4.3 Presentation of the lesson

Take a brainstorming session on the importance of studying about environment by asking students or telling the day to day news of environmental chaos and leaders concern to protect our world from disaster. Ask students on the "Did you know?" brainstorming question for motivating students.

This concern starts from our individual knowledge and understanding about environment and the need for conservation.

6.1.1 What is Habitat?

Students should understand that habitat is the natural home of an organism; the place where living things get all the necessary things for existence. Point out to students that each organism that lives in a habitat has evolved special adaptations that allow it to live successfully.

SA = Starter activity MA= Main activity CA= concluding activity	
Why is it so important to know about our environment?	
SA	Students brainstorm on the importance and relevance of knowing about our environment.
MA	Students discuss and define on the characteristic difference between aquatic and terrestrial habitat based on their observation.
CA	Students list out animals living in aquatic and terrestrial habitat and the importance of knowing about environment.
What is Habitat? (Activity 6.1)	
SA	Students are arranged in groups to visit and identify a habitat to examine (identify their choice as a log, a stone, a tree, a river, or a pond…)
MA	Students examine on the habitat, which they have chosen, observed and classify them into an aquatic or terrestrial. Students carry out activity 6.1 and write a brief report on their findings.
CA	Students list out the different types of terrestrial and aquatic habitats.
Population and Community	
SA	Students list types of populations from their local area.
MA	Students define population and community in their own words and analyze in relation with their environment. Students differentiate between population and community with examples.
CA	Students perform exercise 6.1 to evaluate their minimum learning competency

Additional Notes

Population and Community

Factors affecting the growth of a given population

1. Temperature, humidity, food and other factors can determine where it can live and reproduce.
2. The presence of predators, competitors, or parasites may prevent a population from occupying an area.

What is community?

- Within a habitat, there are likely to be populations of different species. A group of populations within a habitat is called a community. All organisms that live together in a place are called a community.

In a particular lake, there are numerous populations of fish, birds, insects, algae, plants and others that together form a community. Species do not use or occupy all parts of their habitat at once. The specific role of a species within its environment is its *niche*. It is the position and function of an organism in the habitat. The niche includes the range of conditions that the species can tolerate, the resources it uses, the methods by which it obtains resources, the number of offspring it has, its time of reproduction and all other interactions with its environment.

The niche of a living organism includes all the matter in the surroundings such as type of food, ways of obtaining food, avoiding predators and passing bad weather. A niche may be described in terms of space utilization, food consumption, and temperature range, appropriate conditions for mating, requirements for moisture, and other factors.

- Therefore, niche is the way of life for organisms within a community while habitat is the address of an organism. Niche is not synonymous with habitat. Habitat is a place; niche is a pattern of living.
- Niche is not synonymous with habitat, the place where an organism lives. Habitat is a place; niche is a pattern of living. For example, a pond is a habitat. Within the habitat there are populations of tilapia, dragonfly nymphs, water fleas and duckweed. The populations combine to form a community in the pond.
- Students should identify the species within a habitat and be able to explain how these relate to populations and the community within which they live. For example, in a pond there may be tilapia, dragonfly nymphs, water fleas and duckweed. We can say:
    - The pond is a habitat
    - Within the habitat there are populations of tilapia, dragonfly nymphs, water fleas and duckweed
    - The populations combine to form a community in the pond

      Students should carry out similar exercises.

In summary revise key points such as

- the importance for studying environment
- key concepts like habitat, types of habitat, population and community
- help them to differentiate between habitat, population and community.

4.4 Assessment and follow up

Students are expected to work on Exercise 6.1 and submit to their teacher for correction.

Answers to Exercise 6.1

I. Choose the best answer

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

II. Classification of habitat

a. Aquatic habitat: Ditch, pond, stream, river, lake, pool, ocean, rain, sea, ocean

b. Terrestrial habitat: farmland, park, savanna, rock, rainforest, mountain, desert

6.2 STUDYING A HABITAT

Period allotted: 8 Periods

1. Competencies

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

- *identify smaller habitats in their surrounding;*
- *examine organisms that dwell in the smaller habitats;*
- *write a report on the small habitats and the organisms dwelling in them;*
- *use quadrats to estimate distribution of organisms in a given habitat;*
- *demonstrate methods of collecting and preserving plant and animal specimen;*
- *collect plant and animal specimens;*
- *preserve plant and animal specimens.*

2. Sub-unit overview

In this sub-unit, students will have a chance to know new idea and on how to study their habitat. Students will have a chance to examine various types of organisms in the smaller habitat. In this sub-unit students will have the opportunity to explore a small habitat and write down a summary report on the small habitats and the organisms dwelling in them. In so doing, students will learn techniques like sampling, quadrants and collection and preserving plants and animal specimens.

3. Forward Planning

In each sub-unit 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

- Sample quadrant model
- Sample preserved animals and plants

4.2 Suggested teaching methods

- Brainstorming during starter activities
- Site seeing and group activity of mapping a habitat
- Summary of key points will be given during conclusion.

4.3 Presentation of the lesson

You can start by brainstorming questions such as

- What is the importance of studying a habitat?
- How is that possible to determine or estimate the number of population within a habitat?

It might be possible to count all the trees in your school or all the insects under a stone, or all the worms in the moist soil sample. However, it would be difficult or impossible to identify and count all the different kinds of fish in a lake or all the trees in a forest. As a result there has to a technique to sample a small part of the habitat, identify and count the organisms within the habitat.

SA = Starter activity MA= Main activity CA= concluding activity	
Observing and studying habitats in our surroundings	
SA	Students brainstorm how it is possible to identify and count all the different kinds of species within a habitat.
MA	Students discuss and define sampling and sampling techniques; quadrats and its importance in determining the nature of a habitat. Students point out how to make quadrats using locally available tools such as stick or bamboo and try to use it to observe and study a particular habitat.
CA	Summarize key points to memorize and understand the topic
Mapping a Habitat? (Activity 6.2)	
SA	Students should identify a habitat to examine and reflect (of the order of less than a square meter).
MA	Students **carry out activity 6.2** for better understanding of mapping a habitat. Students map their habitat and identify its nature: The size of the habitat, the nature of the habitat, sizes of the various populations of organisms found and identified, comments on any particular interesting features e.g. particular plants found only where the ground is damp
CA	Students summarize by reporting their observation of the activity in the class room. Summary of the key points will be given by the teacher.

Using Quadrats	
SA	Students repeat from previous sessions how it is possible to determine the population of a certain species within a habitat? Students define quadrats in their own words.
MA	Students discuss how quadrat is used to introduce the idea of sampling. Students analyze that sampling give us an overall picture of what is present. Students differentiate the different techniques of sampling in determining the population of a species.
CA	Students comment on how reliable the estimates using a quadrats and discuss on other techniques such as line transects as an options for different types of sampling methods.
Identifying and examining of a small habitat	
SA	Students prepare materials necessary for activity 6.3.
MA	Students carry out activity 6.3 to examine and identify the organisms which are identified.
CA	Students summarize their fining and discuss their challenge in determining the population of a given habitat.
Why do we collect and preserve specimens of plants and animals?	
SA	Students brainstorm how organisms are abused within their environment
MA	Students discuss on the ethical values of and importance of collect and preserve specimens of plants and animals.
CA	Students summarize and make commitment of preserving and caring specimens of plants and animals
How can you collect and preserve animal specimens?	
SA	Students discuss the methods they would use to collect animal specimens.
MA	Students identify the different types of tools used in collecting animal specimens. Students discuss what types of chemicals are used for preserving animal specimens. They demonstrate some of the methods.
CA	Students name the different types of tools used for collecting animal specimens and take an assignment to develop the tools using locally available materials.
How can you collect and preserve plant specimens?	
SA	Students brainstorm the methods they would use to collect plant specimens

MA	Students identify the steps followed in collecting and preserving plant specimens.
CA	Students summarize the lessons and take key notes on overall process of collecting and preserving plants and animals.
Collecting and preserving animal and plant specimens (Activity 6.4)	
SA	Students arrange in a group and choose either to collect or preserve plant or animal specimens.
MA	Students carry out activity 6.4 using the given procedure given on the student text.
CA	Students display and reflect on the process of their activity. Students perform exercise 6.2 to evaluate their competence on the lesson.

Additional Notes

Sampling is a techniques used to estimate the population of a species that are found in a given habitat. There are three main ways of taking samples. These are

1. **Random Sampling**: Random sampling is usually carried out when the area under study is fairly uniform, very large, and or there is limited time available.
2. **Systematic Sampling:** Taking samples that have some sort of systematic or regular arrangements.
3. **Stratified Sampling:** The area can be subdivided into approximately equal areas and each section randomly sampled with fewer quadrats. This is called stratified random sampling, or restricted random sampling.

As a result of their work, students realise that using a quadrat is not always the best method of sampling organisms in a habitat. They could research other techniques, such **as line transects**.

Line transects are used when you wish to illustrate a particular gradient or linear pattern along which communities of plants and, or animals change. They provide a good way of being able to clearly visualize the changes taking place along the line. Depending on how detailed the line transect is, they can usually be accomplished fairly quickly.

To obtain the density of the species in a habitat

- First count the number of a plant species present within a quadrat?
- Repeat counting until the quadrat has reached and placed all the randomly selected area of the habitat.
- Finally calculate the average number of this plant species per unit area.

Students should evaluate the different methods and determine the conditions under which each one would be best used.

Students should use a variety of techniques to obtain animal specimens. Students should treat all animals with respect. If the animals are simply to be examined and drawn they should be returned to the wild unharmed as soon as possible. If the animals are to be retained as specimens, they should be killed in a humane way, using chemicals such as chloroform, and immediately placed in a preservative solution such as formalin.

Students should discuss the best technique for collecting plant specimens. They should be aware that some plants are rare and pictures can be drawn but should not be removed from their habitat.

Students should devise a method of removing plants whole from the ground, taking care that the root system is not damaged. Any soil should be washed off and the plant left in the sun to dry out.

Studying habitat requires techniques and skills

- *identify smaller habitats in their surrounding;*
- *examine organisms that dwell in the smaller habitats;*
- *write a report on the small habitats and the organisms dwelling in them;*
- *use quadrats to estimate distribution of organisms in a given habitat;*
- *demonstrate methods of collecting and preserving plant and animal specimens;*
- *collect plant and animal specimens;*
- *preserve plant and animal specimens.*

4.4 Assessment and follow-up

Students 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 active participation and close attention for the slow learners accordingly.

Answers to Exercise 6.2

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

6.3 FOOD RELATIONSHIPS

Period allotted: 5 Periods

1. Competencies

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

- *describe food chain with a practical example;*
- *construct a simple food chain by observing food relationship of organisms in their surrounding;*
- *describe food web with a practical example;*
- *explain the different trophic levels of a food chain;*
- *describe the pyramid of numbers using a diagram;*
- *describe the pyramid of energy using a diagram;*
- *indicate the trophic levels on the diagram of the pyramid of numbers.*

2. Sub-unit overview

Living organisms in a habitat interact with each other for food, space and other resources. In this sub-unit, students we explore how the food relationship looks like among living organisms such as food chain and food web. This is further explained by constructing food relationship models. The sub-unit also describes the different types of ecological models such as trophic levels, pyramid of numbers and pyramid of energy.

3. Forward Planning

In each sub-unit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach. In this sub-unit, the teacher should prepare diagrams and pictures that can demonstrate the different types of food relationships and ecological models.

4. Suggested Learning-Teaching Approaches

4.1 Suggested Teaching Aids

Diagrams and models on food relationships and ecological models

4.2 Suggested teaching methods

- Brainstorming during all starter activities by asking questions
- Facilitate group activities
- Provide summary of key points during conclusion.

4.3 Presentation of the lesson

You can start by a brainstorming question

- What are the basic physiological needs of living organisms?

This chemical energy in the form of food is transferred through the various organisms. The transfer of energy containing food can be well explained in terms of food chain and food web.

Following the brainstorming discussion highlight the following key points

Food Chain: What is food chain?

Define food relationship with an example

- Define food chain and its characteristics
- Give different types of examples related to food chain
- Define terms like: producers, consumers (primary, secondary, tertiary ...)
- difference between producers and consumers

SA = Starter activity MA= Main activity CA= concluding activity	
What is a food chain?	
SA	Students mention the different types of feeding relationship within an environment from their own experience.
MA	Students discuss on the definition of food chain and list out examples both in terrestrial and aquatic environment. Students carry out activity 6.5 in groups using the given procedures and relate the concept with real life examples.
CA	Students should describe the general pattern of food relationship in a food chain and contemplate on its pattern using diagrams.
What is food web?	
SA	Students discuss on the real life examples of food relationship and give their own definition of food web.
MA	Students discuss what food web means and give examples of food web in terrestrial and aquatic environment. Students discuss on the classification of consumers as carnivores, omnivores and herbivores depending on their nature of feeding. Students carry out activity 6.6 and discuss on their response in groups.
CA	Students differentiate the nature of food chain and food webs using definitions and diagrams.

What are trophic levels?	
SA	Students brainstorm how the food relationships can be described in pyramids.
MA	Students carry out activity 6.7 using the procedure given on the student text and analyze the concept
CA	Students apply the idea of trophic level to food chains and food webs.
What is a biological pyramid?	
SA	Students brainstorm how the food relationships can be described in pyramids.
MA	Students carry out activity 6.8 using the procedures given on the student's text. Students differentiate the difference types of biological pyramids: pyramids of numbers, pyramids of energy and pyramid of biomass.
CA	Students compare pyramids of number and energy.
Unit Summary of food relationships	
SA	Students form in groups to recap what has been discussed in the subunits
MA	Students define and describe food chain and food web; biological pyramids.
CA	Students workout exercise 6.3 and unit review questions to evaluate their competences.

Additional Notes

Basal Energy Requirement (B.E.R) is the amount of energy used by an organisms body just to keep alive, when no food is being digested and no muscular work being done.

Give summary on the key terms and their concepts

- Living organisms in a habitat interact with each other for food, space and other resources. The food relationship among living organisms can be best expressed by food chain and food web.
- Plants are the first to convert sunlight energy into chemical energy through the process of photosynthesis and are called producers.
- Consumers can be classified into three depending on their feeding habits tertiary as primary, secondary or tertiary consumers.
- Consumers can be classified as herbivores, carnivores and omnivores depending on the types of food they eat in the food relationship.

- Ecologists expressed the different biological relationships through biological pyramids: trophic level, pyramid of numbers, and pyramid of energy.

3.4 Assessment and follow up

Students 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 close attention for the slow learners accordingly.

Answers to Exercise 6.3

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

Answer for Review Questions

Part I: Multiple Choices

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

Part II: Matching

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

Part III: Fill in the blank

21.	Producer	22.	Formalin/Ethanol	23.	Decreases

Part IV: Give short answers

24. Aquatic habitat is a habitat dominated by water and terrestrial habitat is a habitat dominated by dry land

25. Environment includes the surroundings of the organisms where they reside. Habitat is the natural living conditions of an organism.

26. Population is the total number of same species with in a habitat whereas community is the interaction among different species within a habitat.

27. The method used in determining the population with a habitat is using a sampling technique by using quadrat.

28. A food chain shows how each living thing its food in a simple chain were as food web is a network of interrelated food chains in a given area.

Part V: Word puzzle answers

Across

1. **AQUATIC HABITAT**
3. **QUADRANT**
5. **CONSUMER**
6. **SAMPLING**

Down

2. **COMMUNITY**
4. **WATER**

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Minimum Learning Competencies

Area of Competency	*Minimum Learning Competencies*
Biology and technology	♦ Define the term biology, list botany, zoology, physiology, cytology, ecology and taxonomy as its branches and explain what these areas study. ♦ Indicate that all natural sciences are interrelated and the knowledge of one is important to the knowledge of the others. ♦ Explain the relevance of biology to the society in health, nutrition, environment and population issues. ♦ Describe that agriculture, medicine and food industries utilize biological knowledge. ♦ Give examples of technological innovations that are derived from biological phenomena. ♦ Identify curiosity, love, freedom, honesty, respect, cooperation, tolerance, humility, reasoning, and openness as values developed in science education.
Cell biology	♦ Identify parts of a compound microscope and tell their uses ♦ Define the term cell, list cell wall, cell membrane, cytoplasm, nucleus, vacuoles, and chloroplasts as structures of a cell, tell their functions, and compare plant and animal cells ♦ Examine plant and animal cells under a microscope and draw and label the structures seen ♦ Show types, shapes and sizes of cells using diagrams

Human biology and health	♦ Describe the structures, divisions and functions of the human skeletal system ♦ List the types of bones as long, short, flat and irregular and give examples for each ♦ List the types of joints, tell their functions, give examples for each, classify them into movable and immovable, and demonstrate movable joints using model or their own body ♦ List the types of muscles and explain their structures and functions ♦ Demonstrate how the muscles work by contracting and relaxing, using models and their own body
	♦ Describe the how muscles and skeletons work together ♦ Describe the importance of physical exercises and proper diet for the strength of bones and muscles ♦ Mention the different types of human teeth using diagrams and relate them with their functions ♦ Define the dental formula and shoe the dental formula of humans and some other mammals ♦ Compare human dentition with the dentition of herbivores, carnivores, and omnivores ♦ Tell that plants are diverse in size, type and distribution and classify them into flowering and non-flowering ♦ State the general characteristics of flowering plants and give examples of flowering plants ♦ Explain the internal and external structures and functions of roots, stems and leaves of a typical flowering plants. ♦ Identify stomata of a leaf using microscope

Plants	♦ Classify flowering plants into monocots and dicots, distinguish between them and give examples for each ♦ Explain sexual and asexual reproduction in flowering plants ♦ with examples ♦ Draw and label the structures of a flower and state the functions of each structure ♦ Examine pollen grains and female parts of a flower using a hand lens ♦ Tell the importance of pollination, explain the process of fertilization using a diagram and state that the ovules develop into seeds and the ovary develops into fruits ♦ Draw and label the structures of a seed and state the functions of each structure
Animals	♦ Tell that animals are diverse in size, type, and distribution and explain why insects are the most diverse group of animals ♦ Define metamorphosis and explain complete and incomplete metamorphosis with at least three examples for each ♦ Describe how tsetse flies affect humans and animals and explain the methods of controlling them ♦ Describe the damages caused by army worm and maize borer and the methods of controlling ♦ Explain the characteristics that are specific to social insects and give at least three examples ♦ State the benefits of bee keeping and name its products ♦ Explain the roles of queen, drones and workers in bees ♦ Explain methods of bee keeping, management of beehive and techniques of harvesting honey ♦ Construct a model of modern beehive and compare it with a traditional beehive ♦ Appreciate the behavior of social insects and express an interest to investigate more about them.

Environment	♦ Define the term habitat and give some examples of habitats ♦ Classify habitats into terrestrial and aquatic and give examples ♦ Identify smaller habitats in their surroundings, observe organisms that dwell in these habitats and report their findings ♦ Use quadrats to estimate the distribution of organisms in a given habitat ♦ Define the terms population and community and give examples for each ♦ Describe food chain and food web with practical examples ♦ Construct simple food chains by observing food relationship of organisms in their surrounding ♦ Describe the pyramid of numbers and indicate the different trophic levels using a diagram

GRADE 7 BIOLOGY SYLLABUS

General Objectives of Grade 7 Biology

1. To develop understanding and acquire knowledge of:

- Biology as a life science, its branches, how it is related to other natural sciences, how it is utilized in the fields of agriculture, medicine and food, its relevance to the society, and technological innovations derived from biological knowledge
- Microscopes, their types, parts and functions
- Cells, their types, sizes, and shapes, some of their parts and functions, and the differences between plant and animal cells
- The structures and functions of human skeleton, types of bones and joints, and their functions
- Types of muscles, their structures and functions, how muscles and skeleton work together, and the importance of physical exercise and proper diet for the health of bones, muscles and joints
- The different types of human teeth and their functions, and the dental formula of humans and other mammals
- Diversity of plants and animals in size, type, and distribution
- Mosses, ferns and gymnosperms as non-flowering plants
- Flowering plants, their general characteristics, and the structures and functions of the root, stem and leaves
- The importance of pollination and the process of fertilization, how fruits and seeds develop, and the functions of the structures of a seed
- Metamorphosis, its types, and insects that reproduce by complete and incomplete metamorphosis
- Tsetse flies, army worm and maize borer, how they affect humans and the methods of controlling them
- Social insects, their characteristics, the roles of queen, drones and workers in bees, methods of bee keeping and management of beehive and the difference between modern and traditional beehive
- Habitats, types of habitats, population and community
- Food chain and food web, the different trophic levels of a food chain, and the pyramid of numbers

2. To develop skills and abilities of:

- Using a microscope to examine plant and animal cells and drawing and labelling the structures seen under a microscope
- Demonstrating how bones, joints and muscles work using models
- Using dental formula to calculate the number of teeth of an animal
- Using a microscope to identify stomata
- Grouping flowering plants into monocots and dicots and comparing the two
- Vegetative reproduction and plants that reproduce by vegetative reproduction
- Drawing and labelling the structures of a flower
- Using a hand lens to examine pollen grains and ovaries
- Demonstrating the techniques of harvesting honey and constructing a model of modern beehive
- Identifying, examining, and writing a report on smaller habitats in their surrounding
- Using quadrats to estimate distribution of organisms in a given habitat
- Collecting and preserving plant and animal specimens
- Constructing a simple food chain by observing food relationship of organisms in their surrounding
- Using a diagram of pyramid of numbers to trophic levels

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
- Love and respect to plants, animals, and the environment
- Appreciating the behaviour of social insects and an interest to investigate more about social insects
- Willingness to conform to a drug free behaviour

Unit 1

Biology and technology *(10 periods)*

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

- *Define biology, list some of its branches, state what these branches study and indicate that it is related to all natural sciences*
- *Describe how biological knowledge is utilized in the fields of agriculture, medicine and food*
- *Explain the relevance of biology to the society*
- *Give examples of technological innovations derived from biological knowledge*
- *Identify values developed in learning science.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • define biology as the study of life	***1. Biology and Technology*** **1.1 What is biology?** *(2 periods)*	Students should be asked what they think biology is. Write terms on the board like: • Natural science • Study of living things • Study of places where plants and animals are found • Study of the interaction between plants and animals From these terms distil a simple definition of biology in terms of studying living things, plants and animals, their inter-reliance and the habitats in which they are found.
• list some branches of biology • state what each of these branches of biology study about	• Branches of biology • botany; zoology; taxonomy; cytology; ecology; physiology • Relationship of biology with other natural sciences	Students should identify different branches of biology and have a brief understanding of what each is about. This should include: • Taxonomy – the classification of plants and animals into groups • Botany – the study of plants • Zoology – the study of animals • Cytology – the structures and functions of cells • Ecology – the study of the environment in which plants and animals live
• indicate that all natural sciences are interrelated		

		• Physiology – the ways in which living thing work Students should appreciate that biology is one of a group of natural sciences and that this group also includes chemistry, geology and physics. Students could be asked to write one sentence about each natural science saying exactly what areas or aspects of nature are studied e.g. • Biology – study of living things • Chemistry – study of the chemical properties of materials • Geology – study of the earth and how it was formed • Physics – study of the physical properties of materials Students should appreciate that there are regions of overlap between the disciplines e.g. • Chemical reactions that take place in the cells of living things combine biology and chemistry
• describe how biological knowledge is utilized in the fields of agriculture, medicine and food	**1.2 Industries that utilize biological knowledge** *(2 periods)* • Agriculture • Medicine • Food	• Examination of fossils as evidence of evolution combines biology and geology • The action of muscles around joints, causing out limbs to act as levers combines biology and physics Students could be asked to identify other topics where the different scientific areas overlap, and particularly those which overlap into biology. Students should appreciate that although the different branches of science often overlap, there are certain areas or industries that are heavily orientated towards biological knowledge. These include: • Agriculture • Medicine • Food

		Students should discuss each of these areas in some detail, identifying biological aspects of each. These could include: Agriculture: • Soil composition • Use of agro-chemicals including fertilizers and pesticides • Requirements for growth • Crop rotation • Soil preservation Medicine: • Effects of drugs on the body • Use of drugs to fight diseases • Use of drugs to relieve pain • Abuse of drugs Food: • Chemical composition of different groups of foods • Products of digestion • Assimilation of the products of digestion • Metabolism of the products of digestion • Deficiency diseases • Diet • Agro-chemical residues on/in food • Selective breeding • Genetically modified crops
• explain the relevance of biology to the society	**1.3 Relevance of biology to society** *(2 periods)* • Health • Nutrition • Environment	Students should appreciate that biology is not simply an academic subject with no relevance: biology is an essential part of the life of society as a whole, as well as each individual. Students should discuss the relevance that biology has to some different aspects of life. These could include: Health: • The use of drugs to combat disease • The abuse of drugs • The physiology of healthy and unhealthy people • The importance of antiseptics and disinfectants

	• Population	Nutrition: • Groups of foods • Types of nutrients • Sources of nutrients • Balanced diet Environment: • Good and bad farm practice • Conservation of natural resources • Loss of species • Deforestation and replanting of trees • Effects of atmospheric pollution due to combustion of fuels and industrial processes Population: • Growth of world population • Problems of providing sufficient medical care • Immunization • Harmful traditional practices
• give examples of technological innovations derived from biological knowledge	**1.4 Biology and technological innovations** *(2 periods)* • Human eye versus camera • Birds versus airplanes • Fishes versus submarines	Students should appreciate how some technologies mimic aspects of biology in what they seek to achieve. Students should discuss: • The similarities between the human eye and the camera in detecting light and recording pictures • How aircraft are able to move in air like birds • How submarines are able to move in water like fish Students could research the story of Icarus. They could investigate how early attempts by people to fly involved trying to mimic the actions of birds. Students could research early attempts by people to work underwater under huge bells containing air.
• identify values developed in learning science	**1.5 Values in biology education** *(2 periods)* • Curiosity, love, freedom, honesty, respect, cooperation, tolerance, humility, reasoning, openness	Students should discuss the different values that can be developed within the context of learning about biology. These should include: • A curiosity about the living world around them

		• A love of nature and a desire to know more about it • A respect for all living things and a desire to live in harmony with them • An honesty and openness in discussing the impact which people have on the environment and a resolve to minimize harmful practice

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 biology, list some of its branches, state what these branches study and indicate that it is related to all natural sciences; describe how biological knowledge is utilized in the fields of agriculture, medicine and food; explain the relevance of biology to the society; give examples of

technological innovations derived from biological knowledge; identify values developed in learning science.

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 *(13 periods)*

Unit Outcomes: Students will be able to:

- *Define microscopes, classify them into simple and compound, identify their parts and tell the functions of each part*
- *Define cell, list parts of plant and animal cells seen under a compound microscope, tell the functions of each part and compare a plant cell with an animal cell*
- *Examine plant and animal cells under a microscope and draw and label the structures seen under a microscope*
- *Show types, shapes, and sizes of cells using diagrams.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • define microscope as an instrument used to look at objects invisible to the naked eye • classify microscopes into simple and compound • identify parts of a microscope • tell the functions of parts of microscope	***2. Cell biology*** **2.1 Microscope and its use** *(5 periods)* • History of the detection of the cell • What is a microscope • Types of microscopes (simple and compound) • Parts of a compound microscope	Students should appreciate that a microscope is an instrument which magnifies so that we can see objects in much greater detail that with the unaided eye. Students should understand that a hand lens or magnifying glass acts as a simple microscope. Students could use a hand lens to examine specimens of plant material, such as flowers, and small animals, such as insects, in detail. Students could draw these specimens. When drawing specimens, students should draw what they can actually see and not what they think they should be able to see. Students should be made familiar with a compound microscope. They should be able to identify key parts including: • Eye lens • Objective lens • Focusing adjustment • Specimen mounting plate and holding clips Students should discuss the function of the different parts of the microscope including: • The mounting plate where the specimen is placed, and the clips used to hold a slide in place • The lenses which magnify the specimen so it can be examined in detail

Competencies	*Contents*	*Suggested activities*
		• The focusing adjustment which is used to give a clear image Students could discuss how the magnification of a microscope is the product of the power of the eye lens and the objective lens e.g. an eye lens of magnification x5 and an objective lens of magnification x10 give an overall magnification of 5 x 10 = x50. Students could be shown micrographs of specimens taken under very high magnification so that they can appreciate the amount of detail that can be seen. In order to broaden the topic students could research such topics as: • the invention of the compound microscope • electron microscopes
• define cell as the smallest unit of life • list parts of plant and animal cells seen under a compound microscope • tell the functions of parts of plant and animal cells seen under a compound microscope	**2.2 The cell** *(3 periods)* • What is a cell? • Structures of plant and animal cells (cell wall, cell membrane, cytoplasm, nucleus, vacuoles, chloroplasts)	Students should appreciate that the cell is the smallest unit of a living organism – and that cells are the building blocks from which all living things are formed. Students should appreciate that cells are too small to be seen with the unaided eye. Everything that scientists know about plant and animal cells was only discovered after the invention of the microscope.
• compare a plant cell with an animal cell	• Comparing plant and animal cells	Students should appreciate that there are both similarities and differences between the structures of animal cells and plant cells. Students should identify the similarities of plant cells and animal cells as: • Cell membrane • Nucleus • Cytoplasm Students should know that, in addition, plant cells have: • Cell wall – made of cellulose • Chloroplasts – to trap sunlight

Competencies	*Contents*	*Suggested activities*
• examine plant and animal cells under a microscope • draw and label the structures of plant and animal cells seen under a microscope	**2.3 Looking at cells** *(4 periods)* • Pollen grains and eggs	• Large vacuoles Students should discuss the similarities and differences between plant and animal cells. Students should appreciate that: • Both plant and animal cells have a cell membrane; in the plant cell this is immediately below the cell wall • Both plant and animal cells contain a nucleus which controls the activities of the cell • Both plant and animal cells contain cytoplasm in which different chemical processes take place • Both plant and animal cells contain vacuoles but these are often larger in plat cells • Only plant cells contain the green pigment chlorophyll needed for photosynthesis Students should appreciate that they are discussing typical plant cells and typical animal cells but that, within and organism, there may be a number of different types of cells, each modified for a particular purpose. For example, students could discuss why, in plants: • Root cells do not contain chloroplasts • Root cells have hair-like projections to increase the surface area of the cell Students should be given some general instructions about using a compound microscope. Issues could include: • General care of the microscope • Importance of using a cover slip to protect the objective lens • Using the adjuster to place the objective lens as near as possible to the specimen

Competencies	*Contents*	*Suggested activities*
	• Onion cells • Cheek cells	before looking down the microscope and then slowing moving the lens away until the specimen is in focus • Using a magnification that is appropriate to the amount of detail that is to be seen – it is not always appropriate to use the highest magnification available. Students should examine specimens such as pollen grains and insect eggs in order to provide them with practice on using the microscope. Students should be given some general instructions for the preparation of specimens to be examined under a microscope. These could include: • Obtaining a thin specimen – so that light can pass through it • Placing the specimen on a clean microscope slide • Staining the specimen so that the different parts show up more clearly • Placing a cover slip on top of the specimen • Using absorbent paper to remove excess stain Students should examine a specimen of plant cells, such as the pond weed *Elodea*, under the microscope. They should draw what they can see and label the nucleus, cell wall and chloroplasts. Student could prepare a sample of onion cells for examination by removing a section of the skin (epidermis) between two layers of onion. The specimen should be stained using iodine solution. They should label the different parts of the cell that can be seen. Students should examine a specimen of animal cells, such as cheek cells, under the microscope. They should draw what they can see and label the nucleus, cell membrane, and cytoplasm. Student could prepare a

Competencies	*Contents*	*Suggested activities*
		sample of cheek cells for examination by scraping cells from their own cheeks. The specimen should be stained using methylene blue solution. They should label the different parts of the cell that can be seen. Students could discuss how it is that chloroplasts are present in *Elodea* but not in the onion epidermis does not. Students could prepare specimens without using stain to assure themselves that the stain helps to see cell detail more clearly. Students could experiment using different stains on onion epidermal cells and cheek cells.
• show types, shapes, and sizes of cells using diagrams	**2.4 Cell type, shape and size** *(1 period)*	Use diagrams and/or models to teach this content. Some of the shapes of cells could also be seen using fresh specimens of cells of plants and animals or using preserved specimens. If you have a microscope in the school, demonstrate this to the class or allow students to observe the shapes in groups depending upon the number of microscopes you have.

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 microscopes, classify them into simple and compound, identify their parts and tell the functions of each part; define cell, list parts of plant and animal cells seen under a compound microscope, tell the functions of each part and compare a plant cell with an animal cell; examine plant and animal cells under a microscope and draw and label the structures seen under a microscope; show types, shapes, and sizes of cells using diagrams.

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 *(15 periods)*

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

- *Describe the structures and functions of human skeleton and divide it into axial and appendicular*
- *List types of bones and joints, state their functions, give examples for each and demonstrate them by using models*
- *List types of muscles, explain their structures and functions and demonstrate how they work using models*
- *Describe how muscles and skeleton work together*
- *Describe the importance of physical exercise and proper diet for the health of bones, muscles and joints*
- *Name the different types of human teeth, relate them with their functions, define dental formula, show the dental formula of humans and compare it with that of some other mammals.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • Divide human skeleton into axial and appendicular • Describe the structures and functions of human skeleton • List the types of bones • Give examples for each type of bone • List types of joints • Tell the functions of each type of joint • Give examples of each type of joint • Classify joints into movable and immovable • Demonstrate movable joints using models • List types of muscles • Explain the structures and functions of muscles • Demonstrate how muscles work using models • Describe how muscles and skeleton work together	**3. *Human biology and health*** **3.1 The muscular and skeletal system** *(10 periods)* • Axial and appendicular skeleton • Structures and functions of the skeleton • Types of bones (long, short, flat irregular) • Types of joints - Immovable - Movable (ball and socket, hinge, gliding, pivot) • Structures and functions of muscle • Types of muscle (skeletal, smooth, cardiac) • How do muscles work • Muscle and skeletal health - Physical exercise - Proper diet	Let the students know that axial skeleton consists of the skull, vertebral column, and rib cage and appendicular skeleton contains the bones of the arms, legs and pelvis. Use a chart or a model to teach the parts of the human skeleton. A simple model of human skeleton could be made using cardboard paper. The diagram of parts of the skeleton could be traced on the cardboard and then cut out and connected to its appropriate position on the system. Models could also be constructed by students to show the different types of joints. Students should be able to give examples of each type of joint. For example, joint at the shoulder (ball and socket joint); joint at the elbow (pivot joint); joint at the knee (hinge joint); and joint at the neck (gliding joint). Let students know that we move by the actions of muscles on bones. The structures and different types of muscle could be taught using a chart. The interaction of muscles and bones could be demonstrated using the models of bones constructed earlier in the lesson and attaching spirally

Competencies	*Contents*	*Suggested activities*
		coiled wire (that represent muscles) to the bones. The contraction and relaxation of muscles could be shown by the contraction and relaxation of the spiral wire as the bones are moving. Let the students discuss in smaller groups on the importance of regular physical activity and proper diet to healthy bones, muscles, and joints. Let them suggest types of exercises recommended for keeping bones muscles and joints healthy and types of food that also keep these body parts healthy.
• Describe the importance of physical exercise and proper diet for the health of bones, muscles and joints • Mention the different types of human teeth • Relate types of human teeth with their functions • Define dental formula as a short way of indicating the numbers, types and arrangement of teeth • Show the dental formula of humans • Compare human dental formula with that of some other mammals	**3.2 Human dentition** *(5 periods)* • Types of human teeth • Functions of each type of teeth • Dental formula	Let the students know that dentition is the development of teeth and their arrangement in the mouth. Humans have four distinct types of teeth, the incisor *(cutting)*, the canine the premolar and the molar *(grinding)*. This could be taught using models of human teeth which could easily be constructed by the students themselves. Let them practice writing and calculating the dental formula. The number of teeth of each type is written as a dental formula for one side of the mouth, with the upper and lower teeth shown on separate rows. The number of teeth in a mouth is twice that listed as there are two sides. In each set, the first number indicates incisors, the second, canines, the third, premolars, and the last, molars. For example, the formula 2.1.2.3 for upper teeth indicates 2 incisors, 1 canine, 2 premolars, and 3 molars on one side of the

Competencies	*Contents*	*Suggested activities*
		upper mouth. Therefore, The human dental formula is: **2.1.2.3** **2.1.2.3** Let the students compare this formula with that of other mammals. For example the dental formula of cats is: **3.1.3.1** **3.1.2.** The differences between the two dental formulas could initiate a very interesting group discussion through which students learn why such differences occur among mammals.

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: describe the structures and functions of human skeleton and divide it into axial and appendicular; list types of bones and joints, state their functions, give examples for each and demonstrate them by using models; list types of muscles, explain their structures and functions and demonstrate how they work using models; describe how muscles and skeleton work together; describe the importance of physical exercise and proper diet for the health of bones, muscles and joints; name the different types of human teeth, relate them with their functions, define dental formula, and show the dental formula of humans; compare human dental formula with that of some other mammals.

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 *(25 periods)*

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

- *Tell that plants are diverse in size, type and distribution and demonstrate love and respect to plants*
- *Classify plants into flowering and non-flowering and mention mosses, ferns and gymnosperms as non-flowering plants*
- *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.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • tell that plants are diverse in size, type and distribution • demonstrate love and respect to plants • classify plants into flowering and non-flowering • mention mosses, ferns and gymnosperms as non-flowering plants	***4. Plants*** **4.1 Diversity of plants** *(3 periods)* • How diverse are plants (in size, type, and distribution) • Classifying plants into flowering and non-flowering • Non –flowering plants	Introduce students to this unit by pointing out them that there are many species of plants in the world and asking them how plants might be classified. Ask students to suggest whether it is sensible to classify plants according to: • Their size • The colour of their flowers • The places where they are found Use this discussion to introduce the idea of classifying according to physical structure. Students should appreciate that not all plants produce flowers so this provides a simple way of dividing the plant kingdom into two large groups: • Flowering plants • Non-flowering plants Ask students to identify different types of plants that do not have flowers. From their suggestions focus on: • Mosses; Ferns; Gymnosperms Students should appreciate that the flower is the organ of sexual reproduction in flowering plants. In non-flowering plants this is not an option so other means of reproducing must take place.

Competencies	*Contents*	*Suggested activities*
• state the general characteristics of flowering plants	**4.2 Flowering plants** *(22 periods)* • General characteristics • Root, stem and leaf (internal and external characteristics)	Students should be able to give examples of flowering plants which grow in their locality. Students should already be aware, from their work in Unit 2, that a flowering plant consists of a number of organs including: • Root, Stem, Leaf, Flower Students should be able to state the internal and external characteristics of each of these organs, and identify and label important parts on diagrams.
• give examples of flowering plants • explain the structures and functions of the root • explain the structures and functions of the stem • explain the structures and functions of the leaf • identify stomata using a microscope		Students should know the functions of each of the organs in a plant including: Root: • Absorb water and minerals from the soil • Provide the plant with a firm anchorage in the soil • In some plants to store sugar and starch Students should examine and compare a plant with a fibrous root system with a plant which has a tap root to see how the later is modified. Stem: • Transporting water and minerals from the roots to the other parts of the plant • Transporting glucose throughout the plant • Support the leaves so they receive maximum sunlight • Support the flower • In some plants e.g. climbers, to provide attachment Students can observe how water and minerals are absorbed up a root by standing a freshly cut celery stick in a beaker of water containing red ink for an hour. If the stick is then cut into sections the progress of the red ink solution up the stem can be seen. Leaves: • Carry out photosynthesis to make food • Excretion of carbon dioxide from respiration • Loss of water Students should carefully examine the underside of a leaf and identify
• classify flowering plants into monocotyledons and dicotyledons • distinguish between monocotyledons and dicotyledons • give examples of	• Monocotyledons and dicotyledons (examples and comparison)	

Competencies	*Contents*	*Suggested activities*
monocotyledons and dicotyledons		stoma from which water is lost using a hand lens or microscope. Students could paint the underside of a leaf with clear nail varnish. When the nail varnish is dry it can be peeled off and will show the imprints of the stoma Flower: • Sexual reproduction Students should dissect a flower, and draw and label the parts including • Petals, Anthers, Filaments, Style, Stigma, Ovary, Nectaries, Calyx Students should understand that flowering plants can be further subdivided into two groups on the basis of whether the seed consists of one or two cotyledons i.e. whether there is one or two seed leaves when the seed germinates. Students should be aware that both groups of plants have certain similarities such as root systems and shoot systems but they also have some important differences. Students should carry out a careful examination of a monocotyledon, such as maize, and a dicotyledon such as cow pea or castor oil, and record any differences that they see in the external and internal structures.
• explain vegetative reproduction in flowering plants • give examples of flowering plants that reproduce by vegetative reproduction	• Reproduction in flowering plants -vegetative propagation	Students should use the differences they have identified to try and identify other examples of monocotyledons and dicotyledons which grow in their locality. Students should appreciate that flowering plants are able to reproduce both by asexual or vegetative reproduction, and by sexual production. Students should examine a number of examples of vegetative reproduction in plants. These could include examples of natural propagation such as: • Rhizome – canna lily • Bulb – onion • Corm – Colocasia • Sucker – banana • Runner – Desmodium

Competencies	*Contents*	*Suggested activities*
• draw and label the structures of a flower • state the functions of the structures of a flower • examine pollen grains and ovaries using a hand lens • tell the importance of pollination • explain the process of fertilization	-sexual reproduction (flower structure, pollination, fertilization) -dissecting the pistil -observing pollen grains	and examples of artificial propagation such as: • Stem cuttings – Hibiscus • Grafting – fruit trees • Layering – Bougainvillaea Students could take stem cuttings of *Hibiscus* or *Geranium* and get them to root in soil or in water. Students could research the use of rooting compounds and rooting hormones in rooting cuttings. Students are already aware that the flower is the organ of sexual reproduction of the plant. Students could examine several local flowers and identify the parts on each of them. Students should appreciate the functions of the different parts of the flower: • Petals – to attract pollinators by sight • Nectaries – to attract pollinators by smell • Anther and filaments – male part of the plant produces pollen • Style, stigma and ovaries – female part of plant; ovules produced and fertilised in the ovary • Calyx – protects flower until it opens Students should dissect the pistil of a plant and observe the internal structure with a hand lens or a microscope. They should identify the stigma, style and ovary. Students should know that pollination involves the transfer of pollen from the male part of a flower to the female part of the same or a different flower. The same - self-pollination and a different flower – cross pollination. Students should discuss how pollination might occur. What agents could transfer pollen? Focus them on the idea of wind and animals (insects and birds) Students could discuss the features of flowers that are wind pollinated. These could include:

Competencies	*Contents*	*Suggested activities*
• state that ovaries develop into fruits and ovules develop into seeds • draw and label the structures of a seed • state the functions of the structures of a seed	• Seeds and fruits (formation, structure, function)	• Light single pollen grains • Dull-coloured petals • Petals fully open exposing the anthers and stigma • Lack of smell / nectar Students could discuss the features of flowers that are animal pollinated. These could include: • Clumps of sticky pollen • Brightly-coloured petals • Petals forming a cup shape around the anthers and stigma • Anthers and stigma inside the flower • Smell and / or presence of nectar Students could be given examples of local flowers to examine and, from their knowledge, to deduce whether the flower is wind or animal pollinated. Students should observe the pollen grains of some plants which are pollinated by the wind and some plants which are pollinated by animals. They should compare the two types and comment on the differences. Students could be given pollen from an unknown plant to examine and asked to deduce from its structure whether it is more likely to be wind pollinated or animal pollinated. Students should appreciate that pollen is the male sex organ of the plant. As a result of pollination: • Pollen becomes attached to the stigma of another flower • Pollen grains digest pollen tubes down through the style • Pollen grains enters the ovary • Pollen grains fuse with ovules to form seeds • The ovary develops into a fruit Students could discuss how the weather and availability of insects affects the seed formation and the importance of this when growing a seed crop such as beans or peas. Students should examine a soaked bean or some other large dichotomous seed. They should identify the

Competencies	*Contents*	*Suggested activities*
		micropyle before removing the testa. The student should draw and label a large dichotomous seed to show parts including: • Testa, Micropyle, Cotyledons Students should discuss the function of each part of the seed including: • Testa – to protect the seed and prevent it drying out • Micropyle – to absorb water into the seed • Cotyledons – to provide a food source for the germinating seed. Students should continue their comparison of monocotyledonous and dicotyledonous plants by examining the seed of a monocotyledonous seed and make a comparison with the dichotomous seed

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: tell that plants are diverse in size, type and distribution and demonstrate love and respect to plants; classify plants into flowering and non-flowering and mention mosses, ferns and gymnosperms as non-flowering plants; 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.

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 *(23 periods)*

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

- *Tell that animals are diverse in size, type and distribution, demonstrate love and respect to them and explain why insects are the most diverse group of animals*
- *Define metamorphosis, explain complete and incomplete metamorphosis and give examples of insects that reproduce by complete and incomplete metamorphosis.*
- *Describe how tsetse flies, army worm and maize borer affect humans and explain the methods of controlling them*
- *Explain the characteristics specific to social insects and give examples of social insects*
- *Explain the roles of queen, drones and workers in bees, explain methods of bee keeping and management of beehive, demonstrate the techniques of harvesting honey and compare a modern beehive with a traditional one.*
- *Construct a model of modern beehive, appreciate the behaviour of social insects and express an interest to investigate more about social insects.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • tell that animals are diverse in size, type and distribution • demonstrate love and respect to animals	***5. Animals*** **5.1 Diversity of animals** *(2 periods)* • How diverse are animals? (in size, type, and distribution)	Ask students to name some different animals which live in Ethiopia. Make a list of these on the board. Point out to students that animals show differences in a number of ways including: • Size – from very large to very small • Type – animals can be classified into groups such as mammals, reptiles, fish, birds, insects etc. • Distribution – some animals live on land, others mostly in the air and some in water
• explain why insects are the most diverse group of animals	• Why are insects the most diverse group of animals?	Students should discuss why insects are the most diverse group of animals. This could include: • The different habitats which they inhabit • The different physical conditions in which they are found • Their ability to adapt to changing conditions • Their ability to reproduce rapidly
• define metamorphosis as a change of form of an animal involving several distinct stages	**5.2 Life histories of some insects** *(4 periods)* • What is metamorphosis?	Students should appreciate that a fundamental difference between some insects and other animals is that as these insects grow, their

Competencies	*Contents*	*Suggested activities*
• explain complete and incomplete metamorphosis	• Complete and incomplete metamorphosis	bodies completely change their form. This process is called metamorphosis. Students should appreciate that metamorphosis may be said to be incomplete or complete. • Complete metamorphosis involves a complete change of form involving four main stages: egg, larva, pupa and adult • Incomplete metamorphosis involves a gradual development involving only three stages: egg, nymph and adult. The nymph closely resembles the adult except it is smaller in size and wingless
		Students should examine an egg, a caterpillar, a pupa and a butterfly in order to satisfy themselves that, although these are the same animal, the stages in the life cycle of this animal are very different. Students should decide whether the metamorphosis is complete of incomplete. Students should examine an egg, a nymph and adult cockroach and decide whether this metamorphosis is complete or incomplete. Students could research other examples of complete and incomplete metamorphosis. Students could be given specimens of other insect in different stages and asked to determine the nature of the metamorphosis e.g. the locust.
• describe how tsetse flies affect humans and animals • explain the methods of control of tsetse flies	**5.3 Some economically important insects** *(6 periods)* • Tsetse flies • vectors of diseases • methods of control	Students should appreciate that some insects of great economic importance; some are harmful while others are beneficial. In this section students will look in detail at three insects which are harmful in different ways. Students should appreciate that the tsetse fly is a harmful pest that affects both cattle and people. Students should understand the

Competencies	*Contents*	*Suggested activities*
• describe how armyworm damages crops • explain the methods of control of armyworm • describe how maize borer damages maize • explain the methods of control of maize borer	• Dark moth (army worm) • how it affects crops • methods of control • Maize borer moth • how it affects maize • methods of control	term vector as a carrier of disease and should know that: • Tsetse flies are commonly found along the edges of lakes and banks of rivers • The tsetse fly carries a parasite called trypanosome • The parasite causes a disease in cattle called nagana • The parasite causes a disease in people called sleeping sickness Students should discuss suitable methods of controlling the tsetse fly. These should include: • Removing bushes and undergrowth along streams to reduce tsetse fly populations • Spraying areas known to harbour the infection with insecticides • Spraying livestock with insect repellent Students could research into a method involving releasing large numbers of sterile male tsetse flies into an area. These sterile males mate with females but no offspring are produced hence the population falls. Students could evaluate this method when compared with other traditional methods of control.
• explain the characteristics specific to social insects • give examples of social insects • explain the roles of queen, drones and workers in bees	**5.4 Social insects** *(11 periods)* • Characteristics specific to social insects • Honey bees and bee keeping -queen, drone and workers	Students should appreciate that some insects live together in large groups or colonies and share out the work needed to sustain the colony between them. Different castes of the insect carry out different duties within the colony. Students should identify examples of social insects. These should include: • Termites • Honey bees Students should discuss the advantages to the insects of living in a large social group. Students should appreciate that honey bees are a social insect which are beneficial to people.

Competencies	*Contents*	*Suggested activities*
• explain methods of bee keeping and management of beehive • demonstrate the techniques of harvesting honey • compare a modern beehive with a traditional one	-methods of beekeeping -management of beehive -techniques of harvesting honey -importance of bee keeping -products of bee keeping	They live in a hive in which there are three castes: • Queen – lays eggs • Drones – mates with the queen • Workers – gather nectar, build honeycomb, protect the hive Students should appreciate that is possible to harvest some of the honey made by bees but leaving the colony of bees sufficient for its needs. Students should examine both a traditional and a modern beehive and discuss the advantages and disadvantages of each.
• construct a model of modern beehive • appreciate the behaviour of social insects	• Constructing a model beehive	Students should discuss how a beehive should be managed and how the honey is harvested. A bee keeper could be invited to come and talk to students about bee keeping and demonstrate some of the techniques used. Students should discuss the economic importance of beekeeping, both in terms of pollinating crops, and obtaining products from the hive. They should discuss how the following may be used: • Honey • Beeswax • Pollen • Queen jelly Students should discuss how bees are able to communicate with each other through various dances, to indicate the source of food. Students should make a model of a beehive. Students should discuss how the ability of honeybees to live together in a hive increases the chances of their survival.
• express an interest to investigate more about social insects		Students could research into how the life of solitary wood bees differs to that of the honeybee. Students could research into the life of another social insect such as the termite and make comparisons with the honeybee.

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: tell that animals are diverse in size, type and distribution, demonstrate love and respect to them and explain why insects are the most diverse group of animals; define metamorphosis, explain complete and incomplete metamorphosis and give examples of insects that reproduce by complete and incomplete metamorphosis; describe how tsetse flies, army worm and maize borer affect humans and explain the methods of controlling them; explain the characteristics specific to social insects and give examples of social insects; explain the roles of queen, drones and workers in bees, explain methods of bee keeping and management of beehive, demonstrate the techniques of harvesting honey and compare a modern beehive with a traditional one; construct a model of modern beehive, appreciate the behaviour of social insects and express an interest to investigate more about social insects.

Students above minimum requirement level

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Students below minimum requirement level

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Unit 6

Environment *(16 periods)*

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

- *Define habitat, classify habitats into terrestrial and aquatic and give examples for each*
- *Define population and community and give examples for each*
- *Identify smaller habitats in their surrounding, examine organisms that dwell in them and write a report on their findings*
- *Use quadrats to estimate distribution of organisms in a given habitat, demonstrate methods of collecting and preserving plant and animal specimens and collect and preserve plant and animal specimens*
- *Describe food chain and food web with practical examples and construct a simple food chain by observing food relationship of organisms in their surrounding*
- *Explain the different trophic levels of a food chain, describe the pyramid of numbers using a diagram and indicate the trophic levels on the diagram of the pyramid of numbers.*

Competencies	***Contents***	***Suggested activities***
Students will be able to: • define habitat as a place where living things live • classify habitats into terrestrial and aquatic • give examples of terrestrial and aquatic habitats • define population as a group of organisms of same species • give examples of populations • define community as a group of populations of different species • give examples of communities	***6. Environment*** **6.1 Habitats** *(3 periods)* • What is a habitat • Aquatic and terrestrial habitats • Population and community	Students should understand that the natural home of an organism – the place where it lives. Point out to students that each organism that lives in a habitat has evolved special adaptations that allow it to live successfully. Ask students to identify some habitats. Group their suggestions under two main headings, terrestrial and aquatic. Ask students if they can add to each list so they have a range of each type of habitat e.g. • Terrestrial – farmland, park, savannah, rain forest, desert etc. • Aquatic – ditch, pond, stream, river, lake, rock pool, ocean etc. Students should identify different terrestrial and aquatic habitats in the area around where they live. Students should appreciate that within any habitat there will be a number of organisms of the same species living together. A group of animals of the same species within a habitat is called a population. Similarly, within a habitat, there are likely to be populations of different species. A group of populations within a habitat is called a community.

Competencies	*Contents*	*Suggested activities*
		Students should identify the species within a habitat and be able to explain how these relate to populations and t the community within which they live. For example, in a pond there may be tilapia, dragonfly nymphs, water fleas and duckweed. We can say: • The pond is a habitat • Within the habitat there are populations of tilapia, dragonfly nymphs, water fleas and duckweed • The populations combine to form a community in the pond Students should carry out similar exercises looking at different habitats.
• identify smaller habitats in their surrounding • examine organisms that dwell in the smaller habitats • write a report on the small habitats and the organisms dwelling in them	**6.2 Studying a habitat** *(8 periods)* • Observing habitats in our surroundings	Students should identify and examine a small habitat (of the order of less than a square metre). All of the organisms found in it should be examined and identified. Students should write a brief report on their findings. This should have such details as: • The size of the habitat • The nature of the habitat • Sizes of the various populations of organisms found and identified • Comments on any particular interesting features e.g. particular plants found only where the ground is damp
• use quadrats to estimate distribution of organisms in a given habitat	• Using quadrats	Students should understand that habitats are often large and it is difficult and time-consuming to identify every species present and to count the size of the population of each. Ask students how this could be done more simply and use the discussion to introduce the idea of sampling.
• demonstrate methods of collecting and preserving plant and animal specimen	• Collecting and preserving plant and animal specimens	Students should understand that sampling can often give us an overall picture of what is present. Discuss with students how they could go about surveying a habitat. Allow them sufficient time to

Competencies	*Contents*	*Suggested activities*
		develop their ideas before introducing the idea of quadrats. Ask students to suggest how the quadrat might be used to sample the organisms in an area. Students should appreciate that a random sample is taken and suggest suitable techniques. These could include: • Throwing the quadrat at random within the habitat • Dividing the habitat into locations and selecting locations at random by picking numbers in some random way Students should use a quadrat to sample the organisms in a larger area. This should involve: • experimenting with obtaining random samples • using results to make estimates for the whole habitat • commenting on how reliable the estimates will be As a result of their work, students realise that using a quadrat is not always the best method of sampling the organisms in a habitat. They could research other techniques such as line transects. Students should discuss different techniques that could be used to collect animals within a habitat. These could include: • pitfall trap • pooter
• collect plant and animal specimens • preserve plant and animal specimens		• sweep net • butterfly net Students should be shown how each technique is used. They should evaluate the different methods and determine the conditions under which each one would be best used. Students should use a variety of techniques to obtain animal specimens. Students should treat all animals with respect. If the animals are simply to be examined and drawn they should be returned to the wild unharmed as soon as possible. If the

Competencies	*Contents*	*Suggested activities*
		animals are to be retained as specimens, they should be killed in a humane way, using chemicals such as chloroform, and immediately placed in a preservative solution such as formalin. Students should discuss the best technique for collecting plant specimens. They should be aware that some plants are rare and can be drawn but should not be removed from their habitat. Students should devise a method of removing plants whole from the ground, taking care that the root system is not damaged. Any soil should be washed off and the plant left in the sun to dry out.
• describe food chain with a practical example • construct a simple food chain by observing food relationship of organisms in their surrounding	**6.3 Food relationships** *(5 periods)* • Food chain and food web	Students should appreciate that, within a habitat, some organisms feed on plants while other animals feed on each other. Use this to introduce the idea of a food chain which shows the food of each animal. Students should write simple food chains based on their own observations from studying a habitat or observing what happens around them e.g. leaf → caterpillar → bird Write some of the food chains on the board. Students should discuss the food chains and look for a general pattern. They may observe that: • A food chain always starts with a plant • The plant is eaten by a herbivore • The herbivore is eaten by a carnivore Build on this simple understanding of food chains and introduce some nomenclature. This could include the following information: • A food chain always starts with a green plant • Green plants manufacture their own food and are therefore called producers

Competencies	*Contents*	*Suggested activities*
		• The Sun is therefore the source of energy for a food chain • The animals in a food chain are called consumers • The herbivore is called the primary consumer • The carnivore is called the secondary consumer • The arrows in a food chain represent 'is eaten by' and also show the flow of energy and nutrients
• describe food web with a practical example • explain the different trophic levels of a food chain • describe the pyramid of numbers using a diagram • describe the pyramid of energy using a diagram • indicate the trophic levels on the diagram of the pyramid of numbers	• Trophic levels • Pyramid of numbers • Pyramid of energy	Students should now be able to write the general pattern for a food chain: Producer → Primary consumer → Secondary consumer Students should appreciate that food chains are not always limited to three organisms. If there are more organisms in the chain they are referred to as tertiary consumers e.g. grass → earthworm → frog → hawk Students should write food chains that contain tertiary consumers. Students should be given food chains and asked to identify the producer and the different consumers. Students should appreciate that some organisms in a habitat may be involved in more than one food chain. For example, in addition to frogs, earthworms may also be eaten by birds. Similarly, in addition to eating earthworms, frogs may also eat beetles. Ask students how such relationships can be shown and use this to introduce the idea of a food web as a combination of two or more food chains. Students should combine the information from related food chains to produce a food web. Students should be given a food web and use it to write a series of food chains. Students should use the information gained from their study

Competencies	*Contents*	*Suggested activities*
		of a habitat to write a food web. Introduce students to the idea of trophic levels where: • First trophic level – producers • Second trophic level – primary consumers • Third trophic level – secondary consumers • Fourth trophic level – tertiary consumers Students should apply the idea of trophic levels to food chains and food webs. Students should discuss the number of organisms at each level in a food chain. For example: leaf → caterpillar → bird One caterpillar may eat many leaves, and one bird may eat many caterpillars. Students should appreciate that the numbers of individuals generally decreases passing along a food chain. We can show the relative number of organisms at each trophic level as a pyramid of numbers. Students should draw pyramids of numbers representing food chains and food webs and mark the trophic levels on the pyramid. Students should discuss how the shape of a pyramid of numbers may be different for different food webs. For example, a single large tree may provide the food for a large number of caterpillars so, in this case, the base of the pyramid of numbers would be very small. Students should discuss how an inverted pyramid of numbers might arise e.g. a single rose bush may support many aphids, and each aphid may support a large number of bacteria. Students should draw pyramids of numbers using the information they gained from their study of a habitat.

Assessment

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Students at minimum requirement level

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